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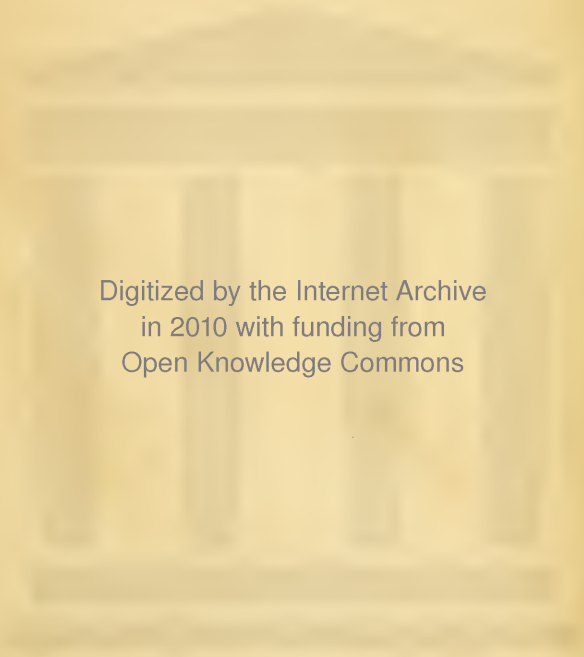
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AN AMERICAN TEXT-BOOK

OF

GENITO-URINARY DISEASES,

SYPHILIS,

AND

DISEASES OF THE SKIN.

EDITED BY

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Illustrated with 300 Engravings and 20 Full-page Colored Plates.

PHILADELPHIA:

W. B. SAUNDERS,

925 WALNUT STREET.

1898

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PREFACE.

THIS addition to the series of "AMERICAN TEXT-BOOKS" on Medicine and Surgery the Editors believe will meet the requirements of both students and practitioners, and will be found to be a comprehensive and detailed presentation of the Diseases of the Genito-urinary Organs, of the Venereal Diseases, and of the Affections of the Skin.

The vast accumulation and diversity of knowledge and the consequent subdivision of labor in modern science render co-operation necessary in works covering wide fields of observation and research; for thus only, as exhibited, we believe, in the present instance, can thoroughness, accuracy, and the results of a mature experience be obtained.

Having secured the collaboration of well-known authorities in the branches represented in this undertaking, the Editors have not restricted the contributors in regard to the particular views set forth in its pages, but have offered every facility for the free expression of individual opinion.

The book will therefore be found to be original, yet homogeneous and fully representative of the several departments of medical science with which it is concerned.

The text has been amply illustrated with typical portraits both in color and in black and white, and especial attention has also been paid to the reproduction of drawings made under the microscope. Many of the illustrations are original, being taken from the private collections of the authors; others have been borrowed, with proper acknowledgment, from various sources. In this matter, as well as in many other ways, the Editors are under especial obligations to the publisher, Mr. W. B. Saunders, for his generous liberality.

The Editors beg to acknowledge their deep sense of indebtedness to the eminent contributors to this work, without whose aid and encouragement it could not have been brought to a satisfactory conclusion, and to Dr. Chas. Langdon Gibson, Surgeon to St. Luke's Hospital, New York, and to Mr. Thos. F. Dagney, of Mr. Saunders' editorial rooms, for their critical and efficient assistance.

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GENITO-URINARY DISEASES

AND

SYPHILIS.

URINE-ANALYSIS,

AND A CONSIDERATION OF THE URINE IN SURGICAL DISEASES OF THE URINARY TRACT.

BY PAUL THORNDIKE, M. D.

ANY attempt to write an exhaustive article on urine-analysis and to confine it within the limits of a treatise of this length would be useless. In the present pages, therefore, the characteristics and chemical constituents of urine, and the commoner and more practical methods for investigating them, will be described. The significance of the pathological conditions of urine found in the various disorders of the urinary tract will be briefly considered. More than this cannot be attempted.

Urine is a watery solution of the products of tissue-metabolism in the body. In health it varies in its characteristics only within certain limits, and is a clear, yellow liquid of acid reaction, slight characteristic odor, and a specific gravity of 1015 to 1025, taking water as the standard at 1000. Healthy people pass about 1500 cubic centimeters—that is, about 40 to 60 ounces—of urine in each twenty-four hours, the amount being greater during the waking than the sleeping hours. The amount passed by a healthy individual is, of course, readily affected by outside causes, such as the amount of fluid taken into the system; the condition of weather and climate, which affects the evaporation of moisture from the skin; and by any condition of the body which affects the blood-supply of the kidneys. It is commonly said that about one-half the total amount of the fluids excreted from the body pass through the kidneys, and the other half through the skin, bowels, and lungs. This is probably practically true, and of course any condition or disease which calls an extra amount of fluid to another part of the body diminishes the amount of urine. For example, exercise in hot weather greatly increases the activity of the skin and so diminishes the urine in amount. Diarrhœa with a large number of liquid stools diminishes the amount of the urine. In dropsical conditions the same is true, the amount of urine diminishing as the dropsy increases, and *vice versa*.

In the acute stage of fevers the urine is diminished, gradually increasing as the fever abates, and often passing beyond the normal limit before settling down to the routine amount of health. After surgical operations upon the abdominal organs the amount of urine is often very markedly decreased, sometimes to the point of complete suppression. In such cases it is of the utmost importance to watch the amount secreted, and this is generally a pretty accurate indication of the degree of shock which the patient has sustained. This is, perhaps, especially true of operations on the genito-urinary organs. In watching the amount secreted it is of course necessary to take care not to miss the urine passed at the time the bowels are moved, and, also, that the urine should be measured and not guessed at. In almost any

disease terminating fatally, and where the decline in health is gradual, the amount of urine decreases as death approaches.

There are various conditions, both of the kidney and of other parts of the body, where the amount of urine is uniformly increased. Among the former may be mentioned the chronic forms of nephritis, especially those where the interstitial element predominates, and amyloid kidney. Among the latter are cerebral hemorrhage from any cause, traumatic or otherwise (here the amount of urine is often very large and sugar is found present in about half the cases); diabetes mellitus, although in this disease the amount may be little, if any, above normal; diabetes insipidus, which is the name given to an indefinite class of cases characterized by nervous symptoms and a urine where both the amount and the solids for each twenty-four hours are more or less largely increased.

In fact, the nervous system often has a very marked effect upon the activity of the kidneys. People in a condition of temporary nervous excitement, as well as people suffering from various forms of hysteria and nervous debility, often pass very large quantities of urine. The condition spoken of as phosphaturia is very often a condition of nervous debility and exhaustion, accompanied by a watery, pale urine of weak acidity and low specific gravity.

Density.—The normal urine is generally of a specific gravity of 1015 to 1025: 1021 is about the healthy average, and anything over this, if constant, is apt to prove irritating to the mucous membranes of the urinary tract. The temporary increase or decrease in this density is so easily produced as to make such changes of no importance clinically. If, however, an increase above or a decrease below such a density is permanent, it demands investigation. The relation between the volume and the density of a urine is so close that the investigation of one means the investigation of the other, as it helps a physician very little in many cases to know the specific gravity if he does not know the twenty-four hours' amount. The specific gravity is so easily taken, and the amount is so much more troublesome to measure, that we are rather accustomed to estimate the latter from a knowledge of the former.

A very simple, and therefore important, way to estimate the amount of solids present is to multiply the last two figures of the specific gravity as recorded by the urinometer by $2\frac{1}{3}$. This gives the amount of solids in grams in 1 liter of urine. This is of course important with relation to the total amount of urine passed.

A small amount of urine of a low specific gravity means the excretion of a small amount of solids, due, of course, either to decreased metabolism or to the ingestion of small amounts of food. If this condition exists together with kidney trouble, it means look out for uremic symptoms. The reverse of this condition—that is, a small amount with a high specific gravity—means concentration from diminished fluid elements.

This is most commonly found after hard exercise in people who drink but little water and in the early stages of acute diseases. It is easy to decrease the specific gravity and increase the amount of urine by taking certain diuretic drugs. This condition—that is, a large amount of urine of a low specific gravity—often exists in convalescence from acute diseases or in the decreasing stage of a dropsical condition. If due to a renal affection, it is most commonly a chronic interstitial nephritis or the convalescence from a very acute nephritis just before the kidneys have re-established themselves in the customary routine of their work. If the quantity and specific gravity are both

large, it means, usually, either diabetes mellitus or the condition known as diabetes insipidus, where both amount and solids are increased.

Color.—The color of urine is usually spoken of as *pale*—that is, colorless to pale yellow; *normal* or amber color; *high* or yellow brown; and *dark*. The first three may be normal urines; the other is never so. The pale urine means an increase in watery elements, and is usually large in amount, but of low specific gravity. If constant, it suggests some affection such as diabetes mellitus or insipidus, where the amount for twenty-four hours is regularly increased.

High-colored urine means concentration. It is usually less in volume than normal, and, if constant, suggests that the urine may be irritating in character and needs dilution. The dark color of urine is generally due to the presence of blood or bile, more rarely to the effects of some drug, generally carbolic acid or, occasionally, rhubarb or senna.

The urines of people suffering from melanotic cancer sometimes take on a dark-brown color after standing for a time, thereby setting free some dark pigment. In the same way urines in cases of carbolic-acid poisoning grow darker the longer they are left standing. In cases of hematuria the color depends upon the seat of the hemorrhage and the length of time the specimen is left standing. If the hemorrhage is from the bladder or urethra, one gets a bright-red color, while if it is from the pelvis or tubules of the kidney, the urine is of a higher-colored red; and, again, the longer the urine stands the darker and less red-looking it becomes. Of course the shade of color also depends upon the quantity of blood present, as a small amount gives only a smoky look to the urine. As the amount increases the urine gets blacker and blacker looking. Blood in the urine is, of course, most easily seen with the microscope, but, occasionally, we find cases where there is no blood present, the urine being colored by blood-pigment. That is to say, these are cases of hemoglobinuria as contrasted with hematuria. No blood-corpuscles are present, the pigment being free in the urine.

These cases are rare, and are usually found in conditions like typhus fever or scurvy, where there is much disintegration of blood-corpuscles. The spectroscope demonstrates this condition best, but if a little of such urine be acidified with a few drops of acetic acid and boiled, a brown precipitate forms. Bile in the urine usually gives a color which varies from a greenish-yellow to a reddish-brown according to whether the bile-pigments are decomposed or not. Such urines nearly always form a greenish-yellow foam on the surface if they are shaken. If a little urine which contains bile be put on a porcelain surface (white), and a drop of nitric acid added to it, the presence of bile is demonstrated by a beautiful play of colors from green, through blue and red, to yellow.

Reaction.—Healthy urine is usually slightly acid in reaction, chiefly because of the acid salts which it contains, and which it is the work of the kidneys to separate from the blood. The reaction is best tested by dipping small strips of blue litmus-paper part way into the urine, and contrasting the undipped portion with the acid red of the part which is wet with urine. The lack of the red acid reaction is usually sufficient evidence of lack of acidity in the urine.

A very acid urine usually means a very concentrated one, from the abundance of the salts which it contains. Whenever the acidity of the blood is diminished by a vegetable diet or by the administration of alkaline drugs, the urine becomes mildly acid or even alkaline to a corresponding degree, and this explains why the urine is often temporarily alkaline after a solid meal.

In certain diseases accompanied by extreme debility the urine is often kept in a faintly acid or alkaline condition for considerable periods of time, probably because of the excessive elimination of alkaline carbonates.

This is often true in anemias, wasting diseases like pulmonary phthisis, nervous debility, etc., and gives rise to a condition commonly but improperly spoken of as phosphaturia, because the alkaline or faintly acid urine is more or less constantly clouded with the precipitate of phosphates.

True phosphaturia—that is, a real increase in the twenty-four hours' amount of phosphoric acid eliminated—is a very rare condition. If a urine is alkaline from decomposition, it means either that it has decomposed while standing or that the decomposition has taken place in the bladder by reason of bacteria introduced from without, and generally by unclean instruments. If care be taken to have the specimen voided into a perfectly clean vessel, it will often keep for days without decomposing, although urines vary in this respect.

If a urine containing pus is found to remain acid for days without beginning to decompose, it should at once suggest that the pus comes from the pelvis of the kidney, as the urines of bladder-disease rarely keep fresh for any length of time.

Transparency.—Normal urine is always clear when passed, but of course many clear urines are not normal. A few minutes after being passed a slight cloud of mucus and epithelial elements may be seen suspended in the fluid. If the urine is cloudy when passed, it means, usually, either *pus* or *phosphates*, more rarely *bacteria*, which may be present in large numbers, with little or no pus, or very much more rarely still a condition known as *chyluria*, which is a milky appearance of the urine caused by minute fat-globules suspended in it. This condition will be considered more at length elsewhere.

If the cloudiness be due to phosphates, a few drops of acetic acid will clarify the urine at once. Free pus settles quickly to the bottom of the glass, leaving the urine clear above it. It can be readily demonstrated with the microscope. Bacteria make a slight, filmy turbidity which is unchanged after standing, showing no tendency to settle. It must be remembered in this connection that some urines, clear when passed, throw down a cloud of amorphous urates as soon as the urine has had a few minutes in which to cool. The turbidity thus produced may be quickly dispelled by a little heat, care being taken that the heat does not prove potent enough to replace the cloud of urates by one of albumin. Decomposed urine always becomes turbid on standing, and is coated over with an iridescent film of triple phosphates.

Odor.—Of the odor of urine little need be said. The ammoniacal odor due to the decomposition of urea is familiar. Sometimes there is associated with it the odor of sulphuretted hydrogen, due to the pus or albuminous matter in the decomposing urine. The only other odors of importance are those due to drugs, such as copaiba, cubeb, sandalwood oil, carbolic acid, turpentine, etc. The characteristic smell of asparagus in the urine is familiar to all.

CHEMICAL CONSTITUENTS, NORMAL AND ABNORMAL.

Urea.—The kidneys throw off a large percentage of the waste products that result from the metabolism of the tissues of the body. The process of combustion that produces these waste products is not always perfectly carried out, so that, instead of having one waste product as its result, we may have any one or more of a series of them.

Urea, which is the chief and by far the most important chemical constituent of the urine, is a white crystalline solid of neutral reaction, and so soluble that its crystals are never seen in the urine. Crystals of it may occasionally be seen on the skin, especially in the axilla after death from uremia. It represents the final product of tissue-combustion, and there may be found with it uric acid, oxaluric acid, xanthin, kreatinin, sarcein, and so on, all of which are products of the less complete oxidation of tissue. With many of these we need not concern ourselves, but uric acid and one or two others demand consideration.

Urea, then, is the chief representative of the waste material of the body, and therefore its amount fairly represents the amount of this waste, and so the amount of combustion itself. The quantitative amount of the urea, then, is often of the greatest importance. The amount secreted in the urine by healthy people under ordinary conditions of life is about 25 to 40 drams in each twenty-four hours, but this varies to a considerable degree with circumstances. It is increased by anything which increases the metabolism of tissue, such as increased ingestion of animal food and increased exercise, mental or physical. Pathologically, in the same way it is increased by any condition which promotes combustion of tissue. In acute fevers, for instance, the amount will sometimes go as high as 60 drams, or, occasionally, even to 80 drams, in twenty-four hours, and, as the ingestion of food in such conditions is usually decreased, this increase of the products of combustion nearly all comes from the tissues themselves.

In acute disease accompanied by dropsy—for example, acute nephritis—part of the urea is eliminated in the dropsical fluid, and so, as this fluid increases in amount, the quantity in the urine may be correspondingly diminished. This is also true in acute diarrheal troubles. In health free perspiration may eliminate urea from the blood to an extent perceptibly affecting its amount in the urine.

If the urea in the blood is not eliminated from the body properly, it gradually accumulates until it gives rise to symptoms indicating its presence in quantity. These symptoms are rather loosely spoken of as a condition of uremia, and it is, of course, in this connection that the quantitative amount of urea excreted is of importance to us clinically, for by frequent such estimates the cause of the disease and the effect of treatment upon it may be judged with some accuracy.

In making such an estimate the urine for the whole twenty-four hours should be mixed and tested, as, with the varying conditions of food and sleep, the amount of urea varies considerably at different times in the day. The various methods for quantitative estimates of urea are so elaborate as to place them practically out of the reach of the practitioner of medicine.

Dr. Charles Doremus of New York has a practical bromine method which can be carried out by means of his ureometer (Fig. 1), made and sold, with instructions for its use, by Eimer & Amend of New York. The writer has no personal experience with this method, and will therefore quote the various directions and suggestions with regard to it made by Dr. Eugene Fuller of New York in a recent paper on urine-analysis:

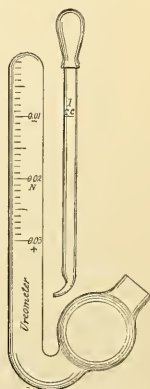


FIG. 1.—Ureometer.

“Reagents Necessary.”—The sodium-hydrate solution (100 grams to 250 cubic centimeters of water, or 6 ounces to 1 pint of water) will keep indefinitely when tightly stoppered. Bromine, 25 cubic centimeters added to the above amount of sodium-hydrate solution, will make the concentrated hypobromite-of-sodium solution. This solution does not keep very well; so, if but few tests are to be made, it is well to make up but a small amount, observing these proportions. The bromine may be removed from the bottle in which it is kept by means of the metal pipette. One cubic centimeter of bromine suffices for a test. More can be removed if a quantity of hypobromite is to be made up. Some care must be exercised in handling the bromine, since it gives off irritating fumes; but by the above method of procedure no inconvenience ought to be experienced.

“This concentrated hypobromite must be diluted with its own volume of water. This can be done approximately.

“The long arm and the bend of the ureometer must be filled with the hypobromite.

“Having washed the pipette, draw up exactly 1 cubic centimeter of urine; pass the pipette through the bulb of the ureometer as far as it will go in the bend; compress the nipple *gently* and *steadily*. The urine will rise through the hypobromite, and the urea will instantly decompose, giving out nitrogen gas.

“Withdraw the pipette after the urine has been expelled, taking care not to press the nipple hard enough to drive the air out after the urine, and read the volume of gas after allowing the froth to subside. The ureometer indicates, according to its graduation, either the milligrams of urea in 1 cubic centimeter of urine or the grains of urea per fluidounce of urine.

“It also indicates by the signs + and — on either side of the central division whether the urea is present in a normal quantity or is increased or diminished.

“When the total quantity voided in twenty-four hours is known, the calculation of the amount of urea is very simple. Multiply the result found in milligrams by the number of cubic centimeters voided, or the grains per fluidounce by the number of ounces voided.

“The percentage by volume, or the milligrams of urea per 100 cubic centimeters of urine, is ascertained by multiplying the milligrams of urea found by the test by 100.

“Lowering the ureometer into a vessel of water until the water and hypobromite inside and that outside the graduated limb are on a level will give a more correct reading. The ureometer is graduated for 65° F., and upon an experimental basis.

“It is well to impress the fact that only those urines which have not undergone decomposition are available for accurate estimations of the quantity of urea, for, as has been previously noted in such conditions, urea is rapidly converted into carbonate of ammonium.”

Uric Acid.—Uric acid, although the product of incomplete oxidation of tissue, is found in a small quantity in all urines, and it is only when it occurs in comparatively large amounts that it is of importance clinically. In the latter instance, if the urine is allowed to stand for a few hours, the uric acid can often be seen by the unaided eye as a red brick-dust deposit in the bottom of the vessel. In health it should be in solution in the urine, and, as it is only slightly soluble in water, it must combine with a basic salt to form urates in order to keep in solution. These urates, if present in any amount, usually cloud the urine after it has been standing for a few hours,

and appear as a white or reddish-white sediment visible to the eye. They are much more soluble in warm than in cold water, and are readily redissolved after precipitation by the addition of hot water to the urine.

This deposit of urates comprises the acid urates of sodium, potassium, and ammonium, and is usually amorphous in character, although occasionally hedgehog crystals of urate of ammonium may be seen in clumps. It is these crystals which often form the nucleus of calculi in children. Urates are often constituents of calculi, and their significance in the urine is often much the same as the uric acid itself.

The uric acid tends to deposit itself from a normal urine after standing ten or twelve hours; then it may be seen in crystalline form both with the unaided eye and with the microscope. The crystals are always colored, but may be of a light-yellow or a deep reddish-brown, or of any color between these two extremes. The size, shape, and arrangement of the crystals vary greatly, the common shapes being pointed oval, lozenge, and dumb-bell crystals; they all tend to arrange themselves in queer kaleidoscopic masses (see Fig. 2). It is

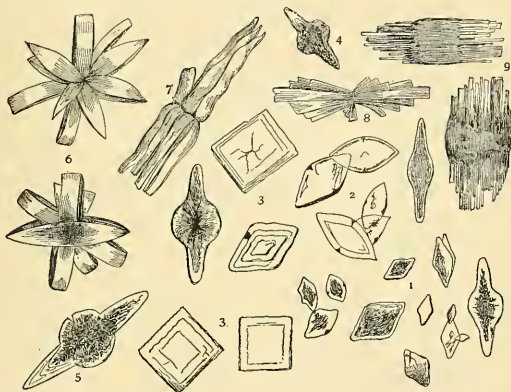


FIG. 2.—Forms of uric acid: 1, rhombic plates; 2, whetstone forms; 3, quadrate forms; 4, 5, prolonged into points; 6, 8, rosettes; 7, pointed bundles; 9, barrel forms precipitated by adding hydrochloric acid to urine.

this strong tendency to combine in masses which makes uric-acid calculi so common.

Uric acid in excess, then, is found in the system in any condition which interferes with perfect oxidation of tissue. Such conditions are commonly certain affections of the nervous system resulting from mental or physical exhaustion; anemias; chronic gastric diseases; some acute febrile diseases; gout and rheumatism. People who are large eaters and take too little habitual exercise often have an excess of uric acid in their system.

Of course, in attempting to treat such conditions the cause must be found and treated. In acute rheumatic conditions we find no increase, and oftentimes even a decrease, of uric acid in the urine during the paroxysms of the disease, and a gradual increase up to far beyond the normal after the paroxysm has passed.

In testing for uric acid various methods may be pursued. A little urine

in a watch-glass can be acidified with hydrochloric acid, and after standing over night crystals will be seen on the sides and bottom of the glass and on the surface of the fluid. This test implies experience in knowing from the quantity of the crystals present whether the uric acid is increased in amount or not. In the same way, blood-serum can be tested for uric acid by separating out the albumin and then acidifying the residual filtrate in a watch-glass, and letting crystals of uric acid collect on a bit of silk thread immersed in the solution. Here, again, experience is necessary.

The classic test for uric acid is called the murexid test, and is the one commonly used in testing calculi, as it will detect either uric acid or urates. It is as follows: Evaporate the fluid to be tested in a white porcelain dish over a water-bath; add a few drops of nitric acid and evaporate again; then add a drop or two of ammonia, and you get a beautiful purple-red color (murexid), and crystals are deposited after standing a time. These crystals reflect light of a cantharides-green color.

Calcic Oxalate.—Oxalic acid is another product that is formed as an intermediate step in the combustion process, and comes between urea and uric acid in the series. It is found in very small quantities in normal urine in the form of calcic oxalate, but it is contained in normal specimens only occasionally and after the urine has been left standing for a time.

It is fair to say that any urine containing more than a crystal or two of calcic oxalate for any length of time is not the urine of a healthy individual, and the condition is one that should be treated. Calcic oxalate occurs in urinary sediments in the form of octahedral (envelope-shaped) crystals (Figs. 3 and 4), which are so easily seen and so characteristic that no further test for them is necessary. Occasionally dumb-

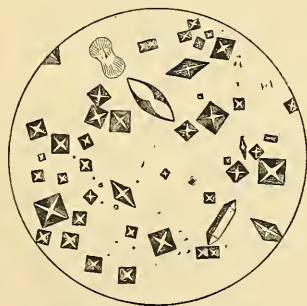


FIG. 3.—Calcium oxalate (Laache).

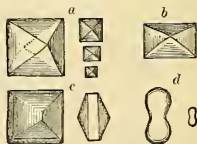


FIG. 4.—Oxalate of lime: *a, b*, octahedra; *c*, compound forms; *d*, dumb-bells.

bell-shaped, oval, or round crystals are seen, the last named being rare and sometimes mistaken for a blood-corpuscle. They are so much more refractive that the mistake is not a common one.

Oxaluria is only a symptom pointing to a debilitated condition of the system, and of the cause of this condition little is known. Oxaluria is most often associated with conditions of nervous debility, perhaps especially often with those cases of debility arising from sexual excesses. So the urines of patients suffering with true spermatorrhea are very apt to contain crystals of calcic oxalate. This is so frequently the case that one should always be on the look out for spermatozoa if, in examining the urine of a nervous patient, he finds calcic oxalate present.

In addition to the nervous condition which is always an accompaniment of oxaluria, we generally have symptoms due to the mechanical irritation

of the mucous membranes of the urinary tract by the crystals in the urine; so there is usually vesical tenesmus and pain across the back, even extending down the thighs and into the testicles. If the oxaluria is marked, we may have a good deal of a deposit in the kidneys, and so a bloody urine with renal epithelium and renal and blood casts in the sediment. If the condition lasts for any length of time, there is usually calculus-formation, the calculi commonly containing uric acid as well as calcic oxalate.

The treatment of this condition, aside from the treatment of the nervous system, is to promote the solution of the calcic oxalate in the urine by giving mineral-acid tonics. Claret and effervescent drinks should be avoided, also the ingestion of the vegetable rhubarb, which contains a good deal of oxalic acid.

Cystine.—Cystine is still another of the intermediate products of the combustion of nitrogenous substances. It occurs in small quantities in solution in normal urines, but when it occurs in pathological quantities it is deposited in the form of yellow six-sided crystals that are characteristic (Fig. 5). It is of interest clinically only because it commonly forms a small yellow calculus, usually soft, but sometimes hard if the cystine is present in combination with uric acid. To test such a calculus dissolve a portion in hydrate of potash; add a little plumbic-acetate solution and boil, getting a black deposit of the sulphate of lead, owing to the large amount (25 per cent.) of sulphur which cystine contains.

Indican.—Indican is in small quantities a constituent of normal urine, and occurs pathologically in much larger amounts. It has, in the past, been considered of great diagnostic importance, and much has been written of its clinical significance, especially by French authors. It is made by the union of indigo-blue with sugar, and is formed chiefly in the upper intestine during the process of digestion. Any cause which interferes with the proper function of the intestine and prevents the absorption of the products of the first part of digestion gives rise to a marked increase in the amount of indican in the urine. This is especially true of obstructive diseases of the bowels and other abdominal viscera—*e.g.* new growths and hernia with some obstruction of the bowel. Peritonitis, cholera, and cirrhosis of the liver are other diseases associated with increased amounts of indican.

On finding such an increase in any specimen of urine, the diagnostician should be cautious in ascribing too much importance to it, for indican is often found in increased amounts in the urines of nervous people suffering from functional digestive disturbances. In testing for indican the reaction of Heller gives a very easy demonstration, and is quite delicate enough to show small amounts of indican.¹ Three or four cubic centimeters of strong hydrochloric acid are mixed with 30 or 40 drops of urine in a test-tube, and if indican is present one gets a color varying from reddish-violet to an intense blue according to the amount present. If a few drops of strong nitric acid are added, the test is still more delicate, and in the course of a few minutes one gets a violet-colored reaction.

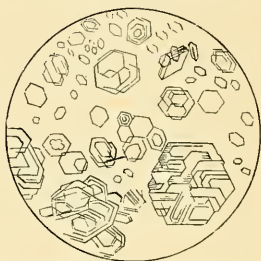


FIG. 5.—Crystals of cystine (after Ultzmann).

¹ See Neubauer and Vogel, 7th ed. (translated), p. 71.

Chlorides.—Chlorides are found in normal urine in considerable quantities, chiefly as the chloride of sodium. They are occasionally of importance to the general practitioner from the fact that in certain acute diseases (notably in pneumonias) they are much decreased in amount. Aside from this, they are rarely of diagnostic importance. They may be demonstrated in an acid urine by adding to it, drop by drop, a solution of nitrate of silver, thereby precipitating a thick white cloud of argentic chloride.

Sulphates.—The sulphates normally present in urine are of little clinical importance, and do not demand consideration in a chapter of this character.

Phosphates.—Phosphoric acid is present in the urine in combination with potassium, sodium, calcium, and magnesium in the form of phosphates. The phosphates of sodium and potassium (alkaline phosphates) are very soluble, and therefore are never precipitated from the urine. The phosphates of calcium and magnesium (earthy phosphates) are of clinical importance, as in many conditions of the system, both in health and disease, they are precipitated from the urine, and are often associated with symptoms of much importance and demanding careful consideration.¹ These urines, turbid with precipitated phosphates, are generally associated with nervous conditions and digestive disturbances. The turbidity at once disappears by the addition of a few drops of acetic acid to the urine. Microscopically, the precipitate is an amorphous sediment. True phosphaturia—that is, an actual increase in the amount of phosphoric acid eliminated in the urine in twenty-four hours—is a very rare disease which comparatively few observers have ever seen.

Triple Phosphates.—Triple phosphates or ammonio-magnesium phosphates are products of decomposition, and appear when fermentation sets in, never in fresh urines. They are easily recognized by the characteristic crystalline form. The crystals are coffin-shaped and very characteristic (Fig. 6). When seen at all, they are usually in large numbers. They are chiefly of importance when decomposition takes place in the bladder in consequence of diseased conditions of the bladder or prostate, as they are then often deposited in large quantities and quickly form calculi. These calculi are frequently found in men leading catheter lives who are not over-cleanly in the care of their catheters.

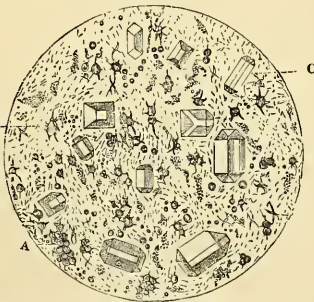


FIG. 6.—Deposits in ammoniacal urine (alkaline fermentation): A, acid ammonium urate; B, ammonio-magnesium phosphate; C, bacterium ureæ.

Albumin.—A generation ago it was the medical belief of the day that albuminuria was a dangerous symptom, generally indicating organic disease of the kidney of a serious nature and warranting the gravest prognosis. To-day we know it to be true that albuminuria is not necessarily a symptom of gravity, and that it often exists, especially in persons beyond middle life, with no other indication of renal disease than, perhaps, a few hyaline or fine granular casts—so few as to be often hard to find.

In fact, so much has been written on this subject of late that the present-

¹ See the writer's paper on "Phosphaturia," *Boston Med. and Surg. Journ.*, Feb. 8, 1894.

day observer is, perhaps, going to the other extreme and manufacturing evidence to show that albuminuria has often no clinical significance and need cause no apprehension in the mind of the physician. Whether or not there be a physiological albuminuria, it is not in the province of this treatise to discuss. The line between health and disease is not an easy one to find, and the term "physiological" might prove hard to define in this connection. At all events, albumin in the urine, if it means nothing else, means that the utmost watchfulness and care should be used before deciding that it has no clinical significance.

In testing the urine for the presence of albumin we are fortunate in having two tests, the heat and nitric-acid tests, which are most satisfactory as being amply delicate enough for clinical purposes, easily carried out, and sustained by the proof of long and satisfactory trial. In the hands of the writer the heat test is perhaps a little the more delicate, but the difference is slight, and either is capable of demonstrating one-twelfth of 1 per cent. by weight of albumin. It may, as a rule, be taken for granted that these two tests are capable of demonstrating any amount of albumin that has clinical significance, and it is the writer's practice to use no other tests than these two.

To carry out the heat test, fill a test-tube about half full of urine which has been previously filtered if it contained any pus; add two or three drops of acetic acid, and then in a flame heat the upper part of the fluid to the boiling-point. The acetic acid will have eliminated any phosphatic cloud which was present, and the heat will have carried away any cloud of urates before the precipitate of albumin begins to appear as a white cloud in the heated portion of the column of urine. If the amount of albumin is very small, the cloudiness may be quite difficult to see, and a dark-covered book will often do good service as a background to make more marked the contrast between the clear fluid below and the turbid area above. If the amount of albumin is greater, the cloudiness is more flocculent, and if the amount is large, the precipitate may solidify in the test-tube and not pour out when the tube is inverted.

The nitric-acid is the most commonly used of all the tests, and is easily carried out. Fill a cup-shaped (not conical) sherry-glass from one-third to one-half full of urine. Tilt the glass to moisten the sides of it up to the rim, and then pour gently and slowly a dram or so of pure nitric acid down the tilted side of the glass, so that it may trickle gently down into the urine and sink to the bottom of the glass, which it will do at once if the test is properly executed. The line where the two fluids join is well marked, and there, if albumin is present, it appears as a sharply-defined white zone, varying in thickness and density according to the amount of albumin, but always situated at this point and always sharply defined.

Various conditions obscure this test. The turbidity due to phosphates is readily dispelled by a drop or two of acetic acid; that due to urates, by a little heat: if pus is present, it can usually be filtered out with ease before the test is applied, but if there is much blood present, there is no need of going through the test at all, for albumin from the blood-serum must necessarily be present in such conditions even if the urine be filtered. Decomposed urines are difficult to test in this way, as the turbidity obscures the test and the effervescence caused by adding acid to an alkaline urine interferes with the delicacy of the test. In such urines the test for albumin is of little value. Again, if the specimen to be tested is rich in urates, we often get, on the addition of the acid, a zone of urates which may easily be confused with one of albumin. The urate zone always occurs in the urine and not at the union

of the urine and acid; so it is higher up and has a layer of urine beneath as well as above it. Very rarely the nitric acid precipitates a layer of a substance (thought to be mucin) which may cause confusion. The upper surface of this zone is not sharply defined, and it tends to spread quickly and cloud the whole urine. It is very rare and hardly needs mention.

If a more delicate test for albumin is desired, the method of Millard may be used. The fluid consists of—acid. carbolie., 20 c.c.; acid. acetic., 70 c.c.; liquor potass., 220 c.c. To about a dram of this fluid add, drop by drop, the urine in question, letting it trickle slowly down the edge of the glass containing the reaction fluid. The presence of albumin is indicated by a fine white deposit at the point of union of the two fluids.

The nitric-acid test for albumin is of the greatest importance, for by it not only can we demonstrate the presence of albumin, but we can, if experienced, tell its quantity at a glance with extraordinary accuracy—in fact, with a degree of accuracy such that for the physician experienced with this test no further quantitative estimation or test for albumin is necessary for clinical purposes. The greatest care is necessary in adding the nitric acid to the urine, so that the spreading of the zone from the agitation of the fluids shall be minimized. Without this precaution the zone of albumin will appear heavier than it should, and so lead one to an over-estimation of its amount. If the zone be examined as soon as formed and the above precautions be carefully followed, it may be stated as a rule that the faintest possible trace of a zone represents one-twelfth of 1 per cent. by weight of albumin. From this up to 1 per cent. the amounts can be calculated by the experience of the observer. Any zone of less than 1 per cent. can be looked through from above downward, so that the bottom of the glass can be seen. If 1 per cent. or more is present, the zone is opaque. When the amount is very great the zone takes on a peculiar thick, curdy appearance which is characteristic of at least 2 per cent. of albumin. Larger amounts than 2 per cent. are very rare, but when present even the experienced eye cannot estimate them by this test. The only great objection to this method of quantitative estimation of albumin is that it takes for granted a considerable experience. This experience must be great, because absolute accuracy and uniformity of observation are the necessary ends to be reached.

Whatever may be one's belief as to the possible indications of albuminuria which is physiological and of no clinical importance, it must be admitted that the constant presence of albumin in the urine is suggestive, to say the least, of disease; and it is the writer's belief that a little time and care will usually suffice to demonstrate the cause of its presence. For example, in the cases in which albumin is present after violent exercise, and not at times of rest and quiet, it is common that the urine contains a little sandy material after exercise, quite enough to be the irritating cause which suffices to produce the albumin, but still so small an amount as to be easily overlooked.

Small portions of albumin are usually referable to the kidneys if pus and blood can be ruled out as a reason for its presence. Occasionally disease of the seminal vesicles or prostate may explain its presence as a symptom. In the latter case the microscope will reveal seminal or prostatic secretion in the urine. Similar slight albuminurias are sometimes the product of the action of certain drugs which irritate the kidneys, such as turpentine, cantharides, and salicylate of soda.

In diseases accompanied by obstruction of the cardiac or pulmonary vessels, also in conditions where there is a mechanical obstruction to the circulation produced by a tumor, the pregnant uterus, etc., albuminuria is a

common occurrence. Again, in acute febrile conditions, such as the eruptive fevers, typhus fever, and septicemia, we get albuminuria due to the accompanying renal condition. Finally, we have to consider the albuminurias due to organic disease of the kidneys themselves.

When a urine contains blood, it need never be tested for albumin, as, no matter how carefully it be filtered, albumin from the blood-serum will still be present. In such cases albumin may, of course, be taken for granted and the test be considered of no significance. Albuminuria from purulent urine needs consideration. Pus in any amount invariably means albumin. Generally it is found in filtered specimens in comparatively small amounts (in the neighborhood of $\frac{1}{6}$ per cent.), whether the pus comes from a gonorrhoea or vesical condition due to whatever cause—*e. g.* the extension backward of a gonorrhoea, obstructive diseases of the prostate, stone, and the earlier stages of a tubercular process.

In cases where the amount is much larger than this (*i. e.* about 1 per cent.) pyelitis should be looked for carefully, unless there be an ulcerated bladder or a condition (prostatic or otherwise) associated with great tenesmus; for both of these last two conditions are often associated with urines containing large quantities of albumin, and it is surprising to see how quickly the relief of the condition by operation will cause a marked diminution in the amount of albumin in the urine.

True renal albuminuria remains for our consideration. The amount of albumin present is always important, as it is sometimes a symptom of diagnostic significance. Of the renal conditions that are accompanied by large amounts of albumin may be mentioned, first, the early stages of acute nephritis, where the amount is often over 1 per cent., although in conditions of active renal hyperemia we may get but a trace of albumin; second, the earlier and more active stage of a chronic parenchymatous nephritis, where the amount is sometimes so large as to solidify in the test-tube when the heat test is applied (over 2 per cent.); third, the later and more inactive stage of chronic parenchymatous nephritis, where the amount, although much decreased, is still apt to remain in the neighborhood of $\frac{1}{2}$ per cent.; fourth, in the later stages of amyloid kidney. In the first stages of tubercular and chronic interstitial kidney, in gouty kidney, and in amyloid kidney (except in its last stage) there is usually a fairly large amount of albumin in the urine, generally in the neighborhood of $\frac{1}{4}$ per cent., although at the stage of the disease when chronic interstitial nephritis (contracted kidney) is most often recognized clinically the amount is much smaller than this, and may be so small as to be incapable of demonstration by either the heat or the nitric-acid test.

The amount of urine is usually very large in such conditions. Millard's test, which is much more delicate than the others, rarely fails to demonstrate the presence of albumin. There are always exacerbations which are readily recognized if these cases are watched for any length of time. At these periods the microscope will show a sediment about which there can be no doubt. The albumin will be present in much larger quantities, and sometimes, though not often, there is present as much as $\frac{1}{4}$ per cent.

In cases of dilated bladder from an obstructing prostate, where the obstruction has existed for a good while, and also in cases of hydronephrosis, the amount of albumin in the urine is usually small as long as the pressure of the fluid exists. If that pressure be suddenly relieved by catheterization or otherwise, there is usually a marked inflammatory reaction and a much greater quantity of albumin in the urine. Such cases often assume the most serious aspect.

To classify rudely these different conditions, then, we may say that we have considered—1. Idiopathic or physiological albuminurias, which are usually slight, intermittent, and are rarely of long duration or of much clinical importance; 2. The cases due to conditions outside the kidneys—*e. g.* albuminurias in acute fevers, from drugs, obstructive tumors, in old people with atheromatous vessels, and in conditions associated with pus or blood, or both, in the urine; 3. True renal albuminurias, due to organic disease of the kidneys themselves. Great care should be taken not to let class 1 get too large by the addition to it of many cases where a little patience will suffice to demonstrate a more or less obscure cause for the albuminuria.

Sugar.—Of the etiology of diabetes we know but little. It is a constitutional rather than a local disease, which Osler, in his *Text-book of Medicine*, defines as “a disorder of nutrition, in which sugar accumulates in the blood and is excreted in the urine, the daily amount of which is greatly increased.”

Glycosuria, then, is merely the manifestation of this general condition, and the sugar in the urine is not due to any disease of the renal structures, which may be in good condition and doing their work perfectly well, although in some cases of persistent glycosuria we find a trace of albumin caused, perhaps, by the passage of the sugar through the kidneys. Of the common causes of glycosuria, heredity should perhaps head the list. Many conditions of the nervous system seem to have a causative influence, and especially conditions involving injury of the brain or spinal cord.¹ Obesity and dietetic excesses are occasionally associated with temporary glycosuria, especially if excessive amounts of saccharine food be ingested. In the real diabetic, however, sugar is practically never absent from the urine, and it is only by the most careful dietetic and hygienic care that its accumulation in the blood, and so in the urine, can be held in check. The disorder is not well marked clinically, and were it not for urine-analysis many cases would inevitably escape detection. Its tests are therefore important, and especially so its quantitative estimation, for by this means alone are we able to watch the progress of the disease and the effect of our efforts against it with any degree of accuracy. Again, too, the ordinary tests for sugar are apt to mislead as to even the approximate amount present in the urine, for the same patient will often pass a very large quantity (in twenty-four hours) of a urine of a low (for diabetes) specific gravity, each specimen tested containing but little sugar, while on the next day the amount passed for the twenty-four hours will be comparatively small, but of a high specific gravity, each specimen tested containing a large amount of sugar. Yet the total amount of sugar excreted in the urine in twenty-four hours may be the same for these two days. So it is evident how carefully the amount of urine, as well as the amount of sugar contained in it, should be watched in the progress of diabetic conditions.

Of the many useful tests for the presence of sugar in urine, the two which seem best adapted for general use are the Fehling's-solution test and the fermentation test. Fehling's solution is a solution of copper sulphate and an alkaline tartrate (sodium). As this makes a combination which does not keep, the copper and tartrate solutions should be kept in separate bottles. To make the test, add to equal quantities of the copper sulphate and tartrate solutions, which have been mixed in a test-tube, about a dram of water; boil for a few minutes to make sure that the solution remains clear, and is therefore fit for use; add the urine drop by drop until about the same quantity has been added as was used of each of the other two substances.

¹ See “Traumatic Glycosuria,” by Higgins and Ogden, *Boston Med. and Surg. Journ.*, Feb. 28, 1895.

If sugar is present, there results a yellow-red precipitate which is so easily seen and so characteristic that it cannot be mistaken. This is an admirable test, quite accurate enough, and having the sole drawback that the solution does not keep well. If the two ingredients be kept in separate bottles properly corked, and the above safeguard be adopted, but little trouble will be experienced.

Dr. Fuller of New York describes a modification of this test which was recommended to him by Dr. Keyes, which he uses because it is easy to carry out and does not involve the employment of the unstable Fehling's solution. It may be done as follows: To 1 dram of liquor potass. in a test-tube add 3 or 4 grains (approximately) of tartaric acid; heat to boiling; then add 6 to 10 drops of a solution of 40 grains of copper sulphate in an ounce of pure glycerin; shake and heat again. To this fluid, which is of a deep-blue color, add the urine to be examined, a few drops at a time, heating between each series of drops, until you have added about half as much urine as there was of the solution in the tube. You get the characteristic yellow precipitate quickly or slowly according as there is a larger or smaller amount of sugar present in the urine.

The fermentation test for the presence of sugar in urine depends upon the fact that grape-sugar and yeast decompose to make alcohol and carbonic-acid gas. It may be easily done, and with a fair degree of accuracy, in the following simple way:

Take two four-ounce bottles of the urine to be tested. In bottle No. 1 put a little yeast; leave it unstoppered and put it in a warm place for twenty-four hours. Put bottle No. 2 in a cool place without any yeast, and at the end of twenty-four hours bring the second bottle to the same temperature, and take the specific gravity of the two specimens of urine. Specimen No. 1 will have a specific gravity much lower than specimen No. 2, and it may be considered as approximately true that each degree of specific gravity lost by fermentation represents 1 grain of sugar to the fluid-ounce of urine. To calculate the percentage of sugar present, multiply the number of degrees difference in the specific gravities of the two specimens by the fraction $\frac{23}{100}$.

Dr. Max Einhorn of New York has invented a saccharometer (Fig. 7) that makes this fermentation test as easily carried out and much more accurate than the above approximate method. The apparatus is accompanied by a set of directions for its use, which the writer appends:

"Directions: Take one-sixteenth of a cake of Fleischmann's yeast (wet compressed cakes), and shake thoroughly in the graduated test-tube with 10 cubic centimeters of the urine to be examined. Then pour the mixture into the bulb of the saccharometer. By inclining the apparatus the mixture will easily flow into the cylinder, thereby forcing out the air. Owing to the atmospheric pressure the fluid does not flow back, but remains there.

"The apparatus is to be left undisturbed for twenty to twenty-four hours in a room of ordinary temperature.

"If the urine contains sugar, the alcoholic fermentation begins in about twenty to thirty minutes. The evolved car-

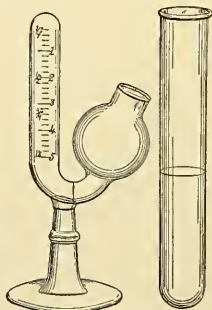


FIG. 7.—Saccharometer

bonic-acid gas gathers at the top of the cylinder, forcing the fluid back into the bulb.

“On the following day the upper part of the cylinder is filled with carbonic-acid gas. The changed level of the fluid in the cylinder shows that the reaction has taken place, and indicates by the numbers to which it corresponds the approximate quantity of sugar present.”

If the urine contains more than 1 per cent. of sugar, it must be diluted with water before being tested.

Diabetic urines of straw-color and a specific gravity of 1018–1022 may be diluted twice; those of 1022–1028, five times; those of 1028–1038, ten times. The original non-diluted urine contains, in proportion to the dilution, two, five, or ten times more sugar than the diluted urine.

The quantitative test for sugar with Fehling's solution requires very carefully prepared solutions; that with the polariscope, an expensive instrument; so that for all ordinary purposes the fermentation test may be conveniently used, the method with the two bottles giving only approximate results, while that of Dr. Einhorn's saccharometer gives fairly accurate ones.

SEDIMENTS.

The crystalline structures which are commonly seen in the sediment of urines have been briefly considered under the several headings of the constituents which compose them. It remains for us to make brief mention of the organized sediments which are most commonly met with in pathological urines.

The study of sediments depends almost entirely on the microscope, and therefore what can be written on the subject in a brief way can be of little service in comparison with the knowledge which careful observation gives. It is the writer's purpose to make this portion of the treatise so brief as to be almost schematic, realizing that it can be at best a very slight aid to a knowledge of urinary microscopy, which nothing but accurate observation and experience can give.

Epithelia.—Epithelium plays a very important part in urinary diagnosis, for by its aid we are often able to locate a pathological process with absolute accuracy, and in many cases where this is not possible valuable suggestions will come from cells which are less accurately characteristic.

Epithelial cells in the urinary tract vary greatly in shape, size, and structure. This is true not only in different parts of the tract, but in different layers of the same piece of membrane. It may be stated as a rule that the cells are coarsest and least delicate in the anterior urethra, and become finer in structure (not in size) as they progress toward the kidney.

The same is true, but to a less marked extent, of the cells of the different layers of the same locality, the new cells of the deeper layers being the most delicate, while those of the older and outer layers are the least so. It is also true that, leaving out the male urethra and beginning in the bladder, the cells progressively diminish in size the higher up toward the kidney one goes.

Epithelial cells from the renal tubules are round in shape and about the size of pus-corpuscles, those from the smaller tubules being a little smaller and those from the pyramids a little larger than this. These cells may be distinguished from pus-cells by their nuclei, which are usually very large.

Cells from the pelvis of the kidney are battle-dore-shaped, although a few such cells come from the tubules at times. A long-continued pyelitis

puts round-cells from the deeper layers in the urine, and few or none of the others can be seen. These round-cells from the pelvis of the kidney cannot be distinguished from those coming from the small renal tubules. Usually, however, the amount of blood and pus present or crystalline elements from a calculus will make the distinction. These cells are also readily confounded with those from the deep layers of the vesical membrane. The latter are, however, rather larger in size and of firmer structure (Fig. 8).

Cells from the ureters are spindle-shaped, and are very rarely seen in urine, as the ordinary forms of inflammation in the urinary tract usually skip the ureters in their course. The ureter-cells are seen only after the passage of a calculus from the kidney to the bladder or during the inflammatory process that results from such a passage.

Bladder-cells are polygonal plates much larger than any of the cells just mentioned, being usually about double the diameter of the renal or pelvic cell. We cannot tell from a single cell whether it is from the bladder or vagina, but the grouping always solves this difficulty; cells from the bladder being seen usually in a single layer, while vaginal cells occur in layers overlapping each other, and they occur in large numbers not associated with the pus which would be the invariable companion of a similar number of vesical cells. Cells from the deeper layers of the vesical membrane appear in the urine in inflammations of a very severe type. They are always associated with a great deal of pus, and are round or oval in shape, resembling cells from the neck of the bladder, although of rather more delicate structure than the latter.

Cells from the neck of the bladder, from the female urethra, and from the prostatic urethra cannot be accurately distinguished. They are denser in structure than ordinary bladder-cells, and are round or oval in shape. Those from the male urethra are found progressively smaller in size as they go down the urethra, and are best seen in the shreds found in the last stages of urethritis. These shreds are composed of pus, a little blood, and a number of round or oval and occasionally caudate cells caught together in a mucous vehicle (Fig. 9). The prostatic cells are often found in pathological conditions where they are associated with prostatic fluid, and can sometimes be localized by this means.

Cells from the anterior urethra are of little diagnostic importance, as the discharge at the meatus, together with the endoscope, serves much better for diagnostic purposes.

It is evident that the cell-characteristics of one area of membrane very often merge so gradually into those of the neighboring regions that accurate lines of demarcation are impossible. None but the experienced observer can



FIG. 8.—Renal epithelial cells and epithelial cells from renal pelvis.

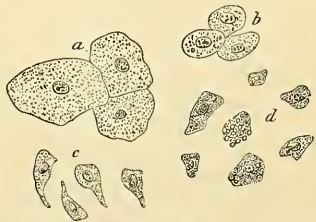


FIG. 9.—Epithelium from the urine: *a*, *b*, epithelium from the bladder, from the pelvis of the kidney; *c*, caudate epithelium (pelvis of the kidney?); *d*, renal epithelium partly changed into fat (Vierordt).

give even an approximate idea of location in many instances, even with the aid of other more or less characteristic evidences in the sediment.

Pus.—Pus is so common a constituent of urinary sediments that its careful study is of the utmost importance, for its very prevalence is apt to make the observer careless and to belittle the part it plays in urinary diagnosis. Pus-corpuscles are about the size of renal epithelium, but have a very distinct outline, and usually more than one nucleus, the most common number being three. The corpuscles have a granular appearance, and if the inflammation has lasted for some time, they lose their distinct outline and their nuclei become less distinct and often take on a horseshoe shape, which is more or less characteristic of old pus.

Pus means inflammation, and where pus is present in the urine its presence means inflammation somewhere in the urinary tract or, more rarely, in some pocket or sinus opening into it. Pus in any quantity is readily seen; in moderate amounts it merely clouds the urine, while in greater quantity it makes it thick and viscid as well as turbid.

The turbidity due to pus may readily be mistaken for that due—1, to bacteria; 2, to phosphates; 3, to urates. The two last-named forms, as we know, are readily distinguished from pus-turbidity by chemical means, and the first-named by the microscope, although the presence of bacteria presupposes a greater or less amount of pus as its companion in the urine.

There are, however, certain bacterially infected urines in which the acuteness of the inflammatory process has long since subsided, the quantity of pus has much diminished, and yet the number of bacteria remains very large. These urines often have but little sediment, and are clouded after long standing, the turbidity showing no tendency to diminish by the settling of the sediment to the bottom of the glass. More commonly, however, pus is present in quantities sufficiently large to pretty well conceal bacterial evidence until it is demonstrated by the microscope.

Before going on to a somewhat detailed consideration of the microscopic appearance, methods of localization, and the diagnostic value of pus in the urine, there are two pus-containing urines so characteristic and so easily contrasted in gross appearance that they should receive separate mention. First, there is a urine which is turbid with pus, but is properly acid, and of low rather than high specific gravity. The pus settles promptly into a small solid mass at the bottom of the glass, leaving above it a clear, good-looking urine. In the absence of a urethral inflammation of sufficient intensity to account for this pus, a pyelitis may be inferred. The urine will keep its acidity, while the pus will remain with few if any degenerative changes for some days.

In direct contrast with this is another class of pus-containing urines in which the acidity is quickly lost and the turbidity remains often after some hours' standing. When the sediment settles, it does so in a half-hearted way, appearing as a loose, flaky layer with uneven surfaces. If the settling has been very slow and the acidity therefore has gone, the sediment appears as a thick, gummy mass which does not redistribute itself uniformly through the urine if the vessel is shaken. Such urines indicate a cystitis.

Briefly, then, renal and pelvic pus settles quickly, and urines containing such pus retain their acidity, while bladder-pus settles badly and the urine decomposes quickly.

Having demonstrated pus in a urine, it remains to localize its source as accurately as possible, and then to consider its significance in the diagnosis and treatment of the case. This localization must be done, if at all, by a knowledge outside that furnished by the pus itself, for, except for the degenera-

tive changes just mentioned, all pus looks alike under the microscope. If the pus comes from the kidney, we are apt to have an acid urine with a sediment of pus, perhaps a little blood, and casts which may have pus-cells adherent to them. If the inflammation is a pyelitis, the urine is acid and the pus is not in clumps, while instead of casts we find many caudate or round epithelial cells according as the case is acute or of a more chronic type. If the bladder is the part involved, there is usually abundant epithelial evidence to show it and the diagnosis is easy.

There are, however, as will be seen presently, cases in which much difficulty may be experienced in localizing the inflammation. Pus from the urethra, excepting the prostatic portion, is rarely difficult to locate; if from the anterior portion, it appears or can be made to appear as a discharge more or less constant, and the second urine (if the micturition be divided between two glasses) will be clouded, all the inflammatory products being washed away in the first part of the stream. If the discharge is very small in amount, the endoscope may be necessary for the diagnosis.

Pus from the prostatic urethra is sometimes difficult to locate in chronic conditions. If the process is acute and the pus abundant, it flows back into the bladder and clouds the second portion of a divided urine, so that the two specimens look alike. Given, then, a urine turbid with pus, how shall we go to work to find its source? Have the patient pass the urine in two portions as nearly equal in amount as possible. If the second portion is clear, the discharge comes from the anterior urethra. If both are clouded, we have to consider, first, the prostatic urethra; second, the bladder; third, the pelvis of the kidney and the kidney. The ureter, as has been said, is rarely involved in the inflammation.

1. The deep urethra can usually be excluded as the seat of inflammation if the finger in the rectum or a steel sound in the urethra gives no marked tenderness and no blood follows such an examination.

There are, however, chronic cases of such inflammation where the discharge is so slight as not to flow back into the bladder and cloud the second urine, but is washed out in the form of shreds in the first portion of the urine. In these cases, although the diagnosis is often difficult, the microscope usually suffices to make it by demonstrating prostatic fluid and epithelial evidence of prostatic trouble. Of course the clinical history is often of the greatest assistance.

2 and 3. The bladder can be investigated by the cystoscope, and so the diagnosis is easy, but if this instrument is not at hand or its use is for any reason contraindicated, the investigation can be fairly well continued by washing out the bladder very carefully and thoroughly until the washed fluid comes away perfectly clean. Then have the patient urinate at the end of an hour or so, and compare the voided urine with that passed before the washing. If the urine passed before the washing is no more turbid than that after the thorough bladder-cleaning, it is probable that the pus comes from the kidney and not from the bladder. For if the latter organ was diseased, the pus ought not to accumulate in an hour to such an extent as to make the turbidity as marked as it was before. If the pus comes from the kidney, pain, tenderness, and possibly tumor often point to one side rather than the other, and the cystoscope, by bringing the mouths of the ureters into view, will sometimes make the diagnosis. Occasionally, on examining the second portion of urine, we find that it is more clouded than the first part, and sometimes that the greatest cloudiness appears in the very last part voided. This means (*a*) that there is an acutely inflamed prostate whose muscular contractions at the

end of micturition are most energetic and are squeezing out a large amount of inflammatory discharge; (b) that the case is one of pyelitis in an old person, or (c) of chronic prostatic hypertrophy with an atonic condition of the bladder, which allows the pus in the urine to settle at the bottom of the bladder, and so the settlings pass off in the greatest amount in the last part of the urine voided or drawn. The first of these conditions is associated with the pain and tenesmus of an acute inflammation; the latter two are not.

Pus coming from the kidney usually means—1. Extension of a gonorrhoea; 2. The results of prostatic obstruction; 3. Calculus; 4. Tubercle; 5. Bacterial invasion of the urinary tract; 6. Abscess from a constitutional cause; 7. Traumatism; 8. New growth.

Pus coming from the ureter usually means the passage of a calculus or its resulting inflammation.

Pus coming from the bladder usually means—1. Gonorrhoea and stricture; 2. Obstruction from prostatic disease; 3. Traumatism from stone, instrumentation, or from without; 4. Tubercle; 5. Bacteria; 6. New growth.

Pus coming from the prostatic region usually means—1. Gonorrhoea; 2. Prostatic hypertrophy; 3. Tubercle; 4. Traumatism from stone or from without; 5. New growth.

Pus coming from the seminal vesicle usually means—1. Gonorrhoea; 2. Tubercle; 3. Sexual excesses; 4. New growth, usually secondary.

Pus coming from the urethra means urethritis due to—1. Gonococcus; 2. Traumatism; 3. Tubercle; 4. Chaneroid; 5. Syphilitic ulceration; 6. Malignant disease.

Blood.—In considering the subject of blood in the urine the writer will confine himself to hematuria as distinct from hemoglobinuria, the latter being a rare condition which has already been referred to in this treatise.

Blood appearing in the urine in amounts large enough to alter its gross appearance has been mentioned in speaking of the color of the urine. The red blood-corpuscles seen microscopically in the sediment of the urine appear very much as do normal blood-corpuscles elsewhere, except that they do not appear in rows and that they have lost their mobility.

They are seen as round disks with a little yellowish tinge of color and a rather high refractive power. The longer they are present in a diluted urine the less easy they are to recognize, as they lose their color and refraction, their biconcavity gradually disappears, and they become globular and full of water.

If the urine is concentrated, on the other hand, they often assume an irregular shape and a shrivelled and dried-up appearance. Blood in the urine may have its origin in any part of the urinary tract, and, of course, the localization of the source of hemorrhage is of the greatest clinical importance. The writers on this subject are fond of making the statement that the only question of real difficulty is the differentiation between renal and bladder hemorrhage, as urethral hemorrhage is rarely difficult of diagnosis, and ureteral hemorrhages and those from the seminal vesicles are extremely rare.

Such statements are in the main true, and yet hemorrhage from the urethra, and especially from the prostatic portion, is common enough to merit always a most careful consideration. The appearance of blood at the meatus, together with a history of urethral inflammation, past or present, and the absence of symptoms pointing to the bladder or kidney, will usually make a diagnosis of urethral hemorrhage which the endoscope will corroborate, "but it is not sufficient to say that the urethrorrhagia, whether from a traumatism

or otherwise, is diagnostic of itself, for the writer has seen a sequel of gonorrhoea in the urethra permit blood to exude which escaped only with urination; nor is it enough to say that blood from the urethra will find its way out in the intervals of urination and has no relation to the act. Blood can escape from this canal during the act of urination. The physiological action of the urethra may cause blood to escape from a diseased area sufficient in quantity to be commingled with the urine as the latter passes, and there be no appearance of it at any other time."¹

Hemorrhage from the deep urethra is usually slight in amount, and has for its companion, as a rule, an amount of inflammation giving rise to pretty severe spasm of the muscles of expulsion; so it is common in such cases to have most of the blood appearing at the very end of micturition, the increased spasm at the end of the act irritating the inflamed surfaces of the membrane much more than at the beginning of the act.

In these cases there will usually be a few drops of clotted blood at the meatus at the end of micturition, and at the succeeding act of urination the clots of blood which have been lying in the canal since the last effort will be washed out in the urine. If the bleeding from the deep urethra is unaccompanied by any spasm and is large in amount, as it usually is under such circumstances, it flows back into the bladder and may even fill that organ. This may occur with the hemorrhage which often accompanies cases of chronic prostatic hypertrophy.

Ureteral hemorrhage occurs only as a result of the traumatism caused by the passage of a stone from the kidneys to the bladder. Here the clinical history and symptoms will make the diagnosis quite apart from any signs of blood in the urine.

Hemorrhage from the seminal vesicles is a result of an inflammation, usually due to gonorrhoeal infection. It is probably caused by the muscular contraction of the organs in expelling their contents at the time of ejaculation. The hemorrhage is evidenced by bloody seminal discharges, and is usually very slight in amount.

In discriminating between renal and vesical hemorrhage there are often many points in the clinical history of the case which will be of the greatest aid to the surgeon in his efforts at localization, but it is not possible to take up the question from this point of view in a short sketch like the present one. It is often written that blood coming from the kidney is blackish or brown in color, while that from the bladder is of a brighter red color.

The writer has never been able to verify this statement, for, although it is true, as a rule, that renal bleeding is less abundant and less persistent than bleeding from the bladder, the color alone is not necessarily an indication or even a suggestion of the source of the hemorrhage; and we may have a diseased bladder voiding a blackish urine in which the blood is very thoroughly mixed, while, on the other hand, we may have a hemorrhage from the kidney containing bright-red blood.

As a rule, the vesical bleeding is more abundant and more likely to coagulate in the bladder. So, if in attempting to use a cystoscope (which is, of course, of the greatest assistance in many of the cases, especially the renal ones) we find that in our preliminary washings it is comparatively easy to get the bladder washed out clean and to get a good view of the vesical interior, that is distinctly a suggestion that the hemorrhage is from the kidney. When the source of the bleeding is vesical, it is frequently difficult, and often impossible, to get the bladder clean enough to render the use of the cystoscope

¹ L. B. Bangs: "Blood in the Urine," *Medical Record*, Nov. 5, 1892.

possible. In renal cases where the cystoscope is successfully used it is easy to see the blood as it enters the bladder from one or the other ureter.

In these cases there sometimes form blood-casts of the ureter on the affected side, and such casts, washed into the bladder and voided at a subsequent urination, are often important diagnostic points in favor of a renal, or more commonly pelvic, source of the hemorrhage.

Of the iodide-of-potash test, advocated and described by Dr. W. K. Otis of New York, the writer cannot speak from experience. To make this test, the bladder to be examined is filled with a solution of iodide of potash, and then, after a short time has elapsed, the patient's saliva is tested for iodide of potash. If present, the hemorrhage is vesical. If absent, the bladder is healthy, as it is held that if the vesical membrane is whole and uninjured no absorption takes place.

Hemorrhage to any extent rarely takes place from the kidney without giving rise to colicky pains on the affected side, and on palpation we find tenderness and possibly tumor, locating the hemorrhage in the kidney of that side. Bladder-hemorrhage, on the contrary, may take place in the absence of inflammatory conditions and with no symptoms pointing to it. It is by no means uncommon for genito-urinary surgeons to be consulted by patients with hematuria who had no inkling of any trouble until they saw the blood in the urine.

Renal hemorrhage is, of course, increased by the instrumentation, irrigations, etc. which a proper examination renders necessary, while vesical hemorrhage is often much increased in this way. Surgeons are constantly reporting cases of renal hemorrhage of obscure origin often cured by an operation which in no way explained the cause of the bleeding.

The above comprise a few of the most important points in connection with the clinical aspects of hematuria. It is to be deplored that a more complete consideration of this most interesting subject is beyond the possibilities of this treatise, as is also anything like a detailed enumeration of the many pathological conditions of which hematuria is often a symptom of prominence.

Hemorrhage from the kidney usually suggests—1. Acute nephritis; 2. Calculus; 3. New growths; 4. Tubercle; 5. Traumatism; 6. Syphilis (rare); 7. Echinococcus (rare).

Hemorrhage from the ureter usually suggests the passage of a calculus.

Hemorrhage from the bladder usually suggests—1. New growth; 2. Calculus; 3. Tubercle; 4. Traumatism; 5. The sudden emptying of an atonied bladder behind an enlarged prostate; 6. Gonorrhoeal ulceration (rare); 7. Syphilis (rare).

Hemorrhage from the seminal vesicles usually suggests—1. Gonorrhoeal inflammation; 2. Tubercle; 3. Malignant disease, usually secondary.

Hemorrhage from the deep urethra usually suggests—1. Gonorrhoeal inflammation; 2. Inflammation behind a stricture; 3. Traumatism from calculus or from without; 4. Tubercle; 5. New growth; 6. Chronic prostatic hypertrophy.

Hemorrhage from the anterior urethra usually suggests—injury from outside causes, such as instrumentation; injuries during intercourse; kicks; irritating injections; the breaking of a chordee by force, more rarely a foreign body; a tubercular, syphilitic, or chancreoidal ulceration; or a localized patch of diseased membrane following an old gonorrhoea.

Carcinoma of the penis of course may cause hemorrhage at the meatus.

Casts.—The inflammatory material which exudes from the walls of the secreting tubes of the kidney under certain conditions often appears in the

urine as a moulded form of the lumen of the tube from which it came. This form is called a cast. Occasionally similar casts are formed in the prostate, but they come usually from the kidney, and their presence in the urine invariably means trouble of some sort in that organ, although the trouble may not have lasted long enough or have been severe enough to be dignified by the name organic disease.

The material that is the basis-substance of all casts is a hyaline material, soft, translucent, and pliable to a degree, although adhesive enough to retain its original form during its passage through the urinary tract. This hyaline substance is colorless, and is sometimes so transparent that it is difficult to see it in the field of the microscope. On the other hand, it may be so firmly pressed and moulded as to lose its transparent look and assume a waxy appearance. It is often discolored, and assumes various appearances from admixture with other substances, such as blood-pigment or granular detritus. It often has cellular and other elements adherent to it, so casts are named according to the appearance they present. The usual forms are designated as follows: pure hyaline; finely or coarsely granular—that is, casts made of a mixture of hyaline material and finely or coarsely granular detritus; brown granular—that is, granular casts stained with blood-pigment; waxy—that is, dense, waxy hyaline casts; epithelial—that is, the cast has adherent epithelium; blood—that is, casts with adherent blood-corpuscles; fatty—that is, casts with adherent fat-globules; fibrinous—that is, a hyaline, non-granular cast stained with pigment.

Casts are the size of the caliber of the tube from which they come, so that those from a child's kidney are smaller than those from the same part of an adult kidney, and those from the straight tubes are larger than those from the convoluted tubes. They are cylinder-shaped, and are often characteristic enough in appearance to be recognized by observers of very slight experience.

On the other hand, these casts may often be mistaken for other things—*e. g.* a bit of mucus rolled upon itself. If the outlines of the object which is being examined under the microscope be focused very carefully, its well-defined parallel sides and its distinctly rounded ends will usually mark it as a cast, while if it is mucus its uneven appearance, the lack of parallelism in its sides, and its indefinite fimbriated ends are usually manifest.

Casts are said to be formed in the prostate at times. This variety cannot be distinguished from renal casts, except that renal casts are usually seen isolated in the urine and not in groups or mixed with other material, while sometimes casts are seen mixed up in a mass of prostatic fluid in a urine containing little or no albumin. These are possibly casts from the prostatic tubules occurring in cases of inflamed and hypertrophied prostates. The writer has never been able to convince himself that such casts do exist.

The significance of casts in the urine cannot here be considered at any length. The mere presence of casts of any sort means, perhaps, only a temporary congestion of the organ or a more definite hyperemia. It may, but does not of necessity, mean organic disease of the kidney. The kind of casts—*i. e.* their shape, size, and appearance—is often an aid in diagnosis, certain forms being more or less definitely associated with certain varieties of renal disease.

Hyaline casts (Figs. 10, 11) occur so commonly as to be the least distinctive of all. They are generally present in passive congestion of the kidneys, during the period of recovery from an acute nephritis, and very generally in a variety of chronic renal inflammations.

Granular casts (Figs. 12, 13) are also found in many of these chronic diseases, but, as a rule, the process is of a more active type than those in

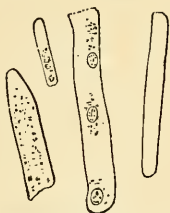


FIG. 10.—Hyaline casts (narrow and tolerably broad ones).

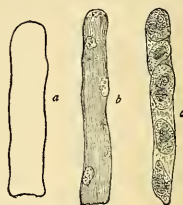


FIG. 11.—Hyaline casts: *b*, with leukocytes; *c*, with renal epithelium.

which exclusively hyaline casts are found. The granular casts also appear in the beginning of convalescence from acute nephritis before the activity of the inflammation has quite subsided.

Blood-casts are found in acute nephritis and in renal inflammations due



FIG. 12.—Granular casts with fatty globules; also, blood- and pus-corpuscles and epithelial cells.



FIG. 13.—Finely granular casts.

to traumatism either from the presence of a calculus or inflicted from without the body. In this form of nephritis the blood-casts gradually give place to the brown granular casts as the bleeding ceases. The latter are also seen in the urine of patients suffering from diseases associated with a greater or less destruction of the red corpuscles in the blood—such, for example, as scurvy. These pigmented casts, if made up of pure hyaline material with little or no granular structure, are sometimes classed by themselves and called fibrinous casts. Fatty casts are found in the chronic parenchymatous forms of nephritis.

Most of these forms of casts have epithelial cells adherent here and there to their surfaces, but in certain forms of disease these cells are so numerous that the casts are called epithelial casts (Fig. 14). In the so-called desquamative nephritis of scarlet fever, for instance, such casts are often found completely covered with renal epithelium, which adheres to them as they leave their tubules. In chronic interstitial nephritis, on the other hand, not only is there no desquamation of epithelium, but the casts themselves are small, scarce, and very hard to find. Sometimes a search of many slides, lasting several hours, will be necessary before a single characteristic cast can be dis-

covered. These cases are sometimes hard to diagnosticate on this account, for, no matter how strong one's suspicion may be, the presence of casts is necessary in order to make the diagnosis justifiable.

The variety of hyaline casts called waxy (Figs. 15, 16) is found in far-advanced types of renal disease, in amyloid kidney, and also in many forms of nephritis as the fatal termination of the disease approaches.

Mucus.—Mucus when seen in any amount usually occurs in cystitis associated with decomposition of the urine. In such cases the mucus coagulates on standing, and forms a thick mucilaginous

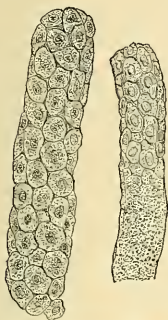


FIG. 14.—Epithelial casts.



FIG. 15.—Waxy casts.

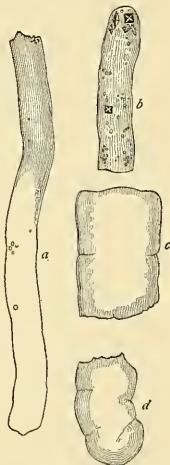


FIG. 16.—a, c, and d, waxy casts; b, a cast containing crystals of oxalate of lime (von Jaksch).

vehicle for the sediment which appears as a ropy gelatinous mass in the urine. Aside from this, mucus is rarely of clinical importance in the urine.

Prostatic Secretion.—The fluid secreted by the prostate, if present in an amount that makes it of clinical importance, can be seen floating in the urine (generally near the surface, for it is very light) as a stringy mass, more or less white and opaque-looking according as it has much or little pus mixed with it. Under the microscope it presents a fine meshwork of fibres, with which are intermingled rounded or oval cells already described in speaking of the epithelium of the deep urethra. Occasionally small refractive bodies, called symplexions by Robin, are seen. He describes them as opaline, transparent bodies, two millimeters in diameter, and with their edges more or less bevelled. They are thought to be the spermatic granules of normal semen held together in a mucous vehicle. Masses of them occasionally occlude the ejaculatory duct to an extent giving rise to what Reliquet¹ has described as *colique spermatique*.

¹ *Gazette des Hôpitaux*, 1874; 1879, p. 891.

If the prostatic fluid in the urine does not contain pus, it means that the condition is a more or less permanent congestion of the organ, which increases the amount of secretion, and is associated, as a rule, with considerable hyperesthesia of this portion of the urethra. It may be caused by increased activity of the organ due to urethral or vesical disease (giving rise to spasm of the part) or to sexual excesses. It results very commonly from urethral stricture, and not infrequently occurs in people suffering from nervous exhaustion. In the latter instance, although it is in most cases due to general nervous exhaustion, it invariably serves as one of the factors which retard recovery.

If much pus is mingled with a prostatic secretion, it generally means an inflammation of the prostatic urethra, usually of gonorrhœal origin.

Vesicular and Seminal Secretions.—The secretions from the testis and from the seminal vesicles are always seen mixed together in the urine when seen at all. Were it not for this fact, the vesicular fluid could not be distinguished under the microscope from the prostatic secretion, as the presence of spermatozoa in the former and their absence in the latter is the only difference in the two fluids.

Vesicular and seminal secretions never occur in healthy urines, except in that voided just after intercourse and containing a portion of the ejaculated fluid left behind in the urethra. It is often of importance in making an accurate diagnosis to be able to estimate the relative amounts of vesicular and seminal fluids present in a given specimen, for in this way we are often assisted in distinguishing between an inflammation of the seminal vesicles and a spermatorrhea due to other than vesicular causes. Spermatorrhea and vesiculitis are often found together, one being a symptom or result of the other, and yet, on the other hand, they may be very distinct pathologically and need very different treatment. If the spermatozoa in the urine are found associated with a large quantity of pus and epithelial cells, the probability is great of there being inflammation of a seminal vesicle. Digital pressure on the vesicles through the rectum will often increase the vesicular elements in the sediment and thereby aid a diagnosis in doubtful cases. More often, however, the diagnosis of vesiculitis is not difficult, as there is abundant evidence of its existence outside of the urine.

New Growths.—Occasionally the sediment of the urine is of the greatest importance in cases of a suspected new growth in the urinary tract, as it will often contain small pieces of the growth, which can be readily spread out on a slide in a way to show its structure under the microscope.

Very rarely indeed pieces of false membrane deposited on the bladder-wall may be seen in a sediment and recognized under the microscope, but in the rare instances where such deposits occur they are usually so extensive as to be easily recognized in the urine by the naked eye.

Filaria Sanguinis Hominis.—Chyluria,¹ which is common enough in tropical countries, notably in India, Egypt, Brazil, and the West Indies, and which occurs more rarely in the Southern United States, is due to the activity of the parasite mentioned in this heading. The appearances are so characteristic that the disease cannot be confounded with any other, and it will suffice to describe the parasite and the appearance of the urine.

The parasite is a little thread-like worm, pointed at both ends, and is only active while the person is quiet, so the night is his working-time, and it is then that the milky appearance of the urine becomes marked, the day urine being comparatively clear. The milky urine looks like rather thick milk with

¹ Mastin: *Annals of Surgery*, Nov., 1888.

specks and streaks of blood in it. It has a milky odor, especially when freshly passed, and quite soon coagulates into a more or less jelly-like mass. Under the microscope it appears very much like a specimen of milk.

The parasite is seen in the urine or perhaps better in a drop of blood from the patient, moving quickly about if the specimen is freshly obtained, or quite dead if the specimen is an old one. In the one case of this disease which the writer has seen there was marked elephantiasis of the scrotum; and this is a very common accompaniment of the disease, the enlargement of the scrotum and legs being sometimes very great.

Echinococcus Cysts.—Echinococcus cysts are rare in the urinary tract, but occur occasionally in the kidney or bladder, and find their way into the urine.¹ The echinococcus heads and hooks may also be present.

Bilharzia Hæmatobia.—This name was given to a parasite discovered by Dr. Bilharz of Cairo, Egypt, in the portal vessels of the human subject, and subsequently found in the portal vein of the monkey by Cobbold. It has been shown that this parasite infests the mesenteric and vesical veins, and produces a disease endemic in Egypt and South Africa. Hematuria is a characteristic symptom of the disease.

Bacteria.—Two forms of bacteria need mention as being of diagnostic importance in the urine—the bacillus tuberculosis and the gonococcus.

The *bacillus of tuberculosis* (Fig. 17) is very difficult to find in the urine, so that, although it is of the utmost importance when found, as it definitely

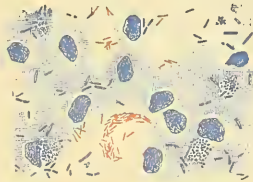


FIG. 17.—Tubercle bacilli in urine (von Jaksch).

makes a diagnosis, still its absence is not to be considered as proving the absence of tubercular disease if there be clinical evidence of its existence. The bacillus is found in such small numbers in urine, and is so difficult to find, that cultures are usually taken from the specimen to be examined, and the bacillus is grown on gelatin and so made more easily manifest. This is the work of an expert bacteriologist. The bacillus can, however, with sufficient care and patience sometimes be demonstrated under the microscope. To do this properly the urine should be passed through a centrifugal apparatus (Fig. 18), and the sediment so obtained taken for examination. If this apparatus is not obtainable, the specimen should be allowed to settle for from twelve to twenty-four hours in a funnel-shaped vessel before it is prepared for examination. Then a little of the sediment is removed with a fine pipette, placed on a cover-glass, and spread out in a thin layer by being rubbed between two cover-glasses. Then proceed as follows:

(a) Dry the specimen on the cover-glass, passing it two or three times rapidly through a Bunsen flame.

(b) Stain by pouring on the cover-glass (held in forceps) a few drops of carbol-fuchsin solution, and then steaming over a flame for two or three

¹ A. M. Page: *Medical Record*, Sept. 21, 1895.

minutes. Two such steamings are to be recommended. The carbol-fuchsin solution consists of 5 per cent. solution of carbolic acid in water, 100 c.c.; saturated alcoholic solution fuchsin, 10 c.c.; alcohol, 10 c.c.

(c) Wash off the excess of staining fluid in water.

(d) Pour on the cover-glass (still held in forceps) a few drops of a solution

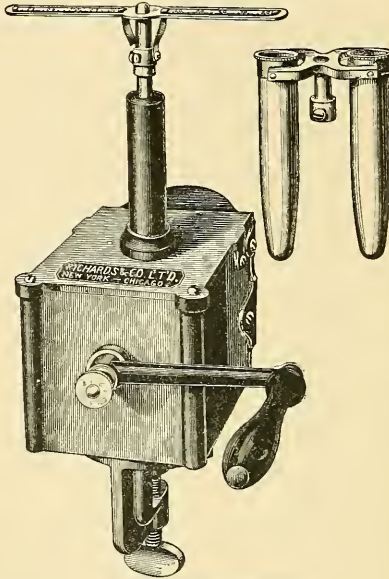


FIG. 18.—Centrifugal machine.

of one to two grams of methylene-blue in 100 c.c. of a 25 per cent. solution of sulphuric acid in water.

(e) Wash again and mount in water on a slide for immediate examination with $\frac{1}{2}$ oil-immersion lens.

This process stains the bacilli red on a blue ground, and is described as the easiest and most rapid method of procedure known to the writer.

In examining urines for the tubercle bacillus it must be borne in mind that the smegma bacillus frequently found in urines is almost identical in its morphology with the tubercle bacillus, and when such bacilli are found in large clumps in a specimen the possibility of their being smegma bacilli must be considered.

Gonococcus.—This germ was discovered by Neisser of Breslau in 1879, and is now considered the cause of gonorrhoeal inflammation, so that any urethral discharge which contains this organism is inoculated from without and is contagious. In fresh gonorrhoeal processes the germs are easily found, but in old and gleet discharges considerable care and patience is often necessary before the presence of the organisms can be demonstrated. They have been

found in urethral shreds remaining from a gonorrhœa acquired as long as four years previous to their discovery, and in such chronic cases it often takes but very slight irritative causes to start up an acute exacerbation of the inflammation.

They are small coffee-bean-shaped bodies, occurring in parallel pairs, and should always be demonstrated in the pus-cells before their presence is taken for granted. They generally occur in groups and inhabit comparatively few of the many pus-cells present. Their presence can be quite easily demonstrated as follows: Smear a thin film of discharge over a cover-glass with a platinum loop; dry in the air; pass two or three times through a Bunsen flame with the smeared side upward; then pour on the staining fluid, which consists of a few drops of a concentrated alcoholic solution of methylene-blue diluted with a dram or so of water; allow it to remain two or three minutes; then wash off the coloring solution with a stream of cold water and examine the cover-slip mounted in water just as it is or after drying and carefully mounting it in Canada balsam.

For a very thorough résumé of the characteristics of this organism the reader is referred to an article by Dr. J. H. Wright of the Harvard Medical School in *The American Journal of the Medical Sciences* for February, 1895, and to an article upon this subject in the present volume.

DISEASES OF THE PENIS.

BY B. FARQUHAR CURTIS, M. D.

MALFORMATIONS AND DEFORMITIES.

Absence, Reduplication, etc.—With the single exception of hypospadias and epispadias, congenital malformations of the penis are so rare as to possess little clinical significance. Absence of the organ has been observed in a very few cases, and probably some of these are really instances of rudimentary or of concealed penis, the organ being very small or displaced under the skin. But there are a few instances in which the penis has been entirely absent, besides the cases of fetuses so afflicted with other extensive deformities as to be incapable of life. In one such case the individual attained the age of twenty-seven years, and was in every other respect a well-formed man. The scrotum and testicles were normal, but the urethra measured only one and a half inches in length from the neck of the bladder, and opened directly into the rectum just within the anus. Urine and semen passed into the rectum, and micturition occurred every three to five hours. A fold of skin in the perineum running forward from the anus, with a warty protuberance at its anterior end, which was said to swell under sexual excitement, was the only representative of the penis. It is the rule in these cases for the urine to be passed into the rectum, the urethra opening directly into it, and in only one instance was there a perineal meatus. The great majority of the cases observed have been in infants, and Jacobson wisely suggests castration for these unfortunates before they grow up.

Rudimentary or undeveloped penis is not uncommon in its lesser grades, and in such it is not of great consequence, the individuals being, as a rule, sexually competent. In the higher grades of the deformity the other parts of the sexual apparatus also show lack of development, and more or less complete impotence results. Nothing can be done to improve this condition, although in those cases which lie on the border-line of competence general treatment directed to the sexual hygiene may be of service; and it must not be forgotten that some cases admit of great improvement, as in that cited by Wilson in which a man twenty-six years of age, with organs no larger than would be found in a boy of eight years, who had never had any erections previously, began to have erections and nocturnal emissions under the influence of a strong attachment, and when married soon after the parts increased nearly to the normal size within two years and he became the father of a family.

In the condition of **concealed penis** mentioned above the organ is more or less rudimentary and undeveloped, and is found under the skin near its normal situation; and in every case in which the penis appears to be absent a careful search should be made for it. The buried organ can sometimes be made to protrude by manipulation, but if this should fail it can readily be released by incisions, followed by some little plastic operation for providing

it with a sheath by cutting flaps of skin from the neighboring parts. The penis should be freed as early in life as possible, in order that its growth may not be checked by its unnatural situation.

In some rare instances the penis has been found twisted upon itself in such a manner that the urethra made a half turn around the corpora cavernosa and appeared on the upper surface at the extremity of the organ, the glans also being turned upside down. Usually this condition is found associated with hypospadias or epispadias, and only very rarely is it seen alone. It requires no treatment.

Cases of double penis have been reported from time to time, but a simple true reduplication of the normal organ is as yet unknown, all of the cases on record being due to unusual modifications of other deformities. The most common variety is that in which a supernumerary limb is present in the perineum, and genitals are found on each side of the central malformation—for instance, in one case a shrunken supernumerary limb hung between the thighs of an otherwise well-formed man, with a scrotum on each side of it, one testicle in each scrotum, while in the natural situation were two perfectly formed penes. The urine and semen were discharged spontaneously from both organs, and either could be employed in coition. Sangalli has reported a case of double penis found at autopsy in a man fifty years of age who died of cancer of the stomach, in whom the pelvic girdle was open in front, and who had two urinary bladders, one for each ureter. The right-hand penis measured hardly five centimeters in length and had no urethra, the urethra from the bladder on that side opening just at the root of the penis underneath, as in hypospadias. The left penis was seven centimeters long, and had a prepuce and urethra, being capable of erection. The testicles were small, and the right one was ectopic in the groin. The left-hand bladder opened into the urethra of the right by a short transverse canal. Another variety is that well represented by the case of Van Buren and Keyes, in which two distinct penes of normal size and apparently well formed lay under a common sheath of skin up to the base of the glans. The glans was double, but on the left side the meatus was imperforate. There was another meatus at the penoscrotal junction which admitted the finger, and resembled the ostium vaginae of a child, and some of the urine escaped from this opening. On one side of this aperture lay a fold of skin like a labium majus, and a testicle could be felt in it, but on the other side the testicle was ectopic, lying over the adductor longus of the thigh. The testicles were small, but sexual relations were possible. Another variety of double penis is the bifid organ, like those reported by Foster and Klebs and by Englisch, in which the penis was cleft in the glans and for some distance back, the urethra being split open and issuing at the bottom of the cleft. These are really cases of hypospadias, associated with cleft of the penis above for part of its length. Sexual intercourse was accomplished by slipping a broad thin band over the cleft glans, so as to hold the parts together.

One of the rarest of anomalies of the penis is the congenital fistula, of which but few cases are known. The fistula is a blind canal lying under the skin, usually opening near the corona glandis and running back along the dorsum subcutaneously for a variable distance, sometimes even beneath the pubic arch. The caliber of the sinus is from two to four millimeters. Although there may be some relation between this rare deformity and the rather common sinuses found near the meatus, both outside and inside of the urethra, they present marked differences and must not be confounded. Both, however, are of some clinical importance, as instances of gonorrhœal

infection of these sinuses are not unknown. The smaller sinuses are probably formed from elongated Tyson's sebaceous glands. They vary in depth from one-quarter of an inch to nearly two inches, and usually only admit a filiform bougie. Their mouths are generally found close to the meatus, and they run backward near the urethra (Figs. 19-22).

Sometimes the penis is found curved downward and adherent to the scrotum, and its growth and usefulness may be seriously interfered with. Although this condition is frequently associated with hypospadias, it may also exist with a well-formed urethra. The deformity is corrected by dissecting up the penis, as will be described under the operations for hypospadias, and this should be done early in life to prevent stunting of the growth of the organ, and also to escape the troublesome erections which complicate any attempt of the kind at a later period.

Hypospadias.—The commonest of all deformities of the penis is that known as hypospadias, which consists of a deficiency of the urethral floor extending over more or less of its length between the meatus and the perineum. The membranous portion of the canal is not subject to this deformity, although it is frequently involved in the opposite defect of epispadias. Hypospadias may be divided into three grades, according to its extent: the *glandular*, confined to the glans; the *penile*, affecting the glans and pendulous portion; and the *perineal*, in which the urethra is deficient in its whole length from the meatus to the perineum. But occasionally it will be found that there are two orifices, one in the perineum and the other farther forward, for instance, the defect showing itself only in the glans and at the seat of the posterior opening, the intervening portion of the urethra not being defective. Or still more rarely, the glans may be well formed, but the penile urethra imperfect.

The etiology of this malformation is not yet fully understood, the most commonly accepted theory being that it is due to an arrest of development, but there are many difficulties in the way of this hypothesis. Any theory should also explain the condition known as epispadias, which is still more difficult to account for, in order to be satisfactory. The developmental theory supposes that the penis is formed by the coalescence of the two lateral borders of the genital groove in the early days of fetal growth, these borders curving downward in such a manner as to enclose between them a canal, the urethra, and after their upper portions are already in contact any failure of union of the parts below would cause hypospadias. This arrest of development would leave the parts as they normally appear in that stage of growth when the sex of the fetus is uncertain, the external genitals of both sexes rather resembling the female type. If, on the other hand, the natural arrangement by which the rim of the pelvis closes first, and then the genital groove forms and closes below, be suspended, and the closing of the rim of the pelvis be delayed until the lateral borders of the genital groove approach each other and form the floor of the urethra, the roof of the urethra may fail to develop and the opposite deformity, epispadias, will be produced. Recently the study of congenital malformations has thrown some light upon the causes concerned in their production, and it appears that many if not all of them are due to interference with normal development caused by amniotic adhesions and bands. It is easy to comprehend how seriously the growth of any fetal part would be interfered with if it should become firmly adherent to the amniotic membrane covering it, instead of being separated from it by a layer of fluid, as should be the case normally. Parts which should tend to approach each other would readily be prevented from so doing by these adhesions. It is

also apparent that any amniotic bands extending from one part of the fetus to another, and crossing the amniotic cavity, might come to lie in the interval between parts which should unite, and prevent that union by simple mechanical interposition.

Another theory has been advanced and warmly advocated by Kaufmann—namely, the supposition that all of the varieties of the deformities known as hypospadias and epispadias are due to failure of the normal development of the terminal portion of the urethra, resulting in urinary obstruction and infiltration, with sloughing and resulting cicatricial contraction of the parts. It is supposed on excellent grounds that the glandular urethra is formed by a canal which begins as a mere depression on the end of the glans, and gradually sinks into it, forming a canal which continues to increase in depth until it unites with the main portion of the urethra, which stops at the glans somewhere in the neighborhood of the corona. This mode of formation is similar to that of the anus and rectum, which are formed independently and unite at a comparatively late period. The time when urine is first excreted by the kidneys is not accurately known, but there are grounds for supposing that it may even antedate the time when the urethra becomes pervious by the junction of the penile and glandular portions of the canal. Should this be the case, the conditions would be similar to those of an impermeable urethral stricture in the same situation, and might result in urinary retention, infiltration of the periurethral tissues, sloughing of the roof or floor of the urethra, and the formation of abnormal openings in any direction, even to the extent of a complete hypospadias or epispadias. The deformity of the penis would be explained by cicatricial contraction. But the difficulty of accepting this theory is also great, for we know even less about the fetal secretion of urine than about the embryology of this region, not to mention the improbability that such pathological changes would take place without producing symptoms which would disturb the pregnancy.

Hypospadias is present to some extent in about one case to every three hundred males, but the severe grades are, fortunately, rare.

Clinical Appearance.—In the penile or glandular form (see Figs. 19–22) the meatus is a mere transverse slit in the skin, and is usually narrower than the urethra just within it. It is often so small and concealed by folds of skin as to be difficult to find, and such cases have sometimes been supposed to be instances of congenital occlusion of the meatus. Beyond the meatus, toward the tip of the organ, there is generally a shallow groove marking the situation of the absent urethra, which often contains one or more narrow sinuses, sometimes an inch or more in depth, with their orifices directed anteriorly, representing the lacuna magna and other follicles of the urethra. The foreskin is usually split or completely wanting in its lower (posterior) half, the fold of skin hanging like an apron over the dorsum of the glans, and often a concentric or helical whorl of the papillary ridges will be seen at each angle of the flap, resembling those which occur on the palmar surface of the tips of the fingers. The appearance suggests the fancy that the rows of papillæ or papillary ridges which were intended to run in parallel lines around the organ, being divided below, had sprung back, and the divided ends had coiled themselves up in this way on each side. The raphe extends from the scrotum along one side of the penis, finally joining the frenum, if one be present, along one side of the urethral furrow. In extensive hypospadias the penis is usually small, bent downward, and adherent to the scrotum (Fig. 23). The sex of the individual may even be in doubt, owing to the deformed condition of the parts in these cases, and the majority of so-called hermaphrodites are really males afflicted

with hypospadias. The perineal urethral opening in these cases resembles the ostium vaginae, the rudimentary penis represents the clitoris, while the halves of the divided scrotum, especially if the testicles be retained within the abdomen, simulate very closely the labia. Such individuals often present a female appearance, having a scanty beard, long hair, wide hips, high-pitched voice, and even well-developed mammae. In some instances they have been brought

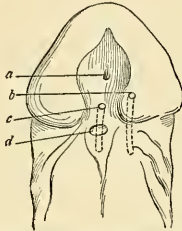


FIG. 19.—Glandular hypospadias: *a*, depression at normal site of meatus; *b*, sinus half an inch deep, admitting No. 5 F., just under skin; *c*, sinus three-fourths of an inch deep, admitting No. 5 F., under skin above urethra; *d*, meatus.

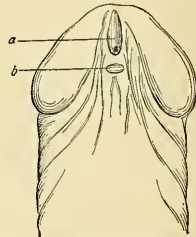


FIG. 20.—Glandular hypospadias: *a*, depression at proper site of meatus (with deep dimple at the bottom); *b*, the meatus.

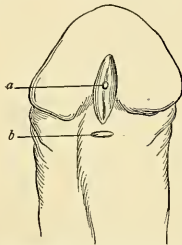


FIG. 21.—Glandular hypospadias: *a* opens a narrow blind pouch which extends for one inch just above the urethra—*a*, lies between two well-marked lips; *b*, the meatus.

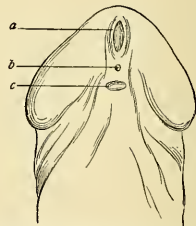


FIG. 22.—Glandular hypospadias: *a*, depression at proper site of meatus; *b*, sinus a quarter of an inch deep, admitting No. 1 F.; *c*, meatus.

up as females and lived as such all their lives, even sustaining sexual relations as women satisfactorily to themselves and their partners. A few individuals are described who have a well-developed penis, together with the perineal meatus, and who have been capable of sexual intercourse with both sexes, but these cases are very great rarities. In the false hermaphrodites only a thorough dissection and the discovery of a uterus and ovaries on the one hand or of testicles on the other can settle the question. True hypospadias is rare in the female, but it is occasionally found, and may be so extensive as to involve the neck of the bladder, differing in this respect from the same deformity in the male, which never involves the membranous urethra. Guyon says that there is no malformation of the floor of the male urethra which corresponds to that extreme deformity of the roof of the urethra that is found in extrophy of the bladder with division of the sphincter.

The *functional disturbances* caused by hypospadias vary according to its degree. In the glandular form there is really no interference with function

except a slight tendency to dribbling in urination on account of the peculiar meatus, but even in these cases the mental effect is often considerable, the patient complaining that he is not like other men, fearing to expose himself before them for fear of ridicule, and sometimes becoming hypochondriacal. In the more extensive forms of the malformation the disability is very great in both the urinary and the sexual functions of the organ. Urination in the erect position is difficult or impossible, and even in moderate cases the semen may not be deposited within the vagina in cohabitation, while the deformity or lack of development of the organ may render sexual intercourse impossible.

Treatment.—The cases of slight hypospadias require treatment only because of the psychological effect, but this is sufficiently important to warrant an attempt at a cure, especially as the little operation is without risk. As to the most suitable time for such an undertaking, it is well to wait until the parts are large enough to admit of easy manipulation, and this will scarcely be before the eighth year. If the operation is delayed too long, the after-treatment will



FIG. 23.—Perineal hypospadias.

be complicated by erections of the penis, and the healing of the wound may be jeopardized, but the technical difficulties of the operation are much reduced as the parts approach adult size. The best time is undoubtedly between eight and twelve years of age. It is well not to attempt too much at once, and in cases of any extent the freeing of the penis, the formation of the urethra in the glans and in the penis, and the closing of the abnormal meatus should be effected in separate operations. Even in the slight grades of the deformity it is well to make the anterior urethra first, and to reserve the closing of the meatus until later. The latter is a trifling operation, and can easily be performed with cocaine anesthesia in the adult, but partial failure is common, and complete union can be obtained only after several attempts.

If the penis is curved downward or adherent to the scrotum, the first step must be its rectification. This can generally be attained by a V-incision on

the scrotum, the point directed downward. The triangular flap of skin is dissected free, the penis drawn upward, and the edges of the raw surface left by the retraction of the triangular flap united with sutures. Sometimes a superficial transverse incision through the body of the organ will also be necessary.

In the formation of the urethra the methods most in use are founded on the suggestions of Thiersch, first employed in operating for epispadias, and we shall illustrate them with figures of that operation. In order to form the glandular portion of the urethra two deep incisions are made, parallel to each other, along the margins of the shallow groove which is generally found marking the proper site of the canal. A short piece of a catheter, No. 15 Charrière, is laid between the incisions, and by this means the strip of mucous membrane lying between them is depressed, while the surgeon draws up the outer edges of the two incisions and unites them together over the catheter, freeing them, if necessary, by dissecting up a small flap on each side. The catheter is left in place for three or four days, or even a week if there is no inflammatory reaction. The sutures must be passed very deeply, and some coarse material should be employed, such as silver wire or silkworm gut, in order that they may not cut out, for the tension is considerable. The method about to be described for closing the penile urethra can also be employed in the glans, and in my hands it has given excellent results, the only objection being the slightly greater loss of blood owing to the larger surfaces involved in the formation of the flaps.

In order to form the penile portion of the urethra double flaps are employed. A flap (*b*, Fig. 24, *A*) is outlined on one side of the urethral furrow

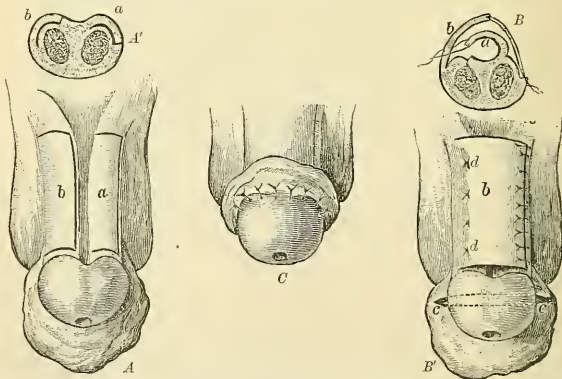


FIG. 24.—Thiersch's operation for penile epispadias, the glandular urethra having been restored. *A*, incisions outlining the flaps: *a*, flap with base toward the urethra; *b*, flap with base in opposite direction, *A'*, section through the penis and the flaps. *B*, section showing the flaps turned over and sutures inserted ready for tying. *B'*, the flaps in place, the flap *a* entirely concealed by the flap *b*; *c, c*, an incision through the foreskin, through which the glans is made to pass, and the redundant foreskin is secured by sutures to the anterior edge of the flap *b*. *C*, the operation completed.

by a three-sided rectangular incision, the first part passing along one edge of the furrow for the necessary distance, and two short incisions being made at its ends, at right angles to the first, running away from the urethra. The other flap (*a*, Fig. 24, *A*) is outlined by an exactly similar incision, the long

central part being parallel with the other edge of the furrow, but at a distance equal to one and a half times the diameter of the desired canal, and the two short incisions at its ends being directed toward the urethra and continuing to its nearer edge. The two flaps are dissected up, the base of the first being distant from the urethra and that of the second lying directly at its edge, but both bases being directed toward the same side of the penis, either right or left. The flap with its base at the urethral furrow is turned over so that its raw surface is outermost, and its long free edge is then united to the incision made along the opposite edge of the furrow in cutting the first flap (Fig. 24, *B*, flap *a*). Two or three mattress sutures are passed through the edges of this flap, and both ends of each stitch being made to traverse the base of the other flap (*d*, Fig. 24, *B'*), they are united on the outer side. Or buried sutures of very fine silk can be used, being so introduced as not to penetrate the skin-surface of the flap or of the urethral furrow, the edge of the flap being somewhat inverted so as to enable them to be tied. The first flap is then drawn across the second, so that the raw surfaces of the two are in contact, reinforcing the inverted flap and covering the buried sutures if they are employed (Fig. 24, *B*). If possible, the edge of this flap should be united with the skin-incision made in cutting the other, but if the tension is too great to allow of this, it should be united to the raw surface at any point to which it can be easily brought. Sometimes the tension can be diminished by prolonging the incisions at the ends of this flap for some distance, in which case they should be made to diverge slightly in order to preserve the full width of the flap when it is drawn upon. It is particularly desirable in this operation to avoid great tension, for this would impair the circulation of parts which need all their vitality in order to resist the danger of infection to which they are unavoidably exposed by contact with urine. When the foreskin is redundant, a transverse incision (*c, c*, Fig. 24, *B*) may be made, the glans made to protrude through this opening, and the redundant portion thus displaced on the opposite side of the glans is employed to help close the deficiency, being united to the anterior border of the flap (Fig. 24, *C*).

It is, as a rule, wiser to abstain from attempting to close the abnormal meatus wherever situated, until the canal in front of it has been entirely formed and the wounds are healed, for this part of the plastic work is the one most likely to fail. Its chances of success are much better when the circulation has been fully restored in the surrounding skin, and, moreover, any attempt to close the meatus at the same time as the other operations jeopardizes their success, because of the exposure to urinary infection. In order to close the meatus a small but abundant flap is cut on any side of the opening, with its base directed toward the latter (Fig. 25). This flap is then inverted across the opening, so that its epithelial surface is directed toward the urethra, and secured in place after freshening the edges of the meatus by fine sutures (Fig. 25). The freshening of the edges should be liberal, and I have found it best to split them and draw the edge of the flap with deep sutures directly into the bottom of the cleft thus made. The raw external surface of the inverted flap may or may not be covered with a second flap from the neighborhood, but if there is abundance of material it is better to reinforce it in this way, on the same principle as that relied upon in constructing the penile urethra. The incision for the second flap is indicated by *a, b*, Fig. 25, and this flap should be rotated so that its apex, *a*, will be brought into the angle *a'*. Very frequently the attempt to close the meatus will fail in part, but it will at least reduce the size of the opening, and the operation is to be repeated in a similar manner after the wounds have healed. If it has partially suc-

ceeded and the resultant fistula is only about the size of a pin's head, this can usually be made to close by cicatricial contraction if its edges are thoroughly burnt with nitric acid, care being taken to protect the inside of the urethra in the neighborhood with vaseline before the acid is applied.

In the after-treatment of these plastic operations upon the urethra the problem of dealing with the urine is of vital importance, and the great differences which exist in the practice of good surgeons show how difficult is its solution. Some prefer to insert a catheter through a small perineal incision, while others drain the bladder by an instrument in the urethra. The former plan involves the risk of causing a traumatic stricture, and, radical as it appears to be, it does not keep the wound absolutely dry, some urine being very apt to find its way past the catheter. This leakage of urine is even more

likely to occur along the side of the catheter introduced by the meatus, and although it can be reduced if the bladder be kept empty by maintaining a siphon action in the tube, it cannot be entirely prevented. A urethritis may also result if the catheter is left long in place. In children it is generally necessary to employ one of these methods, but in adults the following plan is more effective, although more troublesome: At regular intervals the urethra is irrigated thoroughly, a catheter is passed, the urine drawn off, the bladder irrigated with a weak solution of boro-salicylic acid, and the catheter withdrawn. The few drops of fluid which will inevitably follow the catheter on its withdrawal are thus not urine, but a harmless solution. The intervals must be suited to the frequency with which the patient wishes to pass urine, and the desire can generally be limited to three or four times in the twenty-four hours. Still another but less effective method, suitable for cases where the wound is near the end of the penis, is to have the patient irrigate the urethra before he passes water,

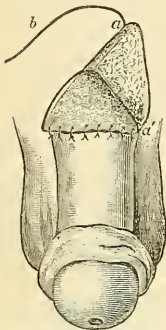


FIG. 25.—The method of closing the abnormal meatus after the operation for epispadias.

and then urinate by holding the end of the penis under water in a cup set in an empty basin, repeating the irrigation at the end of the act. The urine is thus diluted at once as it escapes, and the overflow is caught by the basin.

After the urethra has been formed by these methods it is necessary to pass a sound to the bladder every three or four weeks during the first six months, or until it is certain that no contraction is taking place. If there should be any tendency to contraction, it can usually be controlled by the weekly application of the sound for a few times.

Epispadias.—In the deformity known as epispadias (Fig. 26) the roof of the urethra is lacking, the corpora cavernosa not being in contact with each other above, and the canal is only represented by a shallow groove on the dorsum of the penis, and even this indication of it may be absent. The union of the corpora cavernosa below the urethra is, however, more apparent than real, for the floor of the urethra can be forced downward into close contact with the skin on the under side of the penis, displacing the corpora to either side. This deformity is much rarer than hypospadias, and, like it, is found in three grades—the *glandular*, the *penile*, and the *complete* form in which the pubic arch remains open, the cleft runs back into the neck of the bladder, and the bladder itself may be extroverted. The first form is exceedingly rare, only three such cases being known. The penile form is also seldom seen, the roof of the urethra being generally defective throughout if absent at all.

Sometimes, however, the glandular part of the urethra is well formed and pervious, but the penile portion of the roof is wanting; or a well-formed penis may even coexist with exstrophy of the bladder, only a slight notch being found in the posterior end of the roof of the urethra close to the neck of the bladder. When the glandular portion is involved in the deformity, the foreskin is also divided above and hangs like an apron from the frenum under the glans. The etiology of this curious deformity has already been discussed together with that of hypospadias. The commonest form of hypo-

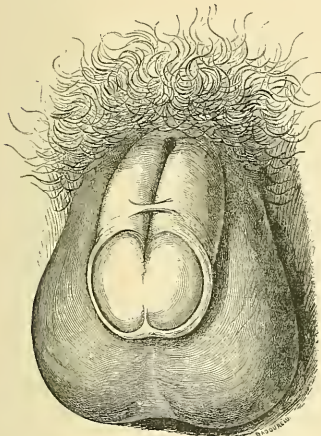


FIG. 26.—Complete epispadias.

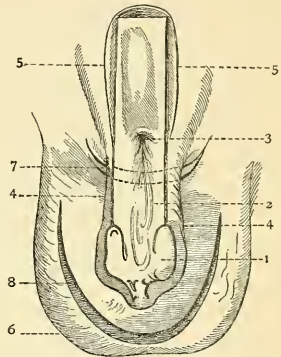


FIG. 27.—Dolbean's operation for epispadias: 1, the glans; 2, the urethral furrow; 3, the entrance to the bladder; 4, 4, incisions made on each side of the urethra; 5, 5, the flap cut from the skin of the abdomen, to be turned down and sutured to 4, 4; 6, incision outlining flap on scrotum; 7, 7, button-hole in base of 8, through which the penis is to be thrust.

spadias is the glandular, while in epispadias the defect is very rarely limited to the glans, but exstrophy of the bladder is a very common complication, as if the forces which produced hypospadias first showed themselves anteriorly, finding their best opportunity in that part of the urethra, while those which produce epispadias were most effective posteriorly, and found the neck of the bladder and the penile urethra more vulnerable than the glans. Perhaps epispadias is to be looked upon as a secondary deformity, a sequel of the failure of the pubic arch to unite, rather than as an independent malformation, while hypospadias should be considered as the failure of the natural closing process of the floor of the urethra, the forces which should normally close it dying out as they advance toward the glans before their work is complete.

The condition of the parts in complete epispadias is rendered worse by the small size and upward curvature of the penis. The penis often seems a mere button of flesh which is drawn into and partially fills the opening in the neck of the bladder, in some cases apparently acting as a valve and assisting in the retention of the urine. The functional results of the deformity are not merely the loss of the proper canal for urination, but, owing to the usual association with a deficient sphincter, if not with extroversion of the bladder, incontinence of urine is the rule. Coition is almost always impossible, and

fecundation can be accomplished only in the very rare glandular form, the semen otherwise not being deposited in the vagina. It is said that the sex of the individual may be uncertain in extreme cases.

In the attempts to remedy this deformity by operation the urethra may be formed, according to Dolbeau, when the bladder is not extroverted, by cutting a narrow flap from the abdomen and turning it down over the dorsum of the penis, with the skin-surface toward the urethral furrow. Lateral flaps are then dissected up from each side of the penis, drawn together over the first flap, and united in the median line so as to cover its raw surface, or a flap is cut from the scrotum, with its base at the root of the penis, and a button-hole incision is made in the latter situation through which the organ is to be thrust, and the scrotal flap is then secured by sutures over the raw surface of the other flap (Fig. 27). Or flaps may be formed, according to Thiersch, as in the operations described for hypospadias, and this method can be employed also when there is exstrophy of the bladder. With the treatment of the last-mentioned complication we cannot deal here. The results of these operations are not so good as in hypospadias, as the development of the penis has generally suffered far more than in that condition and there is less material for flaps. The functional results in regard to coition are also much less satisfactory.

Malformations and Contractions of the Meatus.—Besides those malformations of the meatus that accompany hypospadias and epispadias there are various others (Figs. 28–30)—none, however, of any clinical

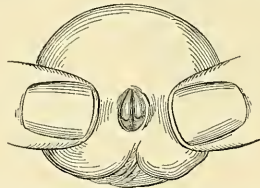


FIG. 28.—Meatus with two internal folds of mucous membrane, resembling the labia minora of the female vulva.

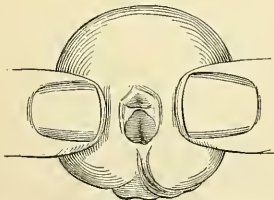


FIG. 29.—Meatus with blind shallow depression just above the urethra.

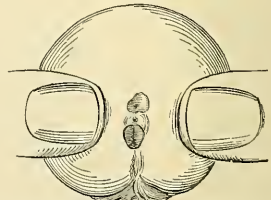


FIG. 30.—Meatus with depression similar to that in Fig. 29, and a long, narrow sinus opening between it and the urethra.

importance except its absence or undue contraction. An imperforate meatus is usually closed only by a very thin membrane, formed of the epithelial cells growing between the prepuce and glans, which is readily punctured or torn through. This is a very common deformity, but the more extensive malformation in which the glandular urethra is partly absent is very rare and

more difficult to treat. If there should be any difficulty in finding the end of the imperforate urethra, it is best to open the canal in the perineum (where it will sometimes be found fully distended with urine), to pass a sound forward, and to cut down upon that instrument at the most anterior point reached. This opening must be made quite free, and the mucous membrane sutured to the skin in order to secure prompt union and the avoidance of cicatricial contraction. In cases of hypospadias, also, the opening is often too narrow, and it should be enlarged by an incision backward, and cicatricial contraction avoided by sutures so placed as to cover the raw edges, or by a small flap cut from the skin near by and secured in the angle of the incision for the same purpose.

A very small meatus may be a congenital defect, when it is apt to be associated with a long, narrow foreskin, or it may be the result of cicatricial contraction from ulceration or wounds. Among the Hebrews many apparently congenitally narrow meatuses are really cicatricial, being caused by improper circumcision, the tip of the glans having been removed with the knife during the operation, and contraction following. Whatever the origin, a narrow meatus is often the cause of serious mechanical and nervous consequences, such as hernia, hypertrophy of the bladder, nocturnal involuntary micturition, and many reflex nervous symptoms; but all of them will be considered under the head of Phimosis, which is a more common cause for these disturbances.

The treatment of a narrow meatus consists simply in incision, followed by the occasional passage of a sound until the wound heals, and afterward if there be any tendency to recontraction. The incision should divide the most constricted part, and this is sometimes to be found just within the edge of the opening. A narrow probe-pointed bistoury is introduced for half an inch or so, and made to cut on the floor of the urethra as it is withdrawn, the tip of the finger outside pressing that part up against the edge of the knife. In cases of very close contraction a notch may be made above also. The edge of the meatus should be saved, if possible, for it is often quite elastic, and will admit a good-sized sound if the obstruction within it be overcome. The spout-like shape of the end of the urethra, owing to the fact that the meatus is naturally smaller than the canal, is important, for if it be lost there is apt to be an unpleasant dribbling after urination. This shape, however, must often be sacrificed in order to obtain an opening of proper size.

(For further details see article on Diseases of the Urethra.)

Malformations of the Foreskin; Phimosis and Adhesions.—The normal development of the prepuce begins in the third month by the appearance of a fold of skin behind the corona, which grows forward, its internal layer becoming adherent to the glans as it progresses, owing to the softness and defective cornification of the cells, although both of the surfaces which are in contact are covered with flat epithelium. There is thus a layer of cells between the two parts of double the usual thickness, amounting to about eight cells. When the child is born the foreskin normally covers the glans and is adherent up to the edge of the meatus. During the first years of life the adhesions give way, partly by advance in the cornification of the cells making its way from without inward, partly from the traction which takes place on erection, until finally the prepuce can be drawn back over the glans. The opening in the prepuce at birth is usually too small to allow of its retraction even if there were no adhesions, but the orifice stretches as the adhesions gradually yield.

If the normal separation of the foreskin from the head of the penis does not occur, it can as a rule be brought about when the preputial orifice is not too small by drawing the prepuce strongly backward and separating the adherent surfaces by some blunt instrument, such as a flat probe. Occasionally it will be found that the adhesions are too dense to allow of this, and it may even be necessary to dissect the prepuce from the glans with the knife, cicatricial tissue having formed in consequence of some previous inflammation. It has been recommended to cover the raw surface produced by this dissection by a plastic operation, but it will usually be found sufficient to invert the preputial flap which has been formed and to secure its edge in the neighborhood of the corona. This may make rather a bulky and short prepuce, but will at least prevent it from forming fresh adhesions with the surface of the glans, which it is otherwise sure to do.

Phimosis is that condition of the prepuce in which the orifice is too small to admit of retraction over the glans. It is usually congenital, and is generally found combined with redundancy of the prepuce and with persistence of the infantile adhesions. In some rare cases the orifice may be entirely wanting. It may be noted in passing that the opposite condition of a short or absent prepuce is a rare deformity. Phimosis may be an acquired condition, being produced by disease or injury, cicatricial contraction narrowing an opening which would previously have given passage to the glans, and also causing the formation of adhesions. In every case of adherent prepuce in infants in whom a balanitis appears the foreskin should at once be forcibly retracted, and many a case of phimosis can thus be prevented. In congenital phimosis the meatus is almost invariably contracted also, and even in the acquired form it is apt to be narrowed. The results of this condition are twofold—being in part purely mechanical, and in part consisting of nervous disturbances set up more or less directly. The mechanical consequences are seen when the size of the orifice in foreskin or meatus is sufficiently reduced to obstruct the flow of urine, and are similar to those observed in any tight penile stricture of the urethra, such as distention and hypertrophy of the bladder, dilatation of the ureters, and even disorganization of the kidneys from the great backward pressure. Hematuria and other symptoms resembling those of vesical calculus may be present. When the obstruction is mainly at the preputial orifice the foreskin may be ballooned out by the urine, which can only issue from the opening drop by drop, and the patient often has to assist the evacuation by pressure on the distended prepuce with the hands. Another mechanical result of the obstruction is the occurrence of hernia, which is very common in infants with phimosis, and conversely phimosis is often observed in infants suffering from hernia, being especially frequent in those with multiple herniæ. The abdominal pressure exerted in the straining to evacuate the urine and in the crying which often accompanies the effort in such children is sufficient to prevent the firm closure of the natural hernial openings and to cause the yielding of those which have already closed. Prolapsus ani is also not infrequently observed as a result of this straining.

Another consequence of the mechanical obstruction is the obstacle which it offers to cleanliness, resulting in a balano-posthitis induced by the retention of the "smegma," which consists of the secretion of the glands of the lining membrane of the prepuce and the covering of the head of the penis, together with the dead epithelial cells from those surfaces, the decomposition of which is hastened by the admixture of urine. This inflammation in turn narrows the opening by subsequent cicatricial contraction and

aggravates the condition. If any venereal infection be acquired by persons with phimosis, the pus collects under the foreskin and the inflammation may be very intense, resulting often in extensive destruction of the parts by ulceration or sloughing, or in a cellulitis or erysipelas which may involve the entire organ. Preputial calculi are also occasionally found in cases of phimosis, and sometimes attain a great size. These may be formed by calcification occurring in the masses of smegma and dead epithelium, etc., or they may form from urine retained in the dilated foreskin; or, finally, they may originate above and be carried down as gravel with the urine into the prepuce.

Certain evil results of phimosis are produced through the nervous system and react upon it. These may be in part due to the mechanical condition of obstruction, but they seem chiefly dependent upon the nerve-irritation caused by the presence of the adhesions and the decomposing matters under the foreskin. This nervous irritation is partly shown by urinary disturbances, such as frequent micturition, involuntary micturition, especially at night, and difficult urination from spasmodic contraction of the neck of the bladder; but its effect in sexual symptoms is much more marked. In infants the sexual irritability declares itself by priapism, the early establishment of the habit of masturbation, with restlessness, sleeplessness, and even convulsions. In the adult the sexual erethism causes masturbation, excessive sexual intercourse, undue irritability of the parts, and produces premature ejaculation, backache, and the whole train of secondary consequences which may follow this sexual disturbance. There are many cases in which distant reflex effects have been observed, such as disturbances of vision which appeared closely dependent upon phimosis and have disappeared immediately after circumcision, muscular contractions, and loss of muscular co-ordination in the lower extremities. It has even been claimed by Sayre that hip-joint disease might be a remote result of phimosis.

The treatment of phimosis is limited to the enlargement of the preputial orifice. Dilatation of the preputial opening by any method is only a half measure, involving almost as much suffering as the cutting operation, acting very slowly, not correcting the redundancy of the prepuce which is so common a complication, and which in itself is capable of producing many of the

results of phimosis; and this treatment is necessarily limited to the mildest cases. The best operation for the enlargement of the opening is the ancient one of circumcision. A very simple substitute for it is the dorsal incision, but this is not satisfactory, because it does not thoroughly expose the parts,

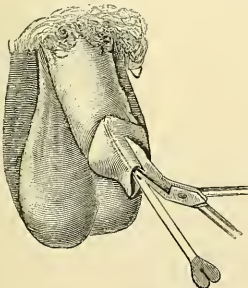


FIG. 31.—Dorsal incision for phimosis.



FIG. 32.—Result after lateral incisions for phimosis, with subsequent trimming and suture.

and because it leaves them so deformed that a subsequent operation is generally necessary to make them presentable. The dorsal incision is made through the entire thickness of the foreskin in the middle line by a stroke of a strong

pair of scissors (Fig. 31) or of a sharp knife introduced along a director previously slipped in up to the corona, the knife being made to transfix and cut outward. Taylor recommends a modification of this in which an incision is made on each side instead of the central median incision, and the prepuce is thus divided into two halves, so that by lifting the dorsal half or flap upward and turning the frenal flap downward the head of the penis can be completely uncovered. On recovery another little operation must be done, consisting, when the dorsal incision has been used, in cutting off the corners on each side of the incision, and perhaps the frenal portion of the prepuce as well. When Taylor's bilateral incision has been employed the second operation should reduce the size of the two flaps, so as to make the organ look as if a circumcision had been performed in the first place (Fig. 32). The dorsal incision can be employed to advantage in infants who have a scanty but close-fitting prepuce. But with this exception these two operations are to be looked upon as operations of necessity, and should be limited to those cases in which there is very intense inflammation, and in which it is desirable to limit the size of the wound and the surfaces thus exposed to fresh infection. Formal circumcision is the operation of choice and is applicable to almost all cases.

In adults circumcision can easily be performed with local anesthesia, preferably induced by cocaine, but in nervous individuals and in children a general anesthetic is desirable in order to obtain the quiet necessary for a neat closure of the wound. In very young infants it is perhaps best to operate without any anesthetic, for they will suffer as much from struggling against its administration as from the operation itself, for the latter lasts only a few seconds if deftly done, and the introduction of sutures is unnecessary in such cases. When cocaine is employed the hypodermic syringe is filled with a 4 per cent. solution, the needle is inserted in the skin of the dorsum in the median line over the corona, and an injection is made in the skin, its correct situation being shown by the appearance of a welt like that of urticaria. It is very essential to have the injection just in the derma, and not in the subcutaneous tissue, if full anesthetic effects are to be obtained. The point of the needle is to be kept in the skin, and made to penetrate it laterally, first on one side and then on the other, until at least one-half of the circumference of the organ has been traversed. It is then withdrawn and reinserted at a point directly opposite the first on the under side of the penis, and from this new point it is worked laterally in the same way. With a needle of ordinary length the whole circumference can be easily reached from these two points of entrance. A few drops are then injected into the subcutaneous tissue along the same line, and, if the adhesions are very dense, the operator should try to distribute the injections as near the preputial lining as possible, or even to make them directly into the thickness of that membrane. Fifteen minims is the most that will be required, and often half that amount will answer. The effect of the anesthetic can be much prolonged by tying a strip of bandage moderately tight around the root of the organ after the injection has been made. This also lessens the liability to constitutional absorption, and the only objection to it is the slightly increased venous hemorrhage.

It is understood that the parts have been carefully cleansed and the usual antiseptic precautions have been observed before the cocaine is introduced, if that be the anesthetic employed. The foreskin is retracted as far as possible, and the edge of the preputial lining seized just at the orifice above and below with toothed forceps or pointed artery clamps (Fig. 33). The organ is then

released by the hand, and traction is made by the forceps, putting the inner layer of the foreskin on the stretch, the outer layer being at its normal tension. A long, slender clamp is then applied to the foreskin just beyond the glans, being held in the sagittal plane, directed obliquely forward and downward, so as to lie parallel with the dorsum of the glans and to include more of the dorsal than of the frenal part of the prepuce.

A special clamp is made for this purpose, but any instrument with two shanks which come close together, such as a pair of scissors with long straight handles, may be employed, although the opera-

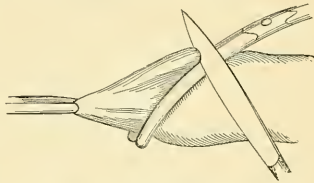


FIG. 33.—Method of performing circumcision with clamp.

tor must be prepared to have them slip off as he completes his incision. When the clamp has been applied the forceps which hold the prepuce can be taken off or allowed to hang, and the prepuce is held by the fingers while a narrow, sharp-pointed bistoury is made to transfix the prepuce just in front of the clamp and cut upward. The edge of the blade is reversed and the remainder of the prepuce cut away, the knife being directed forward just as it is severing the last shred, so as to produce a little point of skin in the flap at the frenal border. The clamp is then released, when it will be found that the skin retracts at once to the level of the corona, while the mucous membrane lining still remains over the glans, with its raw external surface exposed by the retracting skin. Some surgeons prefer to cut away the foreskin on the proximal side of the clamp, that is, on the side toward the glans, because they claim that the instrument bruises the edges of the incision so as to lessen the chances of primary union. The novice, however, should adhere to the first method, for there is danger of wounding the glans with the knife in trying to pass the latter between that organ and the clamp. Other surgeons prefer to use a scissors instead of a knife in cutting away the foreskin, and there is no objection to this, provided that a very sharp and strong pair be employed and used with a very quick stroke, otherwise the soft tissues are apt to slip away from their edges and the incision is very uneven.

The inner layer of the prepuce has next to be divided, and this may be done with a pair of straight scissors, cutting it up in the middle line along the dorsum all the way to the coronal groove. Some surgeons prefer to give a Y-shape to the upper end of this incision, as the little triangular flap thus left facilitates the adjustment of the edges of the two layers at this point. In infants, especially if no anesthetic is employed, this dorsal division of the mucous layer can best be done by seizing it on each side with the finger and the thumb-nail and tearing it apart upward, the same movement generally sufficing to separate the adhesions, so that the flaps can be quickly rolled back from the glans. If the adhesions are strong, they must be broken down by the nail or by some blunt instrument, taking care not to injure the surface any more than absolutely necessary. Rarely is the use of the knife needed for this purpose, and it should be avoided, because it is difficult to follow the correct plane; and if the surfaces are injured, troublesome oozing may occur and the healing may be delayed by the excoriations produced. The corners of the two flaps thus made in the mucous membrane lining are rounded off by the scissors, and if the operation has been properly performed,

it will be found that the edges of the skin and mucous layers fall together nicely, and that the frenum has not been shortened. The hemorrhage from the operation is trifling, but a ligature may be needed near the frenum. In infants sutures will be unnecessary, for the little wound heals so readily, and in cases of venereal infection they should be omitted, as primary union cannot be hoped for. In all other cases, however, the healing of the wound will be much more rapid if they are employed. The best material for sutures is fine silk, and in introducing them the needle should pick up just the edges of the skin and mucous layer, the loose cellular tissue between them being pushed back as the knot is tightened. The sutures should be interrupted, for the continuous stitch leaves a long thread to be removed, and may cause some constriction if made continuous entirely around the organ.

A strip of iodoform gauze wound around the penis, secured by two longitudinal strips of plaster carried along the sides of the organ and up on the abdomen, and a circular strip around the whole, or by painting the entire outside of the dressing and the neighboring skin with collodion, will be the best dressing until all oozing has ceased. The meatus should be left free for urination. After twenty-four hours the dressing may be removed and the wound painted with collodion after being washed with alcohol. Union will generally be complete by the time this coating detaches itself, and the stitches can be removed at any time after the fourth or fifth day.

A condition resembling phimosis is that produced by a frenum which is too short to permit retraction of the foreskin without force, even when the orifice is ample and there are no adhesions. The frenum pulls the glans sharply downward when the foreskin is drawn back, and if much force is employed the bridle may be torn across, occasionally setting up a severe hemorrhage. This condition also interferes with sexual intercourse, rendering it painful and liable to cause abrasions if not rupture of the frenum, and these wounds greatly increase the danger of venereal infection. The short frenum has also been known to cause reflex nervous disturbances, with undue sexual excitability and premature ejaculation.

The frenum is easily lengthened by making a V-shaped incision across the band, with the base of the V directed toward the meatus, the little flap thus formed being then slid toward the meatus sufficiently to relieve the tension even in erection, and the edges of the wound left by its retraction being sutured. When there is abundant material another method of elongating the frenum consists in dividing it transversely, pulling the wound widely open, and uniting the angles at the ends of the incision across the center by a stitch, thus converting the transverse wound into a longitudinal one and lengthening the frenum.

Paraphimosis.—Paraphimosis is the condition produced when the preputial orifice is narrow and the prepuce has been forcibly drawn back over the glans, and its return is prevented by the arrest of the narrow opening behind the corona. Great edema and swelling of the glans follow from the obstruction to the circulation which is thus caused. The prepuce may slip back as a whole, and then its margin will be found deeply buried behind the prominence of the corona. But more commonly the foreskin is more or less everted as it is retracted, and then its internal layer forms a thick edematous fold directly behind the corona, while the narrow preputial margin will be found in a deep furrow behind this fold. Beyond the furrow will be seen another fold formed by the cutaneous layer of the foreskin. When edema and inflammation have swollen the parts the glans is found bent more or less acutely toward the dorsum by the great swelling of the loose tissues about the

frenum, while just above the glans will be seen a series of transverse edematous and reddened ridges and deep furrows.

This condition is produced in various ways, sometimes by boys in play, sometimes during coitus, and sometimes in attempts to uncover the glans for the examination or treatment of some pathological condition under the foreskin. Even when the preputial orifice is not so tight as to render retraction very difficult, if it is left retracted too long the circulation in the parts beyond may be interfered with sufficiently to make them swell, so that they can no longer be made to re-enter the foreskin, and therefore paraphimosis is possible even in cases of only moderate contraction of the orifice. It is well to warn all patients with venereal disease who have any narrowing of the foreskin against forcible retraction, and against allowing the prepuce to remain retracted for any length of time.

If this condition be left unrelieved, it may result in gangrene of the glans in whole or in part, but such a termination is fortunately rare, for before it occurs the constricting bands generally lose their vitality and slough, leaving narrow transverse ulcers at the bottom of the deep grooves, but allowing the circulation of the parts beyond to return. These ulcers and sloughing surfaces become infected, and the severest forms of cellulitis or erysipelas may follow, with extensive sloughing, which not infrequently invades the urethra and produces large penile fistulæ. If the constriction is not severe enough to cause sloughing, the parts may become habituated to the impeded circulation, and the edema gives place to new connective tissue, which renders the hypertrophy and deformity of the organ permanent.

To reduce a paraphimosis, the penis should be grasped between two of the fingers of each hand placed so as to interlock behind the constriction and draw the foreskin forward, while the thumbs make lateral and direct pressure upon the glans and swollen portions, trying to squeeze out the blood and serum and so reduce the swelling, and finally to press the glans backward through the constricting ring (Fig. 34). Or one hand may grasp the penis

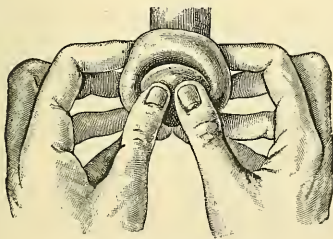


FIG. 34.—Reduction of paraphimosis.

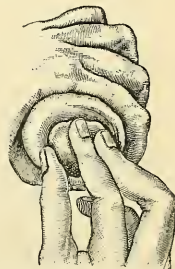


FIG. 35.—Reduction of paraphimosis.

firmly (Fig. 35), while concentric pressure is made upon the swollen parts with the tips of the fingers of the other hand, backward pressure being made when it is felt that the swelling is lessened. If the thumb-nail or a stout piece of wire bent like a hair-pin can be introduced under the constricting edge of the foreskin, the latter can sometimes be worked forward by sweeping lateral movements with the nail or wire. It is well to apply a little oil to the parts near the constriction, but it should be limited in amount, as it will

render them too slippery to be manipulated. Sometimes an elastic bandage or strapping with plaster will reduce the swelling, and scarification and multiple punctures can be employed for the same purpose. Soaking in very hot

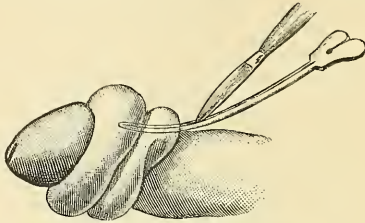


FIG. 36.—Division of paraphimosis.

water will also assist. If all of these attempts fail, the constricting band should be divided, and it is best to do this by a single dorsal incision in the median line (Fig. 36), which should be quite free, for the constricting band generally lies at a considerable depth. To try to divide this band subcutaneously as one would operate for a tenotomy is a mistake, for considerable cutting must be done before the band is divided, and this large wound is more liable to troublesome infection if made by a puncture through the skin than if the latter is freely incised. Even a large incision will appear small when the swelling subsides after reduction. A general anesthetic will usually be necessary for the maneuvers of reduction, but if not cocaine must be inserted for the incision. In the chronic unreduced cases massage should be added to the measures already suggested.

INJURIES.

Owing to its sheltered position the penis is rarely severely injured, and yet it does not entirely escape. Contused, lacerated, incised, punctured, and gunshot wounds, and even burns, occur, and do not materially differ from the same injuries elsewhere, except in the profuse hemorrhage which may follow when the cavernous tissues are injured—whether it be external bleeding or the formation of large hematomata. There are numerous instances where insane individuals have themselves cut off the penis or where this mutilation has been inflicted in savage warfare. In the recent Abyssinian-Italian war many such cases were noted, and about one-third of the individuals survived, the hemorrhage stopping spontaneously. The tissues of the penis are well endowed with vitality, except the skin, and sloughs seldom occur after injury unless it be accompanied by urinary infiltration—a complication which is naturally quite common after these accidents.

Any two of the three erectile bodies may be entirely severed, and yet the circulation will be sufficiently sustained by the third to prevent gangrene. The extensive scars which follow such injuries, however, damage the erectile power. The hemorrhage from the erectile tissues can be controlled by firmly closing their capsules by deep sutures.

The most common injury to the penis is rupture of the frenum, which usually occurs during coitus in individuals with a short band, and this trifling accident has been known to be followed by fatal hemorrhage.

Another not uncommon injury is the so-called fracture of the penis—

that is, a rupture of the fibrous coat of one of the erectile bodies during full erection. This accident may occur as the result of awkward coition or of an intentional blow, and one curious case is on record in which it resulted from forcing the erect penis into the clothing while dressing. But the injury is also frequently produced intentionally by striking the organ or by bending it forcibly in the hands in order to straighten the curve caused by "chordee" or by a chronic strictured urethra. The urethra itself is, fortunately, rarely injured, for suppuration is then inevitable. The injury causes a hematoma on the side where the fibrous tunic has given way, and the swelling should be treated by compression with a bandage and the application of ice. Urethrotomy should be done at once if the urethra is also ruptured. This injury is very apt to leave behind it a loss of erectile power or a curvature of the penis toward the injured side as the result of the cicatricial tissue formed at the seat of the rupture, which not only interferes with the circulation in the erectile tissue beyond, but makes the organ rigid and inelastic at that point. These evil consequences are apt to be permanent, although as time goes on the cicatrix tends to soften and to be absorbed, so that the condition generally improves to some extent.

A severe blow received directly upon the penis when in the flaccid state has been known, especially in young boys, to tear some of the subcutaneous cellular tissue at its root, and even the attachment between the glans and foreskin, so as to allow the organ to slip out of its sheath and to become incarcerated in the subcutaneous tissues of the abdomen, scrotum, or thigh. This accident is known as dislocation of the penis. The condition is generally accompanied by difficult urination, the urine being forced to follow the strongly curved urethra, or, if the coronal attachment has given way, to follow a long and narrow channel through the tissues in order to escape. Coition is impossible even when the power of erection is preserved. When the case is seen early, the penis can generally be restored to its proper place by manipulation, but when the accident occurs in the ignorant or careless the organ may be left so long in its new situation as to form adhesions from which it is not always easy to free it, even with open incisions. Another difficulty arises in these neglected cases from the shrinking which the sheath has undergone, necessitating some plastic operation to provide the penis with a covering.

Birkett quotes a curious case in which the corpus spongiosum was divided by a horse's bite one inch behind the glans, and the anterior end was turned out through the meatus. The urine was voided by the side of this protruding portion, and nineteen years after the accident it was still projecting from the meatus as a soft pink cylindrical appendage over an inch in length, which seemed to occasion no discomfort.

A common result of a horse's bite, and also of certain accidents in which the clothing is caught in machinery and torn off, is the stripping off of the skin of the genitals with the garments, sparing the organs themselves. The scrotum, as a rule, is easily replaced spontaneously by traction upon the surrounding skin as the wound begins to heal, and by the growth of epidermis over the granulations. But it is difficult to secure a covering for the penis. The best results have followed flaps taken from the abdomen, the usual method being the formation of a bridge-like flap marked out by two horizontal incisions, one near the root of the penis, the other parallel with the first at a distance above it equal to the length of the organ. The skin and subcutaneous tissues are separated from the deep fascia, and the broad strip between the two incisions is lifted up and the penis slipped under it and

secured in place by a few stitches. A catheter should be introduced through a perineal boutonnière to avoid the danger of urinary infection of the wounds. After the lapse of a week one of the pedicles is severed and the skin folded under and sutured to the dorsum of the penis. A week later the other pedicle is severed, its edge united to that first sutured to the dorsum, and the organ is thus provided with a covering. The raw surface on the abdomen may be grafted with skin at the same time. The difficulties in the way of the operation are the changes in size which the penis undergoes from the occurrence of erections and the liability of urinary infection of the wound in spite of the perineal drainage. The erections can be moderated by the use of bromide and camphor in large doses, assisted perhaps with morphine. A similar plastic operation may be necessary after sloughing of the cutaneous coverings of the penis from cellulitis or gangrene.

A very common form of injury to the penis is that produced by constricting it with a string or the introduction of the organ into a tight ring of metal or some similar object. This may be done merely in mischief by some boy or from lustful or morbid mental excitement. The delinquent is usually the patient himself, and motives of shame are apt to make him avoid disclosing his condition for some days, by which time considerable damage has been done. The most extraordinary objects are employed by these individuals, and as an example we may mention the case of a man who introduced his penis in a flaccid state into the opening for the handle in the head of a small sledgehammer, and was unable to withdraw it because erection took place at once and was followed by edematous swelling. The surgeon was compelled to take the patient to a blacksmith's shop, where the steel hammer-head was with great difficulty broken in pieces and the penis was extricated, fortunately without serious injury. The removal of these objects will require the greatest ingenuity and patience on the part of the surgeon. They are usually of a narrow ring-like shape, and cut deeply into the tissues, often penetrating the urethra before the patient comes to the surgeon. In such cases the constricting body may be completely buried from sight, and free incision will be necessary before the cutting pliers or other instruments can be applied to it. In a case related by Kaufmann a small boy was supposed to be suffering from urethral stricture and fistula, but a closer examination showed that a fine string had been tied around the penis and had divided the urethra, while over the dorsum it had cut through the skin, and the latter had healed over it, leaving only a narrow red scar to show its situation. It is generally best to make a long median dorsal incision through the swollen skin, and to expose the constricting body thoroughly as it crosses the bottom of the wound before it is divided. Metal rings are best divided by strong cutting pliers, and if very thick and hard the large "snips" used by tanners will be found useful, for they are very powerful and will cut the metal with the least danger to the surrounding parts. The gangrene which follows the application of such rings is usually limited to the tissues directly beneath them, for they are seldom so tight as to cause complete obstruction of the circulation beyond; but the slough often involves the floor of the urethra and causes extensive urethral fistulæ.

All of these injuries, as well as the sloughing of venereal ulcers or the results of cellulitis, may leave behind them great cicatricial deformity of the penis in the shape of torsion or curvature. The torsion may be so severe as to give the head of the penis a complete half turn on its long axis, the frenum then presenting on the upper surface. The curvature may be so great in any direction as to entirely prevent coition, or at least to compel the

individual to assume some unusual position for its accomplishment. Occasionally the cicatrices can be softened and stretched out in time by persistent massage, or the condition can be improved by plastic operations of some kind, such as the excision of cutaneous scars or the division of tense bands by properly placed incisions, followed by grafting or flap-transplantation of skin. But the majority of these conditions will remain permanent in spite of our best efforts, and it is fortunate that really great disability from such causes is comparatively rare.

GANGRENE.

In addition to the common cases in which more or less sloughing of the penis follows as the result of injury or of inflammation, there is a considerable number of instances in which it is produced by some more or less distant cause. In such cases the gangrene affects the distal part of the organ first, and is apt to be extensive, although it is sometimes limited to the prepuce and glans. Apart from a few cases in which it has been the result of obstruction of the iliac veins, the causes are generally constitutional, and most commonly gangrene occurs in one of the infectious fevers in which the patient's vitality has been greatly reduced, the death of the parts being a natural consequence of the poor circulation, which affects the penis as rapidly as the ends of the extremities. It has been observed even in children as a result of one of the exanthemata, although not so commonly as noma of the genitals in little girls. While most commonly seen in typhoid fever, it has also occurred in severe forms of malarial fevers. Atheroma of the vessels undoubtedly predisposes to gangrene, but cases in which that condition has seemed to be the efficient cause are very rare.

The gangrene is usually of the moist form, although isolated cases of dry gangrene have been reported, the constant exposure of the parts to infection undoubtedly explaining the rarity of the latter. When it is observed that the circulation of the genitals is very poor in any case where gangrene is to be feared, it is possible that something can be done to avoid this accident by elevating the parts on a towel or handful of cotton placed between the thighs, and, indeed, this precaution should always be taken in unconscious patients who lie absolutely still and in whom the circulation is much reduced, for it will frequently be observed in them that the flaccid genitals hang down between the thighs, and may even be subject to considerable compression by the limbs, so that the return circulation is much impeded. When gangrene has once set in, all that can be done is to keep the parts as dry and as free from infection as possible. Perineal drainage should be made, if the anterior urethra is involved, to prevent contact of the urine with the sloughing tissues.

INFLAMMATORY CONDITIONS.

Posthitis and Balanitis.—*Posthitis* is an inflammation of the foreskin, the term being usually limited to inflammatory affections of the lining membrane. *Balanitis* is an inflammation of the mucous membrane covering the glans. The two surfaces are generally attacked simultaneously, except in chronic processes which are limited to small areas. The predisposing cause to inflammation of these parts is the difficulty or impossibility of cleansing them, especially when the foreskin is long and narrow. The active cause may be the retained pus of a gonorrhœa or venereal ulcer, or merely the accumulated smegma mixed with urine, and perhaps some vaginal discharges added to it in coitus. Balanitis also occurs in diabetic patients, it is supposed

on account of the ready decomposition of their sugar-laden urine, a certain fungus being found in the smegma in all diabetic cases, but it is not a common complication of that disease.

In the simpler form of balanoposthitis the glans and the inner layer of the prepuce are red and moist, and a serous pus oozes from under the foreskin or covers the surfaces with white flakes. When the inflammation is more intense superficial erosions and ulcers are seen, especially in the region near the corona. Sometimes thickened patches of the mucous membrane can be felt through the skin of the prepuce, and may even simulate the induration of a chancre. In very severe cases partial gangrene of the foreskin has been observed in posthitis, being caused by the intensity of the local inflammation, and the glans has been found protruding from lateral or dorsal openings in the foreskin thus formed. Croupous and diphtheritic forms of inflammation have been observed also in these parts, the surfaces being covered with a membranous coating, but both of these varieties of inflammation are very rare. If venereal ulcers coexist with the balanoposthitis, they will present their usual appearances, and in cases of phimosis it is often very difficult to ascertain whether there is a simple balanoposthitis or one complicated with venereal ulcers or gonorrhœa.

The treatment of balanoposthitis consists chiefly in the establishment of cleanliness, and, if the prepuce can be retracted, this will usually suffice to cure. The parts should be washed with warm water or mild solutions of borie acid (gr. v-f ʒj), alum or sulphate of zinc (gr. ij-f ʒj), or nitrate of silver (gr. j-f ʒj). There is no advantage in employing carbolic acid or corrosive sublimate in weak solutions, and solutions strong enough to have any real germicidal effect would be irritating to the inflamed surfaces. It is best to keep the parts as dry as possible, and after using any application they should be carefully dried without rubbing, and small pieces of gauze the size of a postage-stamp should be laid upon the glans and the foreskin gently drawn forward over them. As the modern surgical gauze is so thin, it will be best to have two or three thicknesses between the glans and foreskin, but gauze is better than absorbent cotton, for the latter does not drain so well. A loose handful of gauze is then folded about the end of the penis and the latter placed inside of a pair of swimming tights which the patient should be directed to wear, for bandages are worse than useless on the penis, either falling off or constricting the parts, and the various bags which have been recommended are apt to be uncleanly from being kept in use too long. The tights not only keep the dressing in place, but support the organ in an elevated position, which improves its circulation. The gauze under the foreskin should be changed as soon as it becomes moist, but the parts should not be washed more than two or three times a day. The patient can easily carry a quantity of the small pieces of gauze with him, and any eloset will give him the opportunity to make the change. If the case does not improve in a few days under this simple treatment, some powder, such as calomel, bismuth, or aristol, may be rubbed into the gauze or sprinkled over the glans.

When phimosis exists the management of these cases is much more difficult, for the parts must be cleansed by injections. These should be made carefully and repeated several times a day, warm water or some of the solutions mentioned above being employed and thrown in by a syringe with a long narrow nozzle. If possible, drainage should be assisted by the introduction of a little gauze tent inserted under the foreskin, but this must not be large enough to block the orifice. If the discharge continues very foul, it will be necessary to use more active measures, and a 1 per cent. solution of ear-

bolic acid or a 1:2000 solution of corrosive sublimate should be employed two or three times, returning to the weaker injections for continuous use. The chief difficulty of these cases will often be the uncertainty as to the co-existence of venereal ulcers or urethritis. If these should be present, and even if they are not, in any case which does not yield to treatment in a few days the foreskin should be split open by the dorsal incision and the parts thoroughly treated. Often a simple case which has resisted injections obstinately will be cured almost at once when the glans is thoroughly exposed. Even if the disease is cured by the injections, the patient should be most emphatically advised to submit to circumcision at once, in order to guard against a recurrence, for the organ which has once been subject to this inflammation will be liable to subsequent attacks on the slightest provocation, and sometimes without any perceptible cause. Circumcision is the only reliable method of preventing these recurrent attacks. When the patient has diabetes, however, any operation must be undertaken with caution, and it should be limited to dorsal incision of the prepuce, owing to the well-known bad effect of that condition upon the healing of wounds.

Occasionally the dry treatment suggested above will be found useless, and the patient will be more comfortable and the inflammation subside more rapidly under a dressing wet with some of the solutions mentioned or with $\frac{1}{2}$ per cent. solution of acetate of aluminum or with balsam of Peru. If these also fail, recourse may be had to the ointments (boric-acid vaseline 10 per cent., or zinc oxide and boric acid in equal parts—5 per cent. of each); but these applications are much less cleanly, and, as a rule, less effective. In very obstinate cases irritant or even caustic local applications may be necessary, and a 2 per cent. solution of nitrate of silver or Churchill's tincture of iodine will be found most satisfactory.

In gouty and syphilitic subjects a dry red patch with a very scanty, thin discharge will sometimes be found, resembling chronic eczema of the skin or even psoriasis, rather than balanitis, and, like these affections, being exceedingly obstinate to treatment. Local applications of nitrate of silver, iodine, or other strong irritant may be tried besides constitutional remedies.

Herpes Progenitalis.—While herpes zoster or zona is found on the penis as well as elsewhere in the distribution of the nerves of the lumbar plexus, it is a rare disease, and does not materially differ from the same affection on other parts of the body. Herpes progenitalis, however, is very frequent, and closely resembles the herpetic vesicles seen so commonly about the mouth in indigestion. A patient will complain of a constant itching about the glans and foreskin, accompanied with a little moisture. When the parts are inspected in the early stages small pinhead vesicles will be seen at the edge of the foreskin, in the neighborhood of the corona, or near the meatus. When the vesicles have broken they leave superficial erosions surrounded by minute circular or crescentic areolæ. The causes of this disease are unknown, but it is certainly more common in individuals with long, narrow foreskins who are somewhat careless about cleanliness of the genitals, and, like the similar affection of the lips, it also appears to be somewhat dependent upon the general health. The eruption is of little significance in itself, as it has no symptoms except the local itching and burning sensations, but it is dangerous, because the erosions which it causes frequently form the grafting spot of a venereal ulcer. Herpes can generally be cured by the dry treatment described above for balanitis, but is very apt to recur, and sometimes no treatment is effectual against these recurrences. Circumcision will generally prevent them, but even after that operation the vesicles will sometimes

continue to appear behind the corona. The internal administration of arsenic has been warmly recommended in these obstinate relapsing cases, but this treatment has also often failed.

Cellulitis; Erysipelas.—The tissues of the penis are liable to the same inflammatory processes which are seen in similar tissues elsewhere. One peculiarity about them, however, is the loose character of the subcutaneous cellular tissue, rendering it very liable to intense edematous swelling, and also to gangrene either of the connective tissue itself or of the overlying skin, because of the unsupported condition of the vessels in this tissue. Another important consideration is the frequency with which inflammations of the penis are found associated with urinary infiltration, and the consequent aggravation of their intensity and septic qualities. Cellulitis and erysipelas present their usual characteristics in other respects. Cellulitis most frequently has its origin in some venereal inflammation or in extravasation of urine. Erysipelas is rare. Both are to be treated on the same principles as elsewhere, but when tension exists incisions must be made very early in order to avoid sloughing. Lymphangitis and phlebitis are not at all uncommon, especially the former, and generally originate from some venereal ulcer or a gonorrhœa. Sometimes they are confined to a single vessel, and at others they are more or less general. If only one vessel is involved, it can be felt as a hardened cord under the skin, and frequently there will be a red line on the surface above it. This inflammation generally resolves, but sometimes abscesses are formed and must be promptly opened. The phlebitis is almost invariably confined to the superficial vessels, and does not spread to the cavernous tissue. A chronic lymphangitis sometimes persists, and results in a permanent enlargement caused by a chronic edema or hypertrophy of the cellular tissue of the parts resembling elephantiasis. True elephantiasis of the penis is very rarely seen in this country.

Cavernitis.—A suppurative inflammation is not infrequently found limited to the cavernous tissues in some one or all of the cavernous bodies, and has been given the name of cavernitis. When the inflammation is general it is sometimes spoken of as a "penitis," but this term is inaccurate and should not be employed. It is generally caused by a folliculitis or a small extravasation of urine, and may be limited to one point or may involve the entire corpus spongiosum or the corpus cavernosum of one side or even all three of these organs. The result is a sloughing or breaking down of all the erectile tissue within their capsules, leaving only the latter, and after recovery the part is represented simply by a small fibrous, cicatricial mass. It is generally indicated at its onset by edema of the prepuce and a painless priapism and induration of the part involved. Pyemia is a frequent but not invariable sequel, for it can be avoided by early incision. Free incision into the fibrous capsule of the affected portion of the organ is the only possible treatment, and must be carried out as soon as the diagnosis can be made. Recovery takes place with a permanent loss of function of the affected side.

There are certain chronic inflammatory conditions of the corpora cavernosa which are of interest. In gouty and diabetic individuals nodules of a fibrous character form in the erectile tissues, or more frequently in their capsules, being produced by a chronic inflammation or cavernitis. They sometimes develop rather acutely, and there is then considerable inflammatory swelling around them, which disappears afterward, leaving the masses smaller, but they are permanent when once formed and no treatment is of any avail. They usually form flat plaques on the surface of the corpora cavernosa, on the sides or dorsum near the root. Fortunately, they are of

no consequence unless they interfere with erection by causing curvature or loss of stiffness, just as deep cicatrices have these effects, but as they occur late in life, even this result is not of great importance. General treatment should be instituted to prevent the formation of larger deposits. The gouty nodules sometimes become calcareous, and occasionally sheets of true bone are found in the fibrous coverings of the erectile tissues, resembling those bony plates which sometimes form in muscular tissue after repeated mechanical irritation.

TUBERCULOSIS.

Tuberculosis of the penis is rare, but occurs in two forms. The majority of the cases are examples of chronic tuberculous ulceration of the skin or mucous membrane resembling that seen elsewhere, the ulcers having the same irregular worm-eaten shape, the same blue undermined edges, and the same slowly sloughing or poorly granulating base. The other form, which is very rare, appears to begin in the depth of the erectile tissue, producing a necrotic mass closely resembling the tuberculous sequestra seen in spongy bone, the wedge-like shape of the latter, it will be remembered, suggesting an origin from a tuberculous embolus having been lodged in one of the vessels. A section through this focus in a case of this kind reported by Kraske showed a rather firm yellowish-white mass of necrotic tuberculous

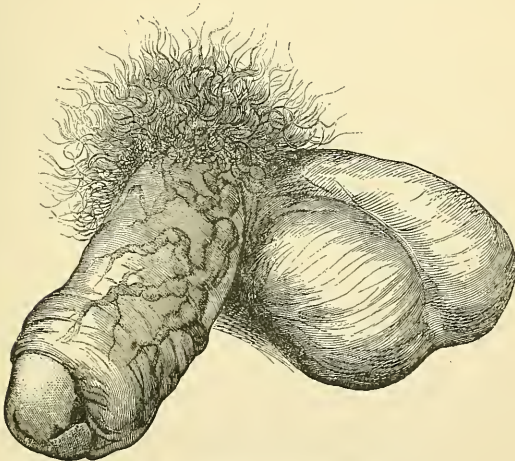


FIG. 37.—Varicose veins of penis (Demarquay).

tissue in the midst of the erectile tissue of the glans, sharply limited from the healthy tissues about it, which had penetrated by extension of the sloughing process through the mucous membrane of the dorsum, producing a circular ulcer with ragged, thin, undermined edges, and a base consisting of the surface of this tuberculous mass. The diagnosis from a gumma would not be very easy in cases of this kind.

VARICOSE VEINS.

Varicose veins are frequently found upon the penis (Fig. 37), and as a rule they are of little pathological significance, although occasionally they may be accompanied by a loss of power in the erection. At all events, failure of erection has been successfully treated by ligature of the dorsal vein or other branches, even when the varicosity of the vessel did not appear very marked. It is difficult to appreciate the real value of this procedure, because the individuals affected are apt to be neurasthenic and easily impressed, so that the mere psychical effect of the operation might suffice to remove their disability, but in two cases the writer has obtained such an improvement that he considers the method of treatment valuable, and certainly it is without danger.

NEURALGIA.

The penis is occasionally the seat of neuralgia, which may be intensely painful. The pain is usually reflex and caused by some vesical or pelvic disease, but in some cases no cause can be found, and we assume that it is due to a neuritis of the pudic nerve. The pain is generally most intense at the head of the penis. If some such cause as suggested can be found, its removal will cure the condition, and a careful search should be made for it. If it cannot be found, reliance must be placed in medical treatment carried out on the usual lines. Gouty symptoms should be sought for, and the treatment directed to that condition in doubtful cases.

PRIAPISM.

Priapism is a condition of continual erection without sexual desire. It occurs as the result of various local disturbances, such as inflammatory swelling of the penis, hematoma, or tumors. It is more commonly, however, the result of reflex nervous irritation caused by phimosis, vesical calculus, or some urethral lesion. It is also found as a symptom of injury or disease of certain parts of the spinal cord, especially in the cervical and upper dorsal regions. In some unexplained way it may also be caused by leukemia and gout. Excessive sexual excitement and indulgence, probably acting on the spinal sexual centers, would appear to be the main factor in its causation in some cases. In all of these instances priapism may be considered as a mechanical result or as a symptom of some other condition, but occasionally it is observed without any perceptible cause, and therefore it requires to be described among the diseases of the penis. In these inexplicable cases the erection comes without warning, although it sometimes follows a natural erection with sexual desire, and persists in more or less complete degree for a great length of time, usually three to six weeks, sometimes as many months. The erection is often painful, and the patient dreads the touch of the bed-clothes, but even when not painful its long continuance is exceedingly trying. Sexual intercourse merely increases the distress. Micturition may be difficult, owing to the swelling of the parts. No treatment is of much use, and sedatives (bromides, morphine), with the occasional administration of a purge, is all that can be done medically, besides the local application of ice or very hot cloths and protection from pressure. In some cases incisions into the corpora cavernosa have been of benefit, and this method of treatment is worthy of further trial. Recovery is sometimes followed by a permanent loss of erection, and this occurs both in cases treated expectantly and in those operated upon, while some cases operated upon have recovered without

this loss, so that it is as yet uncertain whether incision increases the danger of the occurrence of this disability.

TUMORS.

With the exception of the papillomata which are so common as the result of venereal infection or lack of cleanliness, new growths of the penis, especially the benign growths, are unusual. Although cancer of the penis is the commonest of its tumors, the penis ranks seventh in the order of frequency of the various organs liable to that disease in the male, and its malignant tumors form only from 1 to 3 per cent. of all cancers of both sexes.

The **chondromata** and **osteomata** of the penis which have been occasionally reported are rather to be classified as cases of ossification of the fibrous structures of the penis than as true tumors. Tuffier, however, has recently reported a small chondroma which grew on the external surface of one of the corpora cavernosa, near the middle of the organ, and was removed by operation when it had reached the size of a small bean. A few instances of *fibroma* and *lipoma* have also been placed on record.

Angioma is rather more frequent than the other benign tumors, although it does not attack the penis so commonly as the female organs of generation. It is usually connected with the blood-vessels, although lymphangioma is not unknown—without including under that name true elephantiasis or other forms of lymphatic enlargement. As it is found in the penis, angioma generally occurs in infants, and forms a superficial flat tumor, which rarely gives rise to any symptoms, although troublesome priapism has been observed when it involved a considerable part of the organ. More than one tumor is sometimes found. Angiomata present the usual varieties seen elsewhere—some a mere dilatation of the superficial capillaries of the skin, others involving the entire thickness of the latter and containing large vessels.

The **prognosis** is the same as in similar tumors elsewhere, many remaining stationary, a few disappearing spontaneously or being cured by ulceration, and others continuing to grow to a dangerous extent. The risks of the condition from extensive growth, hemorrhage, and septic infection are sufficiently great to demand immediate treatment, especially as the latter is without danger. This treatment should be similar to that employed for angioma in other situations—electrolysis, canterization, or excision. When not too extensive, removal by the knife will be found to be the readiest and surest method, for the hemorrhage is slight if care is taken to make the circumscising incision in the healthy skin just beyond the dilated vessels, and the superficial wound which results can readily be closed by sutures. But if the angioma involves much of the skin of the organ, and it is feared that there will not be enough material to allow of excision, multiple puncture with the sharp point of the thermo-cautery or the galvano-cautery (an anesthetic having been administered) will generally prove satisfactory, although several sittings may be necessary. The minute wounds heal under a scab or by granulation. Electrolysis is less certain and very tedious, for it requires many applications, which protract the treatment over several months, even if applications are made every week. The various methods of treatment of angioma by ligature or the introduction of threads soaked in perchloride-of-iron solution should not be used for angioma of the penis, because of the difficulty of keeping the parts clean and the consequent danger of septic infection.

Primary sarcoma of the penis is a very rare affection, although in the few cases reported the round-cell, the spindle-cell, the melanotic, and the angiomatous forms have all been represented. Like sarcoma in other parts of the

body, it may be found at any time of life from childhood to old age. It has been observed only in the connective tissue of the erectile portions of the organ, running a rapid and insidious course, and probably for this reason generally returning after extirpation, having already reached a development at the time of operation which gave no hope of cure. Secondary sarcoma is found rather more frequently, but is nevertheless a rare occurrence.

Sebaceous and dermoid cysts have occasionally been observed. The dermoid cysts are very small, develop along the raphé, and are very rare tumors. Sebaceous cysts, however, are quite common, and may originate from the modified sebaceous glands (Tyson's glands) behind the corona, as well as from those of the skin, so that they are found in all parts of the organ. They are sometimes multiple, and are in that case small, but the single cysts not infrequently attain the size of a hen's egg, forming a serious obstacle to coition, especially when they are situated in the prepuce, which is their usual location. Solid tumors have also been known to grow from the modified sebaceous glands, forming adenomata. All of these benign tumors should be removed by operation, the sac of the cysts being carefully dissected out in order to prevent a return. The very numerous small cysts, however, may be simply incised, and their lining destroyed by thorough cauterization.

Papillomata are to be found anywhere on the skin or mucous membranes, but are most common on the inner side of the foreskin near its reflection upon the glans. They occasionally attain great size (Fig. 38), and have been known



FIG. 38.—Papillomatous hypertrophy of the penis (case of Dr. R. Abbe).

to perforate the foreskin in cases of phimosis by their outward pressure—a condition which might lead to the mistake of supposing them to be infiltrating malignant growths unless a careful examination was made. Under the general name of papilloma we include the so-called venereal wart, as it differs in nothing from the ordinary forms, and its only connection with venereal diseases is the fact that the latter are apt to cause irritant discharges, which are a well-recognized cause of the growth of warts in general. Any irritant discharge or secretion, especially if covered and protected from the air by a long foreskin, will cause the growth of papillomata, and this fact explains their frequent appearance behind the corona. There are some instances on record of contagion of these warts from one sex to the other, but probably this is merely due to a transfer of the irritating material, with a similarity in habits of neglect and lack of cleanliness, as there is nothing specifically contagious in their secretions, foul as they often are.

The papillomata may be single or multiple. When protected from the air they are moist, soft, and pink, but if exposed they become dry, hard, and brown in color. In the latter case they sometimes give rise to the curious appendages called horns, resembling those found on the skin elsewhere. The horn sometimes forms a flat plate, but far more often a projecting appendage (Fig. 39), which may attain a length of three inches. These horns

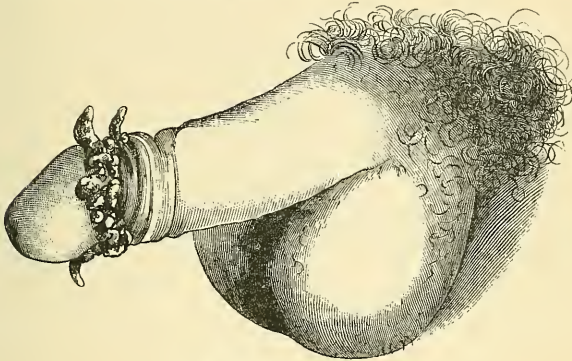


FIG. 39.—Horn of penis (Demarquay).

are usually more or less curved if long, and of a dark-brown or green color, in texture resembling the nails, but rough on the surface. They generally arise from the coronal sulcus, especially near the frenum, and on removal a wart will be found at their bases. They are found in persons of careless habits, and, although more frequent in advanced life, they have been seen at the age of nineteen years. They are so rare as to be little more than surgical curiosities, but are worthy of mention because they are occasionally the cause of an epitheliomatous growth around their bases.

The ordinary papilloma may sometimes become converted into an epithelioma after retaining its original benign character for years, and it should also be noted that epithelioma, and even sarcoma, may resemble ordinary warts in their early stages. A positive diagnosis will be impossible in some cases, and every wart which does not yield promptly to treatment or which obstinately returns after removal should be regarded with suspicion, especially if the patient is over thirty years of age. The tumor should be examined microscopically before further treatment, or else it should be dealt with at once as if it were malignant.

Every case of papilloma, in fact, demands thorough treatment, for even the simplest forms are marked by their tendency to return after removal unless the original cause is abolished and the tumor eradicated in the most thorough manner. The first steps in the treatment must be the cure of any balanitis or venereal discharge or ulcer, the reform of the patient's hygienic habits, and the institution of perfect cleanliness, and, in addition, the performance of circumcision if there is phimosis or an unduly long foreskin. The little tumors themselves can be destroyed with caustics, such as alum, salicylic acid, ferric chloride, glacial acetic acid, or fuming nitric acid. The last-mentioned acids are generally preferred, being applied with a little

splinter of wood to the growth after the surrounding surfaces have been carefully protected with some grease, such as vaseline. After the wart has sloughed the base should be cauterized again, as it is seldom that the first application will destroy the roots of the diseased papillæ. The hot iron may be employed for cauterization instead of chemicals. Some recommend the ligature of such papillomata as have slender pedicles, and perhaps this procedure might be permitted with very timid patients or where the tumor is so near the meatus that there seems danger of the production of a contracting scar by the caustic, but the pain is quite as severe as removal with the scissors, and the base must be cauterized afterward to prevent recurrence. For growths of any size removal with the scissors or sharp curette is to be recommended, cutting away not only the growth, but a portion of the tissues upon which it is seated. This little operation can be done painlessly with the help of cocaine applied to the surface or injected at the base of the wart, and the hemorrhage can always be controlled by pressure and styptics, although in some cases it has proved very obstinate and required the cautery. After the removal of the growths by caustic or excision the parts should be kept as dry as possible by some of the methods suggested in the treatment of balanitis.

Cancer of the penis is almost entirely a disease of advanced life, the sufferers generally being over fifty, and it is very rare before the thirtieth year. Weir has reported one at eighteen years of age. It occurs almost exclusively in the form of epithelioma, or that variety of carcinoma which consists of flat epithelial cells, although isolated instances of true carcinoma, and even melanotic carcinoma, of the penis have been reported, and it corresponds in etiology and prognosis with the epitheliomata of the skin observed elsewhere in the body. Secondary carcinoma is unusual, but sometimes follows a primary tumor in the testicle, scrotum, rectum, or other pelvic organs, seldom in any other part.

Etiology.—Its most frequent cause appears to be the chronic irritation set up by dirt or foul secretions, especially when retained under a long foreskin; but while some observers have found phimosis present in three-quarters of the cases which they collected, others deny that the combination is present in more than one-tenth. The disease certainly appears to be less common in circumcised individuals than in those with a natural prepuce. Many efforts have been made to bring syphilis and other venereal diseases into causal relation with cancer, but these diseases appear to be active only in so far as they give rise to inflammation, acrid discharges, chronic ulcers, and masses of induration, which may furnish the necessary irritation which seems to cause the epitheliomatous proliferation. A sufficient indication of the rarity of syphilis in the early stages acting as a cause of cancer is furnished by the statement of Taylor, that he has seen but one case of cancer developing upon the basis of a syphilitic lesion, that having appeared upon the scar of a chronic induration left by a previous chancre. But in the chronic ulcers of late syphilis malignant change is not rare. The writer has observed an epitheliomatous ulcer develop from a tertiary syphilitic ulcer behind the corona in a man only thirty-eight years old, the original ulcer having been under observation for several years, in which time it was repeatedly closed by antisiphilitic treatment, but as often returned, and finally perforated the urethra before the patient would submit to operation. It is true that in this case the ulcer had been subjected to a very vigorous and perhaps injudicious use of caustics (in other hands) when it returned the last time. The organ was removed with the inguinal glands before the latter were infected.

It has often been claimed that this disease might be due to infection from

PLATE I.

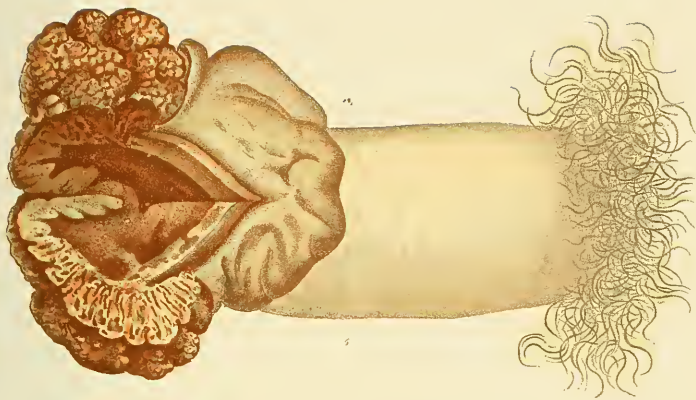


FIG. 1.—Cancer of glans penis: vegetating form (Demarquay).

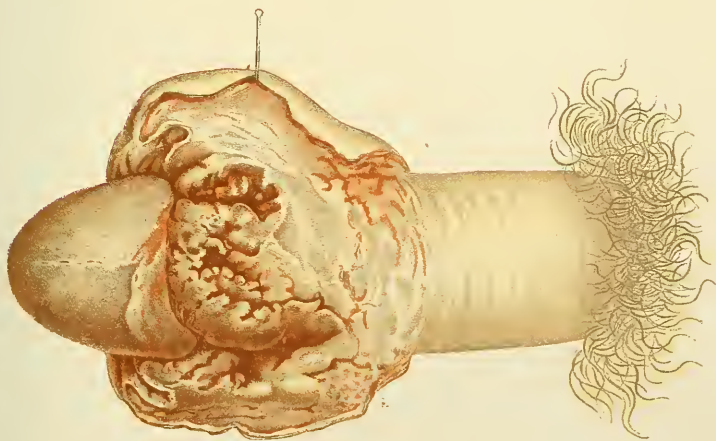


FIG. 2.—Cancer of the prepuce and body of the penis (Demarquay).

the cancerous uterus, but the immense number of cases of cancer of the uterus, in many of which coition has been continued long after ulceration has taken place, is in striking contrast to the rarity of the corresponding disease in the penis. In spite of the careful search which has been made by investigators all over the world for more than a century, there are not more than two or three authentic cases on record of the simultaneous occurrence of cancer of the uterus and penis in a married couple, and this small number indicates that their combination was probably a simple coincidence. This supposition, therefore, is absolutely without foundation in facts. Another favorite hypothesis in the etiology of cancer is the influence of heredity, but it has even less basis in the case of cancer affecting the penis than in the same disease elsewhere, for only two or three cases are known in which cancer existed in the parents of an individual afflicted with cancer of the penis. As in the case of malignant disease in the other organs, there are not wanting a few instances of cancer of the penis in which a traumatism was apparently the cause of the new-growth, but the number is too small to serve as the foundation for any theory.

Clinical History.—Epithelioma of the penis may arise from a wart, either single or multiple, and it may also resemble a wart in its earliest stages. In other cases it develops from a simple or venereal ulcer, especially a chronic ulcer of syphilitic origin, or even from a superficial excoriation such as is common in balanitis. If a wart becomes indurated and brittle, the base growing hard, and the induration tends to invade the surrounding skin, it has probably undergone malignant change. In the same way a marked induration and a tendency to spread or a readiness to bleed at the slightest touch should make one suspect any chronic ulcer or patch of excoriation, especially in elderly men. In some cases thickened patches slowly develop in the epithelial covering of the glans, resembling the condition known as leukoplakia in the tongue, producing whitish spots which crack and easily become excoriated, and these patches, like the similar disease in the tongue, are very liable to malignant transformation. In still other cases the malignant disease seems to begin below the surface, probably in some of the sebaceous glands of the skin, forming a small hard lump covered in its early stages by unaltered epithelium. We need only mention the fact that epithelioma of the scrotum or other parts may spread over and involve the penis by extension of its growth.

Cancer almost invariably originates from the glans or foreskin. On account of its insidious beginning, and owing to delay from carelessness, ignorance, and false modesty, it is generally allowed to grow for many months and to spread to a considerable extent before it is brought to the surgeon's attention. At this time, when it is fully developed, it usually appears in one of two distinct forms. The commoner of these types is papillomatous, in shape like a cauliflower, being smaller at the base than above, with deep clefts between the warty protrusions which form its mass, these warty protrusions being sometimes numerous, small, and slender, sometimes more scanty, but large and fleshy. The tumor may attain a large size, forming an immense knob on the end of the penis, sometimes measuring nine inches or more in circumference. While it is small the mass may be covered in whole or in part by the foreskin, but the latter is gradually pushed back or sloughs, and the growth is exposed. The surface of the tumor may be moist and of a bright-red color, or it may be more or less covered with white or gray sloughs. The small tumors, however, may be very dry and the surface a dirty gray or brown.

In the other and rarer variety, destruction of tissue is marked as well as growth, and the tumor consists of an ulcer which may be very deep in the center, with greatly thickened and indurated borders, the induration preceding the spread of the ulcer on all sides. The base of the ulcer is irregular, sloughing, and not infrequently perforates the urethra so that the urine finds its way out through the soft and sloughing tissues as well as through the meatus. The ulceration may progress until nearly the entire organ has been destroyed, but in spite of these extensive changes it is only in rare instances that any real obstruction to the escape of urine is found. In the last stages the two forms described may present a similar appearance, for extensive sloughing may take place in the large fleshy tumors also, resulting not only in reduction of their size, but in destruction of the penis itself.

Either form may develop under a narrow foreskin, and the extent of the destruction cannot be realized until the prepuce is laid open, when the glans will sometimes be found to have disappeared entirely, its place being filled with large fungating masses from the inner side of the prepuce, the only evidence of this extensive disease being a little papillomatous growth at the orifice of the latter and the fetid discharge. For these reasons Kaufmann wisely recommends that in elderly men with phimosis and a foul discharge from under the foreskin, the possibility of cancer should always be borne in mind, even if no characteristic induration can be felt.

Beyond the discomfort of the sloughing and the offensive discharge sometimes found, the tumor does not affect the general health of the patient, and causes comparatively little suffering, although severe hemorrhages have occasionally been observed in the late stages of the disease, and pain is also sometimes severe at that time. But the great danger to the patient lies in the spread of the disease by the infection of the lymphatics. This usually attacks the nearest lymphatic glands, but in at least one recorded case a secondary tumor was produced in the course of the lymphatic vessels along the sides of the organ. We are all familiar with the very early infection of the lymph-nodes in the groins which occurs with venereal ulcers, and this rapid involvement is not surprising when we consider the short distance and direct route which the lymphatic vessels pursue along the dorsum of the organ to these glands. Although the progress of the carcinomatous infection in the same direction is not so speedy, yet it is even more certain, and in some cases undoubtedly takes place very early. In some instances the disease appears to be very slow in reaching the lymph-nodes, as in a case reported by Taylor, in which the penis was amputated without removal of the glands after the tumor had existed for six years, and yet the patient remained well ten years later. On the other hand, other observers have found the glands attacked in every case, although in some the changes were so minute as to be recognized only by the microscope. Jacobson believes that the time of infection depends in part upon the local conditions, and that the glands will be involved early when the tumor is moist, especially if it is protected by the prepuce, and also in cases in which its growth is rapid; while if the tumor is dry and its discharge is not retained about it by the foreskin, or if it spreads slowly in the surrounding tissues, this infection will not occur until later, because under the latter circumstances there will not be so much tendency to absorption of cancerous material. But these considerations appear to be purely theoretical, and we know too little about the real causes of carcinomatous growth to be able to say what conditions would encourage or delay infection of the lymphatics. It is certainly impossible to tell from the condition of a cancerous growth in other situations—in the breast, for exam-

ple—whether the glands will be found extensively diseased or not, some of the largest, most rapidly growing, and most extensively sloughing tumors apparently involving the glands very late; while other tumors of slow growth and apparently rather benign local characteristics infect the glands from the first.

The lymph-nodes involved in cancer of the penis lie so close to the femoral and saphenous veins that their enlargement causes obstruction of the circulation in these vessels, with edema of the lower extremities, and when ulceration attacks these glands severe hemorrhages from the veins are common occurrences. Sloughing and ulceration of these glands, moreover, is very common, and is undoubtedly due to the fact that they are subject to pyogenic infection as well as to carcinomatous infiltration, owing to the foul condition of the penile growth. This tendency to pyogenic infection readily explains those rare cases in which the glands were enlarged at the time of operation for cancer of the penis, but were left untouched by the surgeon, and yet have disappeared spontaneously afterward.

With the appearance of greatly enlarged glands in the groin the end approaches. The penis has been more or less destroyed or altered into a shapeless mass, the urine escaping from a dozen sinuses in the ulcerating tumor, large sloughing ulcers exist in the groins, and the feet and legs are swollen. The patient is poisoned with septic substances circulating in the blood, pale from repeated hemorrhages, and often suffers continual and sometimes agonizing pain, until he finally succumbs to the disease. The duration of cancer of the penis is variable, for it sometimes runs its course in a few months, and sometimes is prolonged by incomplete operations or even by its own slow progress over many years, but, as a rule, the time elapsing from the first marked symptom to the end in cases left without treatment is about two years. Secondary deposits in other parts of the body are very rare, only three or four such cases being known: the writer has seen extensive secondary deposits in the lung in one case causing death a year after operation without local recurrence. The disease spreads almost entirely by the lymphatics, very seldom invading the cavernous tissues. In some cases, however, it attacks the latter, and microscopic deposits have been found in them even when they appeared healthy to the unassisted eye.

The diagnosis of epithelioma in its early stages may present the greatest difficulty. The most reliable symptom is the induration generally found at the base of a wart or on the edges of a suspected ulcer, which tends to spread into the surrounding tissues; but, as Jacobson remarks, this sign is not altogether to be depended upon, for both wart and ulcer may remain free from induration long after the microscope would show the beginning of malignant changes. Fortunately, the microscope can always be made to decide in doubtful cases, for excision is excellent treatment for both wart and suspicious ulcer, so that if the small lesion be removed it can be subjected to examination, and the patient will be cured by the trifling operation even if the suspicion prove without foundation. In fact, it is safer to make a wide removal in both cases if the disease proves obstinate to milder measures, even if the microscope fails to discover proof of malignancy. The diagnosis of cancer from venereal ulcers is usually simple, owing to the well-marked peculiarities of the latter lesions. But the diagnosis between ulcerating gumma and epithelioma is not so easy. The gumma, however, is known by its soft, undermined edges and by the fact that ulceration is the main feature, while in cancer there is always some new growth, and finally by the readiness with which the syphilitic lesion generally yields to treatment.

As has been stated, any case of foul discharge from a narrow foreskin in an elderly man should be considered suspicious, and should be subjected to dorsal incision or circumcision, even if no induration can be felt through the prepuce, in order to settle this important question. Even if only a severe balanitis exists, it is for the best interests of the patient to be freed from a disease which is a constant source of danger, especially at this time of life. Sometimes when the prepuce cannot be retracted the hard swelling of a lymphatic vessel in the sheath of the penis or the induration and enlargement of the inguinal glands will give a clue as to the real nature of the affection. The presence of primary or tertiary syphilis should not long delay the surgeon, for it is quite possible for epithelioma to coexist with syphilis or to develop upon a syphilitic ulcer, and if a fortnight of well-directed treatment with mercury and the iodids does not bring about a marked improvement, the disease should be considered malignant and dealt with accordingly.

The prognosis of the disease under any other than operative treatment is hopeless: the tumor must be removed by the knife or by caustics. Nor should the surgeon be satisfied with thoroughly removing the tumor itself, but the glands in the groin should also be removed, even if they give no evidence of disease, for enlargement and induration are the only signs by which the presence of disease in them can be recognized, and the microscopic changes begin long before these symptoms are evident. In 9 cases examined by Gussenbauer after operation, the glands were diseased in all, but in 2 of them the changes were so slight as to be discovered only under the microscope. There is no possibility of this change ever retrograding when it has once begun, and the only safe rule is to extirpate the inguinal glands as well as the original tumor, however small the latter may be, and even if there is no outward sign of glandular disease. Many cases are on record in which the glands have enlarged and proved to be carcinomatous long after the removal of the penis, even without any local recurrence, showing that if the glands had also been extirpated in the first place a complete cure could have been obtained. If the tumor is thoroughly eradicated, the prognosis is one of the best in malignant disease, being as good as in ordinary epithelioma of the skin, and giving a cure in 40 per cent. of the cases. If only favorable cases were considered, the percentage of cures would undoubtedly be much greater, and it can certainly be improved in the future by earlier and more thorough operations.

In all cases except the most trifling the entire organ should be removed down to the pubes, and in bad cases the complete extirpation, including the crura, first systematically carried out by Thiersch, should be performed. In all cases, too, the lymphatic glands in the groin should be removed. As has been already mentioned, both the crura and the glands may contain microscopic changes, although nothing is evident to the naked eye; but, as a matter of fact, at the time of the first examination of the patient by the surgeon the glands will usually present distinct enlargement. The time has not yet come when we can afford to relax our vigilance in the treatment of malignant disease, and our operations should be more radical rather than less so until the results improve.

Caustics should not be employed in the treatment of cancer of the penis, for they are not sufficiently thorough, and in modern times with anesthesia at hand it is needless cruelty to subject patients to the suffering of such extensive cauterization as must be employed to fully eradicate even the smallest malignant tumor of the penis. We must also give warning against

the use of *mild* caustics in the treatment of suspicious warts or ulcers. The practice of applying such substances as nitrate of silver to warts, ulcers, and excoriations of all kinds is still too general. Such applications can serve no good purpose, and if there is any beginning malignant tendency they do untold harm, setting up more irritation and hastening the malignant changes. If any lesion upon the penis is suspicious, it should either be completely eradicated by the most powerful acid or by the knife, or else left entirely untouched under some simple indifferent treatment, while the surgeon watches its development in order to determine its true character. There is good reason for believing that the application of such irritants as nitrate of silver can turn the scale in favor of malignancy in some simple wart or ulcer which would have been permanently cured without tendency to return if it had been clipped out with the scissors or completely destroyed by nitric acid.

Amputation of the Penis.—The usual amputation of the penis by the circular or flap method is not a difficult operation. In the former the skin is divided by a circular incision a finger's breadth in front of the pubes and retracted. The dorsal vessels are secured with clamps or ligatures, and then each corpus cavernosum divided in turn close to the pubes, the central vessel being secured by a clamp. The corpus spongiosum is then separated from the cavernosa anterior to the point of division of the latter, and divided half an inch farther forward, so as to assure a proper length to the urethra. Hemorrhage is controlled by ligatures, or, if there is a great deal of oozing from the erectile tissue, the fibrous coat can be sutured over the stumps of the corpora cavernosa. It is better to make the section of these parts slowly as described, taking up the vessels as they are exposed or divided, than to trust to compression by an assistant's fingers or by the rubber ligature, as these aids prevent the surgeon from cutting close to the pubes. In any operation upon the anterior part of the penis, however, it is possible to make the incisions entirely bloodless by transfixing the organ by two large needles or pins placed in X-fashion, so as to clear the urethra, some distance behind the site of the incision, and then winding a narrow rubber cord around the organ two or three times just behind the pins, the latter preventing it from slipping off. But this is not recommended in amputations. After the parts have been cut away the urethra should be slit up for at least half an inch along its floor and secured to the edges of the skin. Whether the latter is united in a vertical or in a horizontal direction is a matter of indifference, but it will be a little easier to adjust the urethra in the former case.

In the flap operation the flaps may be of equal length and cut either laterally or above and below. A favorite method is to cut a single long dorsal flap, dividing the skin below circularly. When the amputation is finished the dorsal flap hangs over the front of the stump like an apron, and a small incision is made in its center, to the edges of which the urethra is secured after being slit up as described. The object in slitting the urethra in this way is to prevent the cicatricial contraction, which would undoubtedly take place if it were allowed to unite by a small circular cicatrix. The opening when the wound heals should resemble the meatus of a slight grade of hypospadias. The old operation of amputation by the galvano-caustic loop is to be rejected as incompatible with asepsis and primary union.

Removal of the Inguinal Glands.—In operating for cancer, as has been said, the glands in the groin should also be removed. This is done by the usual incision along Poupart's ligament. The skin should be dissected up and down, thoroughly exposing the region. When the upper flap has been

dissected far enough back to be entirely clear of the glands, the knife is directed toward the abdominal wall, and made to cut inward until the fascia of the external oblique is reached. Beginning at the outer angle of the wound, the whole mass of fat and glands is then dissected from the abdominal wall bluntly or with scissors and knife, in a direction inward and downward, until Poupart's ligament is reached. The same plan is then adopted below, cutting directly toward the fascia when the skin-flap has been dissected up, then beginning again at the outer angle and working inward and upward. Here the dissection must be very carefully conducted, as the saphenous vein should be avoided, and yet it is necessary to dip well down into Scarpa's triangle in order to secure the glands which lie just over the femoral vessels. Finally, the two planes of dissection will meet at Poupart's ligament, and the entire mass of fat, with the glands included, can be removed in one piece. Only in this way can the surgeon be sure that all the small lymph-nodes of the region are extirpated, together with their communicating vessels, for all of these are sources of danger. When the operation is systematically performed it should not require much if any longer time than the desultory picking out of one gland after another which is so often practised. The operation is to be carried out on the same principles as the clearing out of the axilla after an amputation of the breast.

Extirpation of the Penis.—When the disease in the penis is extensive and the ulceration has attacked the erectile tissue, it is necessary to remove the erura as well as the rest of the organ. The operation already described will give good results when the erectile tissue is not compromised, for it removes all of the lymphatics which are likely to be diseased. But if the erectile tissue be involved, the same principle of complete extirpation must be applied to those parts. In performing this extirpation of the penis the author follows the teaching of Thiersch, but prefers to remove the inguinal glands first in a manner similar to that described above, but making the incisions on the two sides meet over the pubes, and leaving the two masses of glands attached to the root of the penis by a pedicle of fat and vessels. The patient is then placed in the lithotomy position, the skin of the penis is divided by a circular incision at its root, and the scrotum is split by a few strokes of the scissors and by blunt dissection, so that the two tunicae vaginales lie on each side like two bags, each containing a testicle. The latter are held aside by assistants, and the urethra having been exposed, it is dissected from the corpora cavernosa and divided at a point as far forward as may be thought safe, its end being closed temporarily by a clamp. If the disease has destroyed much of the glands, it must be assumed that the corpus spongiosum is seriously infected, and the urethra should be divided far back in the perineum. If, on the other hand, the glands has not been attacked, but involvement of the corpora cavernosa affords the indication for the operation, the urethra may be cut across more anteriorly, the corpus spongiosum being dissected from the cavernosa. The suspensory ligament is next divided, the penis drawn downward, and the corpora cavernosa stripped off the rami of the pubes with a periosteal elevator, their arteries being secured by clamps if possible before being divided. The entire organ is thus separated from its attachments and removed in connection with the contents of the groin. The end of the urethra is then trimmed off where it was crushed in the clamp, and slit up on the floor for about half an inch. If it has been divided very far back, it is secured at the posterior angle of the wound in the perineum. If it has been left long, the author generally brings it forward between the testicles and secures it on the anterior surface of the scrotum, which is then reunited in its original shape. This gives the patient

a meatus where he can see it, and by taking the scrotum in his hand and holding it forward he can make use of it as a sort of funnel and project the stream over his feet without wetting himself. A small tin funnel carried about with him renders him able to use the ordinary urinals. The author has also employed the same method in some cases of amputation of the penis at the pubes, separating the urethra and bringing its end forward by splitting the scrotum part way down in order to secure it in the same manner. In order to accomplish this it is not necessary to leave the urethra very much longer than if it were secured in the stump in the usual manner, and the method gives a far better functional result.

When the urethra has been thus secured the ligatures are applied and the wound closed by sutures, the whole acquiring a Y-shape. It is well to apply a rather heavy compressive dressing in order to prevent edema of the scrotum, and the urine should be drawn by the catheter for the first two days in order to prevent it from soiling the dressing and infecting the wound. Otherwise, the patient requires very little care, and the catheter can even be dispensed with if desired, as the meatus is at the lowest part of the wound, and the urine is not very liable to infect the latter.

Many surgeons advise the removal of the testicles also, and there can be no doubt but that this would be desirable and would not greatly complicate the operation. It is said to add greatly to the comfort of the patient both during the wound-recovery and afterward. But in practice this suggestion is not easy to adopt, because the patients generally feel that the operation for removal of the penis is very serious, and will not consent to anything more extensive, especially as they consider the loss of that organ a great sacrifice and fear to submit to what they imagine is a further attack upon their virility. As a matter of fact, however, the removal of the genitals in men of advanced years does not seem to produce any change of character, being essentially different in effect from similar operations in young individuals. Nor does it seem that the isolated cases of insanity which some have supposed to have been caused by this operation were really a legitimate consequence of it, for not only is any operation upon persons of advanced years more liable to affect the mind than is the case earlier in life, but the suffering, both bodily and mental, which patients afflicted with this disease undergo before consenting to operation is generally sufficient to account for some mental deterioration.

DISEASES OF THE MALE URETHRA.

By G. FRANK LYDSTON, M. D.

ANATOMY AND PHYSIOLOGY OF THE URETHRA.

AN exhaustive discussion of the anatomy and physiology of the urethra would not be in keeping with the character of this work. There are a few

points, however, that are of practical interest in the clinical and pathological study of its diseases. The urethra may be described as a musculo-membranous tube extending from the meatus urinarius to the bladder. It is divided into three portions—the penile, spongy, or pendulous urethra, the membranous, and the prostatic. The two latter constitute the fixed or deep urethra. The spongy or penile urethra is about 6 inches in length, and extends from the meatus urinarius to the opening in the triangular ligament, at which point it joins the pars membranosa (Fig. 40, *d*). The latter is about $\frac{3}{4}$ of an inch in length, and extends from the anterior to the posterior layer of the triangular ligament (Fig. 40, *d*); the remainder of the canal is included in the prostatic portion, which is about $1\frac{1}{4}$ inches long (Fig. 40, *e*). The meatus urinarius is the narrowest portion of the canal, and serves the purpose of directing the outflowing semen and urine. The meatus varies considerably in size. A small meatus is not necessarily an indication for a surgical operation, but when a small-calibered orifice is associated with urethral disease or reflex disturbance of the genito-urinary tract, a congenital contraction of the meatus at once assumes surgical importance. The meatus is sometimes narrowed because of the comparatively great thickness of that portion of the glans forming the floor of the fossa navicularis, the latter being the relatively dilated portion of the urethra situated within the boundaries of the glans penis and terminating at the junction of the latter with the corpora cavernosa. In other cases the relative narrowness of the meatus is due to a thin membranous fold at the inferior commissure of the orifice. This is dilatable, and offers little or no resistance to instrumentation, the contrary being true of the variety of narrowing previously mentioned. Narrowness of the

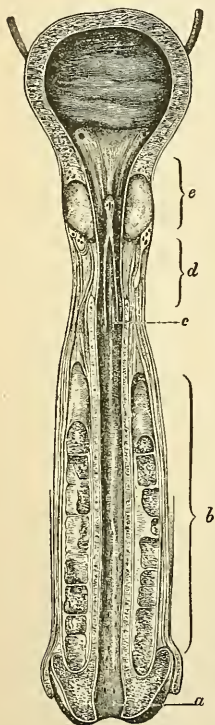


FIG. 40—*a*, fossa navicularis; *b*, cavernous portion; *c*, bulbar enlargement; *d*, membranous portion; *e*, prostatic portion (Finger).

meatus is generally congenital, destructive ulceration being, however, a fre-

quent cause of acquired contraction. In some instances the canal is relatively narrow because of the presence of a congenital band just within the meatus, the orifice proper being fairly dilatable.

The spongy urethra is so called because of its investment by the corpus spongiosum. The mucous membrane of this portion of the canal is abundantly supplied with mucous glands and ducts. These, when infected, are likely to become dilated and their orifices more or less obstructed, with a resultant accumulation of infectious products in the glandular tissue proper. Latent infection and successive auto-inoculations with gonorrhœa are often thereby explained. As is well known, these ducts and follicles may be so dilated that they catch the points of instruments employed in exploration of the urethra. They may also be the starting-point of urinary abscess and fistula. Their abundance and the difficulty of rendering them aseptic offer a logical explanation of the obstinacy of some cases of urethritis.

The membranous portion of the canal is invested by relatively powerful layers of longitudinal and circular muscular fibers—the compressor urethræ and accelerator urinæ muscles. On this account it has been sometimes termed the muscular portion. The function of the muscular structure of the urethra is very important. That of the membranous urethra constitutes the true sphincter of the bladder. This is under volitional control, but in rather a peculiar fashion. It would seem that the sympathetic nerve-fibers supplied to the muscle are responsible for its normal tonicity. Voluntary nerve-fibers supplied to the part enable the patient to inhibit the normal contraction at will, as a consequence of which the steady pressure or normal tonus of the destrusor urinæ muscle is enabled to overcome the slight remaining resistance of the true vesical sphincter, with resulting voluntary micturition. Direct or reflex excitation of this portion of the canal is likely to result in retention of urine. Conversely, paralysis of the pars membranosa produces urinary incontinence.

The prostatic portion of the urethra will receive attention in connection with the anatomy of the prostate. The principal diseases of this part of the canal will also receive consideration as prostatic rather than urethral affections.

While the urethra is, under normal circumstances, a urinary organ, it is by no means necessary to the function of micturition. It is, however, quite necessary to the procreative act. The urethra is, therefore, a sexual rather than a urinary organ.

The length of the urethra as given by most anatomists is from 8 to 9 inches, but the greatest discrepancy exists upon this particular point. A table showing the estimates of various clinical observers would show a marked variance of opinion. A difference of from 20 to 30 per cent. in the estimated measurements of equally competent observers is not unusual, and is hardly to be wondered at. It is probable that no two observers can possibly obtain precisely similar conditions for measurement. The penis varies in size not only in different subjects, but there is the greatest imaginable variation in the same subject under different psychological conditions. The same conditions affect the caliber of the canal.

The individual urethra is a law unto itself as far as its length is concerned. The length of a particular urethra may be said to be the distance from the meatus traversed by the catheter before the urine begins to flow, the penis being flaccid and subjected to a degree of tension merely sufficient to afford adequate support during instrumentation. Due allowance should be made for sexual excitation or emotional inhibition of blood-supply.

The consideration of the physiological functions of the urethra bears a very important relation to the study and treatment of its diseases. It is well to remember that while the urethra is of greater sexual than urinary importance, both functions must be taken into consideration in the pathology and therapeutics of the canal. Were it possible to inhibit for the time being the function of urination and to bring the sexual function of the urethra under complete control, diseases of this part would be of trifling importance and their treatment simplified. It is safe to say that the diseases of no other structure of the body are treated upon such irrational principles as those of the urethra, because of the necessity of mechanical disturbance of the canal at variable intervals in the act of micturition and the difficulty of repressing sexual emotions and stimuli, to say nothing of the frequency with which the patient is exposed to the mechanical dangers incidental to actual intercourse.

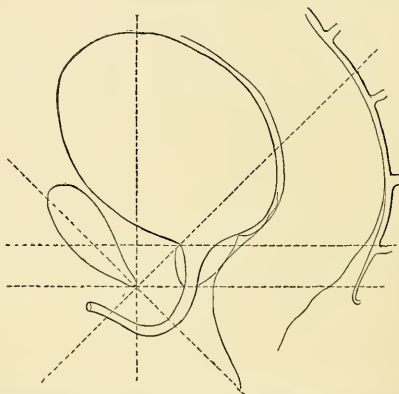


FIG. 41.—Schematic representation of urethral curve and its relation to the symphysis pubis (Tillaux).

The anterior curve of the urethra is not of great importance with relation to instrumentation, as it can be adapted to almost any form of instrument. It is different, however, with the posterior or deep curve (Fig. 41), which is relatively fixed; it cannot be said to be constantly fixed, for, as is well known, straight instruments can be introduced into the bladder. The fixed urethral curve is not uniform, but varies widely with the period of life and the condition of the prostate body. It is comparatively short and sharp in the child, much longer and less abrupt in the adult, these characteristics greatly increasing in prominence as the subject grows older. In prostatic enlargement the curve becomes so greatly elongated as to necessitate considerable modification of instruments and manipulations for entering the bladder. This point is of the greatest practical importance to the genito-urinary surgeon. The direction and conformation of the pendulous urethra may be modified by changes in the position of the penis. It may also be adapted to any form of instrument necessary for urethral or bladder manipulation.

The average normal curve, as established by Bell and verified by Thompson, Van Buren, and others, corresponds to a circle $3\frac{1}{4}$ inches in diameter,

the proper length of curve for adaptation to the deep urethra being an arc of such a circle subtended by a chord $2\frac{3}{4}$ inches in length. The length of curve advised by Thompson is generally too long for instruments. The shorter the beak of the sound, providing it be adapted to the normal curve, the more thoroughly under control will the instrument be during instrumentation.

The author takes the opportunity of stating at this point his belief that the majority of surgeons have a very exaggerated estimate of the length of the urethra from the standpoint of instrumentation. As a result of this fallacious belief, instruments for vesical and urethral exploration are much too long upon the average, and it is probable that considerable damage results therefrom.

One of the most important structures in relation with the urethra, from a surgical standpoint, is the deep layer of the superficial fascia of the perineum. This was first described as a special fascia by Gurdon Buck, and is generally known as Buck's fascia. It is attached to the rami of the pubes and ischia laterally, and to the triangular ligament behind, in such a manner as to limit extravasations of urine, blood, or pus to the perineum. Buck's fascia is continuous with the fascia abdominalis above; hence it is possible for fluids to burrow in this direction alone as long as the fascia is intact below. This special fascia splits into two layers that enclose the corpora cavernosa and corpus spongiosum before it dips downward into the perineum.

The triangular ligament is another special fascia of importance. It is really the deep perineal fascia. It is divided into two layers, the compartment between which contains the membranous urethra and Cowper's glands.

INJURIES OF THE URETHRA.

The subject of traumatism of the urethra, while in the strict sense of the word a surgical one, is very important for the consideration of the general practitioner, especially as he is quite likely to be first upon the scene, and is liable to be led into the belief that certain injuries are of trifling importance when, as a matter of fact, they require the immediate attention of a surgical expert. It is by no means cases in which serious swelling, pain, and perhaps retention of urine occur that alone require careful surgical treatment. A knowledge of their possible gravity, ultimate results, and the proper method of management of traumatisms of the urinary canal is of the greatest importance, not only because of the immediate gravity of many cases, but because of the more remote yet serious results that may follow apparently trivial injuries.

Possible results of urethral traumatism.

}	Hemorrhage ;
	Retention of urine ;
	Extravasation of urine ;
	Sloughing ;
	False passages ;
	Urethritis ;
	Pus-infection and abscess ;
	Urinary fistula ;
	Permanent curvature of the penis ;
	Stricture of the most intractable form ;
Fatal sepsis.	

The urethra may be contused, lacerated, or cut either from internal or external violence. Internal injuries are generally the result of surgical interference with the canal; occasionally, however, the patient wounds his urethra

by the introduction of foreign bodies of various kinds. The penile urethra is only exceptionally injured by external violence, on account of its extreme mobility. The deep urethra is frequently injured by falls or blows upon the perineum, the bulbo-membranous region being caught between the impinging body and the sharp lower border of the subpubic ligament. A slight blow in this region may produce serious injury.

The urethra is occasionally cut or lacerated from external blows with sharp instruments.

Treatment.—In all injuries of the urethra, however slight they may seem, the practitioner must have in view the danger of subsequent stricture. This may be averted by systematic sounding during the healing of the wound. Hemorrhage may be controlled by pressure, the ice-bag, or the retained catheter. If the injury be at all extensive and a catheter can be readily passed, it should be retained in the bladder for a few days, after which the danger of extravasation will have subsided. Systematic dilatation should now be substituted for the retained catheter. If the penile urethra be extensively lacerated, a perineal puncture should be made for vesical drainage, and the lacerated tissues should be stitched in layers over a soft catheter or a piece of rubber tubing. The perineal tube may be removed at the end of a week. Primary union may be expected from this procedure.

In all urethral injuries great care should be taken in passing instruments, lest the lacerated tissues be torn up and a false passage thereby made.

In deep urethral injuries a catheter should be carefully passed and retained for a week or more, after which dilatation should be begun. If great difficulty be experienced in passing the catheter or if the injury be severe, perineal section is indicated. If it be possible to suture any portion of the divided urethra, this procedure is advisable. The author is of opinion that perineal section is by far the safest method of treatment for the majority of cases of injury to the perineal portion of the urethra. Should extravasation of urine be suspected, perineal section is imperatively necessary.

In the management of all cases of urethral injury the strictest attention should be paid to asepsis and antiseptis. The most important practical point in connection with urethral traumatism is the fact that stricture of the canal often follows injuries which are so trivial as to attract little or no attention at the time of their infliction. Careful attention may obviate this untoward result.

The author desires especially to emphasize the desirability of systematic dilatation after all injuries of the urethra that are sufficiently marked to attract attention. If this plan be followed, serious traumatic stricture will often be prevented.

FOREIGN SUBSTANCES IN THE URETHRA.

It would require much more space than the subject demands to enumerate the variety of ordinary and extraordinary substances that have been introduced into the urethra by patients who are actuated by curiosity or perverted sexuality. Young lads quite often introduce foreign bodies into the urethra, and these bodies, slipping from their fingers and being swallowed up by the canal, produce a degree of subsequent trouble determined entirely by the character, size, and location of the foreign substances. It is by no means exceptional for surgeons to break off catheters or other surgical instruments in the urethra. The French gum catheters are particularly dangerous in this respect, especially after they become old and brittle.

Possible results of foreign bodies.

Retention of urine ;
 Hemorrhage ;
 Urethritis ;
 Ulceration ;
 Rupture of the urethra ;
 Sloughing ;
 Abscess and fistula ;
 Deposition of urinary salts and resulting calculus formation.

Treatment.—Simple manipulation, perhaps combined with meatotomy, is often successful in removing foreign bodies from the urethra. Specially constructed urethral forceps are sometimes necessary. When these means fail the foreign body should be pushed on into the perineal urethra, and a perineal section made. It is well to make the perineal section before the foreign body is pushed down, unless it be of good size, for small bodies may otherwise be forced into the bladder.

In the author's opinion, prompt perineal section is very much better practice, upon the average, than prolonged attempts at extraction of a foreign body by urethral forceps *via* the meatus. In the case of soft bodies it has been recommended to insert a fine needle into the urethra from without and pry the foreign body outward toward the meatus.

TUMORS OF THE URETHRA.

The urethra is occasionally the seat of new growths of various kinds. Since endoscopy came into vogue urethral tumors have been found to be much more frequent than had previously been supposed. These tumors vary in degree and gravity from small inflammatory neoplasms to malignant growths.

Inflammatory neoplasms are usually concomitants of chronic urethritis, and, as Dittel long ago showed, are occasionally associated with organic stricture. As he originally described them, these neoplasms consist of an overgrowth of the connective tissue underlying the mucous membrane which projects into the lumen of the canal. They are richly supplied with blood-vessels, and are covered with epithelium similar to that found in the normal urethra. Fungous or papillomatous excrescences are sometimes formed, the point of departure being apparently a granular urethritis. In some instances the vascular supply is so rich that the growth is not unlike an angioma.

In a general way, urethral growths of inflammatory origin resemble the vegetations that are met with upon the external mucous surface. The author has noted several cases in which the growth was associated with external vegetations, the urethral growth being limited to the fossa navicularis. In other instances papillomata have occurred in the anterior urethra independently of any external growth. Distinct polypi of the mucous membrane of the urethra have been met with. Such a specimen exists in the museum of Guy's Hospital, London.

It will be readily understood that prior to the introduction of the endoscope no ante-mortem diagnosis of the softer varieties of urethral neoplasm could be considered as more than guesswork. Urethral tumors, usually in the form of the well-recognized caruncle, are much more readily recognized in the female than in the male, on account of the limited length and great dilatability of the canal.

Cancer of the urethra is usually secondary to cancer of the penis, and

requires no special consideration here. Several cases of primary cancer of the urethra have been reported, but they have been erroneously diagnosed until late. Such cases as have occurred have been located in the perineum, and even in these cases the urethra may have been secondarily diseased.

Grünfield has reported one case in which he diagnosed a primary cancer of the prostatic urethra by the endoscope.

Benign tumors of the urethra are usually found casually when the surgeon is seeking for a cause for a protracted urethral discharge. The symptoms of urethral tumor are those of chronic urethritis, with obstruction—if the growth be sufficiently large—and in some cases hemorrhage during micturition.

The **treatment** of urethral tumors is, briefly, removal by forceps or scissors *via* the endoscope or urethral speculum, with subsequent careful cauterization of the base of the growth.

URETHRITIS.

Urethritis is the most frequent disease affecting the male genito-urinary tract. It is usually contracted during sexual intercourse, and is so exceptionally acquired in any other way that it has been termed the most venereal of the class of diseases to which it belongs. The most common term for urethritis is gonorrhœa. This is a misnomer, for several reasons: First, because it implies a discharge or morbid flow of semen; second, because it implies a disease of an unvarying type of specificity. The generic term urethritis is accurate as applied to the affection in the male, inasmuch as it not only implies an inflammation of the urethral mucous membrane, but is sufficiently comprehensive to embrace all the varying forms of the disease whatever their origin. Neisser's discovery of the gonococcus has, however, in all probability permanently fixed the generic term gonorrhœa in its application to a specific type of inflammation affecting the mucous membranes in both the male and female. If we accept the specific character of the gonococcus, a broad line of clinical differentiation is at once established in urethritis. We are still compelled to recognize, however, certain cases in which the presence or absence of the gonococcus cannot be accepted as proving or disproving the venereal origin of the disease. This is especially true in cases in which the affected individual has indulged at more or less frequent intervals with different females, and has suffered from previous urethral infection. Under such circumstances the recent attack may have been due to the development of gonococcal auto-infection from a focus originating in some prior attack of inflammation. In other instances the patient presents himself with a non-gonococcal discharge, and we are called upon to decide as to its specificity. Here we are compelled to acknowledge that the gonococci may have been present, but have disappeared. Practically, therefore, we are often essentially in the same position as before the discovery of the gonococcus. Especially is this true from a medico-legal standpoint. The sources of error in the diagnosis of the origin of urethritis are so numerous that it is never safe to pronounce a case of urethritis to be of specific origin, whether the gonococcus is present or not, unless the affected individual can be shown to have been perfectly healthy before the development of the urethritis, or to have had intercourse with a woman suffering from virulent vaginitis—proven by microscopic examination of her vaginal secretions—or to have a history of a more or less recent attack of gonorrhœa. This caution is particularly necessary in passing an opinion in the case of a married person.

The discovery of the gonococcus has not changed the views of the author

regarding the origin of gonorrhœa and its congeners. This class of affections, in common with chancroid, may still be classed as filth-diseases which originate *de novo* in the female. The author believes that germ-infection of one kind or another is the *fons et origo* in the majority of cases of urethritis. It is not probable, however, that the germs producing such infection are always and invariably the same. Gonorrhœa is probably as old as the human race, but the development of the gonococcus—and, indeed, of all germs capable of producing urethral inflammation—has been along evolutionary lines. We cannot accept the spontaneous generation of germs of either indeterminate or specific type. We may, however, believe in the transformation of innocuous germs, by virtue of their adaptation to environment, into germs of a specifically pathogenic character. The female generative apparatus constitutes the most favorable environment for the development of germs, and their acquirement of pathogenic properties, that could be imagined. Protection from air and light and the presence of heat, moisture, and decomposable secretions of various kinds constitute excellent conditions for bacterial evolution. Pathological discharges and exposure of the parts to sources of local irritation constitute an additional and important factor. In uncleanly women, vaginal discharges, as well as both pathological and physiological discharges of the male, are allowed to accumulate and undergo decomposition. The semen is a highly complex organic substance, the decomposition of which in all probability results in the development of toxins of a highly irritating character.

When the author uses the term *de novo* as applied to chancroid and gonorrhœa, he does so with the full understanding that both are germ-diseases, and that, consequently, spontaneous generation of these diseases in the sense of the development of their germs *de novo* is an utter impossibility. He believes, however, that the perfected germs of these affections represent the acme of spontaneous cultivation of germs which were primarily quite different, from a pathological standpoint at least, from the final product. Evolutionary changes, and especially differentiation of biological and pathogenic properties in germs, must be admitted, for we must necessarily apply the same law to the parasite as to the host. It is very interesting to the author to observe that the views which he expressed some years ago upon this subject in an article entitled "The Evolution of the Local Venereal Diseases" are being daily substantiated by the practical results obtained by bacteriologists in the laboratory. A recent case coming under the author's observation appears to be an illustration of the fact that the germ of gonorrhœa is capable of transformation.

The case was that of a young man who had been troubled with posterior urethritis and stricture for nearly two years. From time to time, within the past year, his semen had been examined by several very competent microscopists and had been said to contain gonococci. Several months after a urethrotomy the patient's semen was examined, and found to contain germs strongly resembling the gonococcus. Closer study, however, showed that they were slightly rod-shaped, although typically paired, like the diplococcus of gonorrhœa. Cultures and experimental inoculations showed that the microbe was pathologically inert, and the patient was assured that he might marry with safety—a point of great importance to him, as he had been contemplating matrimony. Did we not have in this case an illustration of a spontaneous alteration in the physical and pathogenic properties of the gonococcus? The case is at least a suggestive one along the lines mentioned. It is of such practical importance that the author is inclined to

believe that test-cultures and inoculations should be made in prolonged cases in which the presence or absence of the gonococcus is to be accepted as the criterion of cure or of the safety of matrimony.

Whether or not the gonococcus be accepted as the cause of a certain specific type of urethritis, the fact remains that the environmental conditions that have been mentioned constitute the point of departure of germ-evolution, the products of which are capable of producing mucous inflammation of varying grades of severity, ranging from a simple form of urethritis to the gonococcal variety of virulent inflammation. Precisely what germ is the progenitor of the gonococcus in the process of evolution would be difficult to determine, but the difference between the specific microbe and certain germs that are normally present in the urethra of the male and the vagina of the female is not very great. The dissimilarity between the gonococcus and the pus-microbe is not so marked as to exclude the possibility of the transformation of the one into the other under favorable circumstances of environment. That we are unable to imitate this process of evolution is not a valid argument against the theory.

Varieties of Urethritis.—Inflammation of the urethra may be divided for description as follows :

Acute and chronic,	{	(a) Simple,	{	Bacterial ; Toxic ; Chemical ; Traumatic.
		(b) Specific,	{	Gonococcal ; Chancroidal ; Syphilitic.

Simple Urethritis.—Simple urethritis is rather an omnibus term, on account of the large number of causes upon which the condition may depend.

Predisposing Causes.—1. Diathetic conditions ; 2. Chronic urethral disease ; 3. Morbid states of the urine ; 4. Sexual abuses ; 5. Dietetic excesses and irregularities ; 6. Alcoholism. It is obvious that any condition of the system which gives rise to irritability of the mucous membranes predisposes to inflammation of these structures. It is possible that this argument cannot be applied with equal pertinency to all mucous membranes, but it certainly applies quite forcibly to the urethra. Especially is this true of such diathetic conditions as rheumatism and gout, in which the urine is likely to be loaded with the products of retrograde tissue metamorphosis, which products may be both mechanically and chemically irritating. Lithemia and oxalemia are especially potent factors in this respect, producing as they do their corresponding conditions of perturbation of the composition of the urine—namely, lithuria and oxaluria. The urine in lithemia is not only likely to be heavy and concentrated by virtue of its disproportionate amount of solids, but the uric-acid crystals present are exceedingly irritating to the mucous membranes of the genito-urinary tract. There is no question but that lithuria is responsible for certain catarrhal conditions of the upper portion of the genito-urinary apparatus. This catarrhal condition is possibly not so manifest in the urethra, yet the mucous membrane, by virtue of the irritating properties of the urine, is in an extremely vulnerable condition. This constitutes a standing invitation to infection and sources of irritation of all kinds. Irritability of the nervous supply of various tissues—which means essentially irritability of the tissues themselves—is another important factor incidental

to the gouty or rheumatic diathesis. Closely associated with the gouty diathesis are the effects of dietetic indiscretions and excesses and indulgence in alcoholic beverages.

The author is of opinion that gout and rheumatism are much more intimately associated with urethritis than is ordinarily supposed. Either or both of these conditions may be a powerful factor in cases in which the exciting cause is undoubtedly specific infection. It is well to remember this, as it is quite often a very important guide in treatment. By taking this factor into consideration some hitherto rebellious cases may often be brought under control. It is certain that the rheumatic and gouty diatheses are of especial importance with relation to inflammation of the mucous membranes. It is not claimed that their importance is as great in the case of the lower portion of the genito-urinary tract, and especially of the urethra, as in the case of the throat, but in a general way it is well to remember that the same pathological principles that govern the relation of rheumatism to acute or chronic inflammation of all other mucous membranes apply to the study of urethral disease.

As is true of all organs of the body, excessive action is a predisposing cause of inflammation. In the case of the urethra sexual excesses and masturbation are the source of much mechanical disturbance, glandular hyperactivity with excessive secretion of mucus, and possibly slight traumatism, these various factors causing a catarrhal state of the mucous membrane that affords an excellent soil for microbial action and exaggerates the results of irritation of all kinds. The element of unrest is of far greater importance in the consideration of the predisposing causes of urethral inflammation than is usually accorded it. The majority of men do not seem to entertain the slightest idea of the possibility of overstrain of the sexual apparatus, and it is well for the practitioner to at least attempt the education of his patients in this particular direction.

By far the most important factor in the predisposing causes of simple urethritis is chronic disease of the genito-urinary tract, whatever its origin may have been. Most of the cases of simple urethritis are due to the effects of sexual, alcoholic, or dietetic excesses upon a urethra already damaged, and in which the products of microbial action, particularly the products of simple decomposition, are present. This must be remembered as bearing very pertinently upon cases of suspected gonorrhœa in which the virtue of one or both parties to the venereal act may be brought in question.

Exciting Causes.—1. Trauma; 2. Bacteria (non-specific); 3. Toxins; 4. Chemical irritation; 5. Sexual strain. It is unnecessary to expatiate upon traumatism as a factor in the production of urethritis. It should be remembered, however, that traumatism in a perfectly healthy and approximately aseptic urethra may be followed by little or no inflammation; often, indeed, by no phenomena that can be properly characterized as urethritis. In the presence, however, of some latent condition of disease—*i. e.* a chronic source of infection—traumatism bears a very important relation to the etiology of acute urethritis. A very pertinent illustration of the relation of traumatism to pre-existing conditions of infection of the urethra is found in the results of operations or instrumental manipulations of the canal in the presence of stricture or congested and granular patches on the urethral mucous membrane.

In considering the relation of bacterial infection to simple urethritis it is well to remember the fact that various forms of bacteria and their products are capable of producing irritation and inflammation of mucous membranes.

The pus-microbe or its derivatives, and possibly the ordinary germs of decomposition, may, *per se* or by virtue of their products, produce urethritis. The author will not discuss here the relation of the bacterium coli commune to inflammations of the genito-urinary tract. It is highly probable that the line of demarcation between the pus-microbe and the colon bacillus would be very difficult to demonstrate. A point worthy of consideration is that the secretions from disease of the urethra, originally of gonococcal origin, but from which all specific characters have disappeared (as in certain cases of chronic urethritis, folliculitis, and prostatitis and in certain inflammations of the female genito-urinary tract), are capable of producing inflammation of the male urethra. That the toxins evolved by microbial action may cause urethritis is almost, if not quite, certain. Any chemical irritant may produce urethritis, which may assume a severe type. The well-known experiment of Swediaur with aqua ammoniæ will be remembered in this connection.

In discussing the exciting causes of simple urethritis it is necessary to correct the fallacious notion that normal secretions in the female are capable of exciting urethritis in the male. It is nothing unusual for the apology to be offered that the affected man has had intercourse with a woman just before, after, or during the menstrual discharge. The inference that the menstrual discharge may produce urethritis is as old as the Bible, as will be noted by a perusal of the fifteenth chapter of Leviticus. The Jewish tradition that the female is unclean for a certain period following menstruation is probably based upon this common but erroneously applied observation. Menstrual fluid, unless decomposed or mixed with the products of bacterial evolution of one kind or another—whether the germs be autogenetic or heterogenetic is inconsequential—cannot possibly produce urethritis. Apparent contradictions are due either to the autogenesis of urethritis in a previously damaged urethra, or to the washing down of the products of an old infection from the upper portion of the female sexual tract by the outflowing menstrual secretion. The menstrual secretion has been accepted as an etiological factor in urethritis; the water-closet theory has been repudiated, but the author entertains the belief that the latter has at least a basis of probability, while the former is positively absurd.

The "strain" theory of the origin of urethritis is a very popular one, but is perhaps the most fallacious of all. It is probable that sexual excess alone is never productive of the disease. Sexual excess in the presence of a diseased urethra is, however, another matter, and under such conditions is a very important factor among the exciting causes of urethritis. As a predisposing factor, on the other hand, it is all-important.

Gonococcal or Specific Urethritis.—*Predisposing Causes.*—These are precisely the same as those enumerated for simple urethritis. It is well to give special consideration to alcoholic indulgence as a predisposing factor in specific urethritis. The promiscuous exposure to infection indulged in by the majority of men who patronize the class of females from which urethral disease is generally contracted is, as a rule, associated with the free use of stimulants. It is by no means unusual to meet with patients who are in the habit of regular sexual indulgence with prostitutes, but who escape infection excepting on such occasions when the exposure is accompanied or followed by a prolonged drinking-bout, such exposure being with the same class of females—and often indeed with the same individual—as during their intervals of sobriety.

Exciting Causes.—The author will not enter into a discussion of the

various arguments relative to the specificity of the gonococcus. It is sufficient to say that certain types of virulent urethritis are characterized by the presence of a germ of peculiar character—the gonococcus—and this microbe may be the cause or the effect of the disease. Whether it be the cause or effect, however, it has been conclusively shown that this microbe is capable of producing in a perfectly healthy mucous membrane an inflammation similar to that from which the secretion that contains it was originally derived.

Apropos of the method of contagion in gonorrhœa, it has seemed to the author that considerable illogical reasoning has been indulged in regarding the possibility of infection with gonorrhœa in an innocent manner. Syphilis *insontium* is well recognized, but whenever an individual presents himself with a gonorrhœa and gives a history of unknown or innocent source of infection, the practitioner treats the history with lofty disdain and a contempt born of profound knowledge of human nature, particularly as manifested in venereal diseases. The author unhesitatingly affirms that, other things being equal, gonorrhœa is more likely to be contracted innocently than is syphilis. The principal limitation of the application of this statement is the fact that the structures susceptible to gonorrhœa are of comparatively small area and not very readily accessible, whereas in the case of syphilis any abraded surface will serve as a port of entry for the germ-disease. Granted, however, the contact of the mucous membrane with gonorrhœal virus, infection very much more readily occurs than in the case of syphilis, the latter disease requiring an abrasion as one of the essential requisites for infection. Admitting that the gonorrhœa depends upon a very virulent germ, or even laying the germ-theory aside for the moment and accepting the broad proposition that gonorrhœa affords a secretion which is extremely virulent, it only remains to show that the facilities for the innocent conveyance of the disease are of daily occurrence in order to substantiate the proposition that gonorrhœa may possibly be contracted in a perfectly innocent manner.

The water-closet theory of the origin of gonorrhœa has received much ridicule, yet the author is inclined to the belief that if logic rather than ridicule be applied to the study of the question, the theory will not appear quite so absurd. It is a practical impossibility for an individual affected with gonorrhœa to use the public closets found in saloons and hotels without leaving more or less of the virulent discharge behind him. The meatus urinarius is dragged over the closet-seat in such a manner as inevitably to deposit more or less secretion, unless the patient be much more careful than the average man. The next individual who uses the same convenience will in the majority of instances, unless extremely painstaking, inevitably bring his meatus urinarius in contact with the infectious surface. Is it illogical to suppose that gonorrhœal infection may occasionally occur in this manner? We are entirely too prone to question the veracity of the patient. Ridicule is hardly a safe argument as applied to a question that can be reasoned upon quite as logically as can the subject of infection of any other kind. The author unhesitatingly affirms that this is important from a medico-legal standpoint. The man who goes upon the witness-stand and offers expert testimony to the effect that any individual might not possibly have contracted gonorrhœa in the innocent manner above described must certainly depart from the ordinary rules of logic, and, however profound his knowledge of bacterial infection in other directions, must necessarily manifest upon this question the densest ignorance of sound pathological and bacteriological principles. The same argument is pertinent, although perhaps not equally so, as applied to possible

innocent infection of the female. The author is well aware that this statement is likely to be received with derision, but, as already stated, ridicule upon a question so open to logical reasoning as the one under consideration is hardly worthy of respect. The possible medico-legal application of the author's opinion has received due consideration, but has by no means weakened the conviction above outlined.

Accepting the gonococcus as the most definite etiological factor that has thus far been determined in virulent urethritis, it becomes necessary to consider its characteristics. During the last quarter of a century several authors have claimed to have discovered the germ or organism upon which the disease depends, but none of their views have been generally accepted by the profession until recently. The most prominent aspirant to honors in the microscopical study of urethritis is Neisser of Breslau, who in 1879 asserted that he had discovered the specific microbe of gonorrhoea, which he termed the gonococcus. Numerous European bacteriologists published confirmatory reports regarding this micro-organism, and during the last few years many competent investigators have endorsed the views of Neisser. At the present time the profession has quite generally accepted the specificity of the gonococcus. The specific micro-organism is found in the pus-corpuscles. Its detection under the microscope was first made possible by certain complicated processes of staining. A little later the bacillus was found in the following rather simple manner: a drop of pus is spread into a thin layer by pressing between two glass slides, and allowed to dry in the air. A drop of solution of methyl-blue in anilin-water is now placed upon it for a moment and washed off with a stream from a wash-bottle. A few drops of Gram's iodo-iodide liquid is then poured on and allowed to remain for several minutes; this fixes the color of micro-organisms in general. Gram's liquid is now washed off, and, while the specimen is still wet, a cover-glass is placed upon it and it is examined with an oil-immersion lens. If micro-organisms resembling the gonococcus are found, they are tested by decolorization. The cover-glass is removed, and the specimen treated with absolute alcohol until the color is as completely removed as possible. The cover-glass is replaced and the specimen examined, when all the gonococci will be found to have disappeared; all other organisms will be distinctly visible.

The gonococcus, as described by Neisser, was developed from the pus-corpuscles by staining with methyl-violet and dahlia. It is located generally upon the surface of the pus-corpuscles; more rarely upon the surface of the epithelium. Sometimes it is incorporated with the corpuscle and replaces its nucleus, which disappears. The microbe is large and spherical when single; in some instances two of them unite together in a sort of biscuit shape. They are usually found in colonies of ten to twenty or more, surrounded by a species of mucous envelopment. For practical purposes the simpler methods of examination of suspected fluids are best. A drop of pus, placed upon a cover-glass, may be spread into a thin layer by placing another glass upon it and sliding the two apart. One of the glasses is then thoroughly dried by passing it rapidly through the flame of a spirit-lamp. The cover-glass is now dipped in a solution of methyl-blue, and the superfluous coloring matter washed off by a stream of cold water. It should now be mounted in Canada balsam.

Neisser has more recently laid especial stress upon the tendency of the gonococci to arrange themselves in pairs. This, he claims, distinguishes them from the urethrococci, which are found singly or in irregular clumps. He also says that the gonococci are found in or upon the pus-corpuscle, never outside of it. One important source of fallacy at once suggests itself. It is

by no means improbable that the urethrococcus may undergo modification by virtue of the existence of a virulent inflammatory process, as a consequence of which it tends to arrange itself somewhat differently and to invade the pus-corpuscles. This is certainly consistent with the evolutionary theory. Taken singly, the urethrococcus and gonococcus are identical in appearance. At present, however, the gonococcus is universally recognized as a diplococcus (Fig. 42).

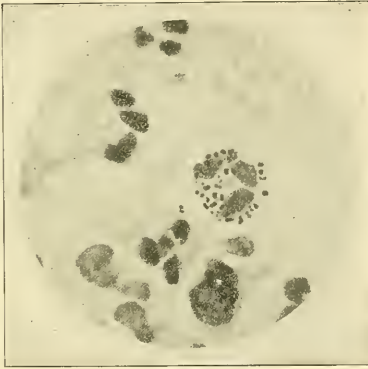


FIG. 42.—Gonococci.

Morbid Anatomy of Urethritis.—Inasmuch as the anatomical features of specific and simple urethritis differ in degree only, the morbid anatomy of the disease in general may be properly taken up at this point. The infection of urethritis is generally supposed to begin at the meatus. Milton has remarked the apparent contradiction of urethral chancre and chancroid as regards the site of inoculation. He believes that in such cases the virus is deposited at the lips of the meatus, and subsequently diffuses itself until it meets with a susceptible portion of mucous membrane. It is a question whether morbid secretions may not be drawn into the urethra during coition. The author believes that they may be. It would seem that a certain amount of aspiration is produced in the urethra during the venereal orgasm, sufficient at least to draw secretions from the vagina into the urethra. The alternate contraction and relaxation of the deep perineal muscles incidental to the efforts of the urethra to clear itself of semen during the venereal act must necessarily produce a more or less marked suction at the meatus. It is the author's impression that the inflammation often really begins in the fossa navicularis rather than at the meatus proper.

The extent to which the urethra is involved is variable. The inflammation is generally most marked in the anterior portion of the canal, but in the severe types almost always involves the entire canal down to the bulbo-membranous junction, and in many cases extends to the posterior urethra. The entire mucous membrane of the urethra from the meatus to the bladder may be infected. In the milder forms of urethritis the pathological changes consist in a few instances of slight hyperemia with attendant reddening and hypersecretion. In by far the majority of cases, however, there will be found

chronic changes in the canal produced by a previous attack of virulent urethritis. The pathological anatomy of simple acute urethritis and that of chronic urethritis are therefore usually identical. In simple urethritis with a chronic inflammatory foundation the localization of the chronic inflammation, with perhaps the formation of stricture or abraded, granular and congested patches, is due to several causes: (1) The most important is the relative inelasticity of the portion of the urethra involved. This produces friction during micturition, with consequent localization of the inflammation at the particular point affected. (2) Dilatation and severe inflammation of mucous follicles at one or more points in the canal. (3) Injury of the canal at different points, due to the introduction of instruments, the long-nozzled syringe being the most frequent cause. (4) The spontaneous or traumatic yielding of the corpus spongiosum in the course of chordee. (5) Slight thickening of the urethra due to previous traumatism. In cases in which posterior urethral infection—prostatitis—has occurred in the course of acute gonorrhoea more or less enlargement of the organ is found, together with a varying degree of interstitial thickening and chronic inflammation in the prostatic ducts and follicles.

In the severe forms of urethritis the principal change consists in intense hyperemia, with swelling of the mucous membrane. This is attended by a diminution in the caliber of the canal that may result in complete retention of urine. When the inflammation is at its height there exists an infiltration of the corpus spongiosum resulting in thickening and inelasticity of that structure. Late in the history of the case this plastic infiltration either disappears entirely or, as is very frequent, localizes itself at certain points. These points are usually the posterior portion of the fossa navicularis, the lacuna magna, and the bulbo-membranous junction. Other points in the pendulous urethra are frequently involved. It is in these situations that we are most likely to find stricture. The follicles of the urethra are found to be dilated and filled with purulent or muco-purulent secretion. Herpetic excoriations are occasionally seen. In view of the severity of the inflammation in some cases it is singular that true ulceration does not more often occur. It is, however, very rare. The epithelium lining the urethra will be found abraded here and there in all cases in which the inflammation is of a high grade. In some instances it is almost entirely removed throughout the extent of the canal. Superficial erosions of the mucous membrane result from abrasion of the epithelium. In chronic cases the pathological factors that are most important in explaining the persistency of the disease are stricture, congested and granular patches, enlargement of the lacuna magna, dilatation and inflammation of the glands of Littre and sinuses of Morgagni, and follicular prostatitis—*i. e.* so-called posterior urethritis.

The tendency to the formation of granulations in the urethra is especially marked in the bulbous region. This is worthy of note, as the recognition and treatment of this condition by means of the endoscope constitute the sole hope of cure in a certain number of cases of chronic urethritis.

Incubation of Urethritis.—It would seem that the period of incubation in urethritis is rather an indefinite quantity. This, however, is due to the many sources of confusion that exist. M. Leon le Fort in a study of over 2000 cases of gonorrhoea found that 50 developed within twenty-four hours, 778 within four days, 869 between the fourth and the eighth day, 276 from the eighth to the twelfth day, 112 from the twelfth to the sixteenth day, 17 from the sixteenth to the twentieth. The author does not accept these figures as accurate, but, after making due allowance for erroneous observation, the figures are still suggestive of the irregularity of the period of incubation.

It is the author's opinion that the period of incubation of true gonorrhœa can be accurately studied only in cases in which there has been no previous disease. In cases in which sexual excitement or irritating vaginal discharges develop primarily simple urethritis the gonococcal element may not appear at once. A discharge that comes on within twenty-four hours, therefore, may be simple, and yet in four or five days become of the gonococcal type.

Simple urethritis may develop at any time after exposure to its exciting causes, the length of time varying with the strength of the irritant and the susceptibility of the urethra, every urethra being a law unto itself. The gonococcal type supervenes upon the simple variety or occurs primarily on the average about the fourth or fifth day after exposure. The author was at one time inclined to repudiate the incubation period altogether, but has lately come to believe in its existence in gonococcal urethritis, due consideration being given to such sources of confusion as previous urethral disease and varied exposures to possible infection.

Symptoms of Urethritis.—The symptomatology of urethritis requires but little attention. Ricord was not far from right when he said, "Anybody can tell when a gonorrhœa begins, but God alone knows when it will end." Modern methods have modified this dictum of one of the masters slightly if at all.

The symptoms of simple urethritis consist of a slight or moderate urethral discharge of a muco-purulent character, with perhaps a greater or less degree of smarting on urination. The discharge develops, as a rule, shortly after venereal excesses or intemperance in gouty or rheumatic patients with damaged urethræ, or in those suffering from stricture with granular congested patches in the canal, independently of any special diathesis. It may occur in individuals possessing healthy but exceedingly sensitive urethræ as a result of contact with unhealthy and irritating vaginal secretions. It is to be remembered that the simple type of inflammation may at any time become very severe and virulent from—*first*, coincidental gonococcal infection; *second*, various sources of superadded irritation.

The symptoms of typical virulent urethritis are pronounced and characteristic. At the end of the period of incubation the patient experiences more or less itching at the meatus, with smarting on urination, and on examining himself he finds the meatus glued together with a clear, sticky deposit of mucus; during the next day an increased discharge is observed, accompanied with considerable heat and painful micturition. These symptoms gradually increase until about the fifth to the seventh day, at which time the disease reaches its maximum degree of severity. The inflammation now becomes stationary, the discharge at this time being thick, creamy, and of a greenish color, due to its mixture with degenerated blood-corpuscles. In some instances distinct hemorrhage occurs; slight hemorrhages from capillary rupture are by no means infrequent. The more virulent the case the more greenish and profuse the pus and the greater the liability to distinct hemorrhage. In some virulent cases, however, there is such a high degree of inflammation that the discharge is merely a thin, greasy, muco-sanious fluid; but as soon as the process begins to subside somewhat the discharge becomes thick, creamy, and purulent, but still of a greenish cast. It is during the stationary period of the disease that the patient is most apt to have chordee: this consists of a painful bending of the penis during erection, and is due to interstitial inflammation of, and plastic exudate into, the corpus spongiosum and the submucous connective tissue surrounding the urethra. The penis, it will be remembered, is composed of three segments, of which the two supe-

rior (the corpora cavernosa) are the main factors in erection. When the organ is erect the inflamed, infiltrated, and inelastic corpus spongiosum acts upon the body of the penis like the string of a bow and causes it to bend. The corpus spongiosum being highly sensitive, severe pain results from its own resistance to erection.

There is a popular opinion to the effect that breaking the chordee will cure the urethritis. This has probably arisen from the fact that more or less temporary benefit has been noticed from the depletion resulting from the accident, and also probably because the rupture has often occurred at a time when the disease should naturally have begun to subside. As a consequence of this popular impression, laymen who are fond of exhibiting their alleged knowledge of medicine and surgery, particularly with reference to venereal diseases, frequently advise their friends to have intercourse during the existence of a chordee or to otherwise attempt its rupture. The patient should be warned against this pernicious practice, and thoroughly impressed with the fact that such a course will in all probability result in severe hemorrhage, and inevitably in the worst form of organic stricture. Even when the mucous membrane alone is infiltrated, it becomes less elastic; consequently, when erection occurs, even without chordee, the patient experiences considerable pain. During erection slight traumatism of the mucous membrane may occur, which subsequently become the points of departure for organic stricture. It is an unfortunate circumstance that any disease or injury affecting the penis or urethra irritates and increases the heat of the parts, and as a result of reflex action produces frequent and violent erections.

During the time the disease is at its height there may be general constitutional disturbance, a severe urethritis often giving rise to considerable fever. Pain and heat about the parts, a sense of dragging along the spermatic cord, neuralgic pain in the testicles, and a backache resembling lumbago are very frequently observed.

After remaining stationary for perhaps six or seven days the inflammation begins to decline, all of the symptoms decreasing in intensity. In the majority of carefully treated cases the discharge ceases in from three to six weeks, with the result of complete recovery. Unfortunately, however, in quite a proportion of cases there is a tendency to chronicity in spite of the best of treatment: the discharge under such circumstances becomes thinner and more watery, and persists for an indefinite period. This condition, or rather symptom, is popularly termed gleet.

Complications of Urethritis.—In considering the complications of urethral inflammation, the author will endeavor to give the main practical points without attempting an exhaustive discussion of subjects the minutiae of which would require a very much greater amount of space than it is practicable to devote to them in a text-book. Bare allusion will be made to such complications as are taken up more exhaustively in other portions of this work. For the purpose of a systematic presentation of diseases of the urethra, however, brief allusion will be made to such complications, even at the risk of repetition of minor points appearing elsewhere.

In considering the complications of urethritis the author desires to advance the proposition that in by far the majority of cases such complications as arise are due, not to the intrinsic pathological tendencies of the disease *per se*, but to irrational general management, necessary or avoidable, or still more frequently to over-enthusiastic attempts to cure the disease. It has been the author's experience that the frequency of complications has been in direct proportion to the amount of energy expended in attempts at a cure of the

disease. Under management as rational as is practicable, with a method of treatment largely expectant in cases that are fully developed, the disease is not, upon the average, attended by many or severe complications. It is safe to assume that the danger of complications in urethritis is directly proportionate to the severity of the inflammation and the degree and frequency with which the canal is mechanically disturbed. An important factor in the production of complications is the amount of exercise indulged in by the patient. In reference to the etiology of the complications, it is to be remembered that the gonococcus is by no means the principal factor. Gonorrhœa is a typically mixed infection, and many of the most severe complications of urethritis are in no wise dependent upon the gonococcus, excepting in so far as the gonococcus may have been the original cause of the urethral inflammation.

The principal complications of urethritis are—(1) Severe chordee; (2) hemorrhage; (3) folliculitis; (4) periurethral phlegmon; (5) retention of urine from inflammatory or spasmodic stricture; (6) prostatitis; (7) cowperitis; (8) cystitis; (9) epididymitis and orchitis; (10) gonorrhœal rheumatism; (11) gonorrhœal ophthalmia; (12) gonorrhœal conjunctivitis; (13) bubo; (14) balanitis and balano-posthitis; (15) vegetations; and (16) lymphangitis.

Some of these various complications are worthy of special description, but an exhaustive presentation is not practicable in a work of this kind. A few general points regarding the most important of them are, however, essential.

Chordee.—Severe chordee and distinct hemorrhage are naturally associated, inasmuch as the latter depends upon traumatism inflicted in the former condition. Chordee develops when the inflammation is at its maximum intensity, at which time the plastic exudate is most marked. It gives rise to no inconvenience excepting during erection. The pain that it produces is therefore usually experienced at night. The penis during erection may be bent to one or the other side or twisted. The principal dangers of chordee are rupture and hemorrhage, with subsequent severe organic stricture or perhaps abscess.

Folliculitis.—Localized and severe inflammation of the mucous follicles of the urethra is likely to occur at any time during acute urethritis, and sometimes in the subacute and chronic types. The condition manifests itself by small, tender, spherical, or oval swellings, from the size of a small shot to that of a pea, along the floor of the canal, especially anteriorly. The condition is due to an infection of the urethral follicles and sinuses of Morgagni, resulting in the formation of small retention-cysts containing pus and mucus. They rarely lead to serious trouble, but usually discharge themselves into the urethra. They are likely, however, to be the source of recurrent urethral infection.

Periurethral Phlegmon.—This is a frequent complication of urethritis. It consists of an inflammation of the cellular tissue surrounding the urethra, and is due to—(1) Minute rupture of the mucous membrane, with resulting periurethral infection; (2) rupture of the inflamed and infected follicle, with a similar result; (3) infection conveyed to the cellular tissue by means of the lymphatics or by migration of pyogenic microbes; (4) rupture and extravasation of the dilated and ulcerated urethra behind the stricture. All of these inflammatory complications imply either extension by contiguity of stricture *viâ* the mucous ducts, or an abrasion of epithelium with resultant absorption of germ-products. Phlegmonous inflammation usually leads to suppuration, but cases occur in which resolution eventually takes place. The favorite seat of this complication is in the floor of the fossa navicularis.

Retention of Urine.—Retention of urine is essentially the same in its various phases as when arising from other causes. It depends on inflammatory swelling of the mucous and submucous tissues in conjunction with deep muscular spasm. This is the so-called congestive or inflammatory stricture, and may be precipitated by sexual or dietetic excesses or indiscretions.

Acute Prostatitis.—Prostatic inflammation is a frequent complication of urethritis, but its discussion does not properly belong here.

Cowperitis.—Inflammation of Cowper's glands occasionally occurs. It is due to simple extension of the inflammation to these glands, which lie upon either side of the urethra behind the bulb and between the layers of the triangular ligament. It is usually unilateral, but may involve both sides.

Symptoms.—The symptoms are pain, swelling, throbbing, and a feeling of tension in the perineum. Early examination detects a small sensitive tumor the size of a pea; later on the perineum becomes swollen, hard, and brawny, and it is impossible to outline the inflamed gland. Swelling, reddening, and edema of the scrotum may occur. There is likely to be considerable constitutional disturbance incidental to the close confinement of the inflammatory exudate within the triangular ligament. Suppuration usually occurs, but resolution occasionally takes place without it.

Gonorrheal Rheumatism.—Gonorrheal rheumatism is an important, although relatively infrequent, complication or sequela of gonorrhoea. The possibility of its occurrence is disputed by some, but the majority of authorities admit that some individuals, who are perhaps free from predisposition to ordinary rheumatic troubles, are attacked with severe pain and tenderness of one or several articulations, attended with more or less constitutional disturbance and synovial effusion, in the course of urethritis. In others the same process attacks various tendinous and ligamentous structures. Some patients are affected with this complication with every attack of urethritis. It rarely begins during the acute stage of the affection, being most likely to occur after the disease has become chronic. The writer has known it to occur, however, within three days after the onset of the disease. Few diseases have been the source of more controversy regarding their origin than has gonorrheal rheumatism, and as yet its pathology must be regarded as *sub judice*. It does not appear to arise as a consequence of varying atmospheric conditions, from over-exertion, nor, it is claimed, from any particular method of treatment of urethritis. The latter proposition, however, the author is inclined to question, from practical experience with the disease, especially in a case that recently came under observation, in which the rheumatic affection speedily followed successful abortive treatment. Its dependence upon purulent inflammation of the urethra is all that has so far been absolutely established, and it is by no means necessary that actual suppuration of the mucous membrane should be present in order to give rise to it. It is claimed that, inasmuch as it occurs independently of the ordinary predisposing and exciting causes of rheumatism, and is seen in only a small proportion of the subjects of urethritis, it must necessarily be the result of individual idiosyncrasy. There is probably much truth in this assertion.

The most generally accepted opinion in regard to the pathology of gonorrheal rheumatism is that it is a mild sort of pyemic infection, due to absorption of the products of purulent inflammation by the urethral mucous membrane. There is hardly a doubt of the correctness of this view; still, as might be supposed, it would be difficult to positively prove it. According to Neisser and others, the disease is due to secondary infection, the specific germ being said to have been found in the fluid of gonorrheal arthritic effu-

sions. It is almost certain that some poisonous material—toxine—elaborated by the virulent germ-infection of the urethral mucous membrane is absorbed into the circulation and conveyed to the joint-structures. In some individuals these tissues are extraordinarily sensitive, and as a consequence reaction occurs in the form of arthritic effusion. Whether the gonococcus or the toxins formed by the mixed infection be the exciting cause of the affection is open to question; the author inclines to the latter view. It is probable that pus-microbes are at the bottom of those exceptional cases in which suppuration occurs, and that certain elements in the surgical treatment of gonorrhœa are primarily responsible for the absorption of infectious materials. The destructive effect produced by strong injections and the rude introduction of instruments upon the epithelium covering the urethral mucous membrane has already been alluded to. When the mucous membrane is abraded or, as is often the case, almost entirely removed, it is obvious that absorption of organic poisons is greatly facilitated. Absorption probably does not occur very readily through the intact mucous membrane, even when it is severely inflamed. When once the epithelium is destroyed, however, it may easily occur. It is probable that the relative facility of absorption in certain individuals explains their susceptibility to gonorrhœal rheumatism and the escape of others who are more fortunate. The immunity from the disease enjoyed by women is an evidence of the correctness of this view, for the only possible explanation of the rarity of the disease in the female that can be offered is that the relatively tough vagina and endometrium, and not the urethra, are the seat of the gonorrhœal inflammation, and as a consequence absorption does not readily occur. It will be found that when it does occur in the female a typically virulent and acute vaginitis has existed and has extended into the urethra and bladder. The rheumatism does not usually follow primarily simple urethritis, and this shows that the severity of the gonorrhœa bears a certain causal relation to its arthritic complications.

There is a question in the mind of the author whether gonorrhœal rheumatism is always due to specific properties of the poison of virulent urethritis. The disease arises in cases in which, so far as can be learned by examination of the suspected party and from a microscopical study of the discharge, there is no reason to believe the origin of the disease to have been of a virulent character. Under such circumstances the severity of the purulent process may be as marked as though the origin of the disease were indubitably virulent infection.

It is probable that cachectic, strumous, gouty, and rheumatic patients have a more pronounced predisposition to the disease than persons who are perfectly healthy.

Symptoms.—The symptoms of the disease resemble those of rheumatic gout rather than the ordinary form of articular rheumatism. As a rule, the local evidences of the disease are not severe, and consequently the constitutional symptoms are comparatively mild, but this is not always true. The disease develops, as a rule, during the decreasing stage, and sometimes occurs during the second or third month. Some authorities claim that it occurs in from five or six to sixteen days, but in most of the cases observed by the author it has occurred later in the course of the disease. The explanation that suggests itself is that the inflammatory thickening of the urethra inhibits absorption from the surface of the mucous membrane, to a certain extent. Then, too, abrasion and removal of the epithelium are not so apt to occur within the first few days as later on, when the poisonous material has been in

contact with it for some time. The products of the purulent process are not so virulent in the first few days as later in the course of the disease.

There is usually neither diminution nor increase of the urethral discharge coincidentally with the development of the rheumatism; rarely it is lessened, most probably because the patient keeps quiet after the development of joint-complications, and this in itself is likely to benefit the urethritis. It is doubtful whether gonorrhœal rheumatism acts as a revulsive or derivative upon the inflammation of the urethra. It is said that when the rheumatism comes on late in the course of gonorrhœa there is liable to be an increased discharge for a few days. In this matter the *propter* and *post* are probably confounded: it is more likely that from some particular cause exacerbation of the urethritis occurs with a coincident rapid formation of its toxic products; the mucous membrane of the urethra being extensively abraded at this time, absorption readily occurs and produces arthritis or other rheumatic symptoms.

The location of gonorrhœal rheumatism varies in different individuals, and sometimes in the same patient in different attacks.

The structures involved, in the order of frequency, are—(1) Articulations; (2) the synovial thecæ of tendons and muscles; (3) synovial bursæ and the sheaths of nerves. Associated with the latter form we may meet with inflammation of the pericardium, the cerebral meninges, and the deeper structures of the eye. The author has seen several cases in which the eye alone was involved. A marked predilection is exhibited for the more important joints, the knee being perhaps most often affected. As a rule, the inflammation expends most of its violence upon one joint, although in perhaps the larger proportion of cases several joints are eventually affected.

Varieties.—Fournier presents a classification involving three distinct varieties of the disease, as follows:

1. Generally mono-articular inflammation, most often attacking the knee, occasionally the ankle or elbow. This form is really a passive hydrarthrosis with much effusion, characterized by very insidious development. Pain, tenderness, redness, heat, and constitutional disturbance are either absent or very moderate. Resolution takes place very gradually, and it is usually some months before recovery can be said to be complete; but even in these cases ankylosis may occur. In some instances the mono-articular form is excessively painful, is attended by marked constitutional disturbance, and tends to affect secondarily the bones entering into the formation of the articulation. The fluid in such cases is apt to contain more or less purulent material, strongly resembling that which is discharged from the urethra.

2. A variety not unlike articular rheumatism. This is accompanied by a moderate amount of local and constitutional reaction. Several of the joints are usually involved, and very often the tendons, various other fibrous structures, and the eye are implicated. The symptoms are not so severe as in acute rheumatism, and generally reaction is very mild as contrasted with the magnitude of the disturbances of the joints and other parts.

The disproportion between general and local symptoms is considered an important point in differential diagnosis. The involvement of the joints is usually consecutive, but there is none of the articular delitescence characteristic of acute rheumatism. Profuse sweating, acid urine, and excessive plasticity of the blood, which are so characteristic of inflammatory rheumatism, are usually absent in the gonorrhœal variety. The serous membranes, such as the pleura, endocardium, and pericardium, are not often attacked. A favorable result generally occurs, but chronic synovitis, strumous arthritis in certain subjects, joint-stiffness, and complete ankylosis are possible sequelæ.

Fournier claims that acute suppuration does not occur in gonorrhœal rheumatism; other authorities say that it is occasionally seen. The author believes that a joint may contain a moderate amount of purulent fluid, and still go on to a favorable issue without radical surgical interference, which is not apt to be the case with ordinary suppurative arthritis.

That suppurative arthritis may occur as a complication of gonorrhœa the author is convinced from experience.

3. (a) This form consists of indeterminate transitory pains in various joints without any local or general evidences of disease. In such cases there is apt to be an exacerbation of the pain, and perhaps a distinct involvement of the joint coincidentally with increase in the urethral inflammation. (b) Thecitis occurs; the synovial sheaths become swollen and somewhat tender, there being moderate redness along the affected tendon in some cases. Movement of the muscle attached to the tendon is very painful. The synovial bursæ may become involved; the one lying under the tendo Achillis and another beneath the inferior tuberosity of the os calcis are most usually implicated. Patients thus affected complain of pain and tenderness in the heel. This particular symptom is not unusual in the course of gonorrhœa. Myalgia, resembling the ordinary form, and perineuritis sometimes occur in the course of gonorrhœa, and seem to be attributable in certain instances to the same pathological condition that gives rise to ordinary gonorrhœal rheumatism. Pain in the back of a severe character, simulating acute lumbago, is very frequently seen: in the majority of instances this is due to over-stimulation of the kidneys by various balsamic preparations, sandal-wood being particularly apt to produce it. It does occur, however, in patients who have not taken such drugs. Whether reflex neuralgia would explain these cases is open to question.

Cases are occasionally seen in which gonorrhœal rheumatism limits itself to a single nerve. One of the author's patients has an attack of sciatica coincidentally with every attack of gonorrhœa. Attacks of simple urethritis are sufficient to bring it on in this case. The first attack of gonorrhœa that he experienced was attended by sciatica of a very severe character, both nerves being involved.

It is somewhat remarkable that authorities so universally concede the comparative painlessness of gonorrhœal rheumatic processes when, as a matter of fact, quite a liberal proportion of cases are attended by severe pain, and not infrequently by sweats quite as profuse as those that attend ordinary rheumatic fever. The tendency to sweating seems to be most marked at night, the only difference between the perspiration in these cases and that of ordinary rheumatism being the absence of acidity, its more prostrating character, and its greater profuseness.

Bubo.—Urethritis is occasionally complicated by bubo. As a rule, the glands enlarge but slightly and are only moderately tender. A moderate degree of tenderness in the groins, accompanied by little if any enlargement of the inguinal glands, is quite frequent in severe cases. The enlargement of the glands may increase until a pronounced inflammatory bubo develops. This is the variety of bubo formerly known as sympathetic. It is due in every instance to secondary lymphatic infection by pus-microbes. Suppuration is unusual, or, at least, pus rarely forms in sufficient quantity to produce a distinct abscess. It is the author's opinion, however, that in many cases in which a distinct bubo forms, but resolves without the formation of a clearly defined abscess, minute foci of suppuration exist throughout the gland-structure. This assertion is based upon a number of cases of this kind in which

the glands have been extirpated. The foci of suppuration are chiefly distributed in the periphery of the gland. When one or more of these foci rupture externally, periadenitis and perhaps abscess develop. Suppuration is most apt to occur in strumous, tuberculous, or otherwise cachectic subjects. Patients recently syphylized are also liable to pus-formation in the affected glands. Trauma or straining efforts in lifting, and over-exertion of any kind appear to have some influence in determining the occurrence of bubo.

Balanitis and Balano-posthitis.—Inflammation of the mucous membrane of the glans penis (balanitis) and the preputial reflexion (posthitis) are frequent complications of gonorrhœa. The two conditions are usually associated—balano-posthitis. These conditions are due to irritation produced by retained and decomposing secretions—usually beneath a tight and elongated prepuce—although this is not absolutely necessary.

Pus forms upon the inflamed surface, which becomes reddened, tender, and excoriated from maceration and removal of its epithelium. Ulcerations of an herpetic or chancreoidal character may be formed. It is the author's opinion that typical chancreoid may be developed *de novo* under a tight and inflamed prepuce. Bubo may result from the balanitis rather than from the gonorrhœa on which the latter depends.

Vegetations.—As a result of prolonged irritation, combined with some peculiar instability of local nutrition—or tropho-neurosis—some patients develop fungoid growths upon the mucous membrane of the glans and prepuce. These are composed of heaped-up epithelium, covering delicate, capillary vascular loops. They are very fragile, painless, and bleed readily. They resemble the vegetable fungi in that their development is favored by heat, moisture, darkness, and filth. They are not unlike a cauliflower in their physical appearance. When the conditions favoring their growth are perpetuated they sometimes attain an enormous size. They are especially likely to develop in women. They may undergo transformation into hyperplastic tumors, particularly in women. The term venereal vegetations oftentimes applied to these growths is a misnomer, as they are in no sense venereal, and may appear in patients who have never had venereal disease of any kind. The author is, however, inclined to the belief that syphilis is often a predisposing factor independently of its local phenomena.

Balano-posthitis is very favorable to the development of vegetations, and they are quite likely to develop in any case where the prepuce is long or constricted.

Lymphangitis.—Inflammation of the lymphatic vessels of the penis occasionally occurs in urethritis. The prepuce becomes swollen and edematous, and sometimes presents an appearance identical with erysipelas. Abscesses may form along the lymphatic vessels. Occasionally the inflammation is limited to a few lymphatic vessels, and does not involve the entire prepuce.

Lymphangitis is due to secondary and probably mixed infection, rather than to the germs of the urethral inflammation *per se*.

In cachectic subjects sloughing of the prepuce and denudation of the penis may occur.

Chronic induration—indurating edema—is an occasional result of lymphangitis. This is most likely to occur in syphylized patients.

Treatment of Urethritis.—The treatment of urethritis comprises a greater variety of methods and remedies than almost any disease that could be mentioned. This fact is in itself strong circumstantial evidence of the self-limited and, as far as specific medication is concerned, incurable character of the disease. Manifold as are the panaceas and specifics for urethritis,

the fact remains that no system of treatment has materially diminished the average duration and severity of the disease, excepting those measures based upon the principle of its self-limitation and an appreciation of the inadvisability and impracticability of attempts to jugulate it. Such measures of treatment have accomplished much; panaceas, nothing but injury on the average. There is scarcely a physician in practice, and probably not a man about town, but claims to have a remedy which is a specific for the "clap," the different remedies varying in position and legitimacy from the fallacious and dangerous patent injections to the more modern application of the bichloride of mercury by the retro-injection method. The author discredits the statements of those surgeons who claim to cure cases of virulent urethritis in a week or ten days, or perhaps less, quite as much as the statements of the veteran "rounder" who has a little preparation that "knocks it in three days." It is not to be believed that by any special system of medication a virulent urethritis is ever cured in any such time. The author has hunted down all the wonderful specifics that have ever been called to his attention, and has tried them all faithfully, but has not yet succeeded in finding a remedy that produces the wonderful results claimed by some surgeons and by quite a proportion of patients. Mr. Milton has well illustrated the fallaciousness of gonorrhœal specifics in a list, taken from various sources, that comprises several hundred infallible remedies, all of which have been tried and found wanting.

Driving a gonorrhœa to a cure is bad as well as unsuccessful practice in general, and much harm may come of it, the best results being apt to follow mild and persistent treatment and the acceptance of the inevitable for several weeks. There is but one substitute for this line of treatment, and that involves absolute rest. If a remedy is ever discovered that will cure every case, even in from three to six weeks, the event will be hailed as a surgical millennium. The author would be very well satisfied if a remedy could be found that would invariably cure gonorrhœa in six weeks or so, meanwhile permitting the patient to go about his business. No matter what system of treatment may be followed, a better average result than this is apparently not to be hoped for in virulent urethritis. If, however, the surgeon includes his cases of the milder forms of urethritis in his statistics, he may achieve in a large proportion of instances the wonderful results claimed by many; and this remark is particularly pertinent when we consider the fact that the average surgeon must necessarily treat at least half a dozen cases of simple urethritis for every virulent case that comes under his observation. It will be found that, with due regard to the self-limitation of the disease and the intolerance of the urethra for harsh measures of treatment, fewer cases of chronic urethritis will be seen and fewer strictures and other sequelæ will result than with those systems of treatment that are said to cure within a few days. There are, to be sure, cases that are likely to disturb our faith in this method of management. How often we hear of some self-satisfied voluptuary who some years ago had a gonorrhœa that proved obstinate to the best professional skill for months and months, but who finally recovered, and now has a prescription that has cured him of from half a dozen to twenty attacks of urethritis! The surgeon should not let such cases lessen his confidence in his own professional ability, for these men are constantly deluding themselves. The only virulent urethritis that the patient under consideration ever had was the first attack, from contagion, the subsequent attacks being bastard clap founded upon the damage done by the old-time gonorrhœa. Sooner or later a second attack of virulent urethritis, or perhaps a mild case

with a tendency to chronicity, is experienced by such patients, and not only explodes their faith in the erstwhile panacea, but gives no end of trouble, and necessitates for its cure surgical measures adapted to the removal of the cause of those numerous attacks that the alleged specific so readily subdued.

Notwithstanding what has been said regarding the parasitic or microbial origin of virulent urethritis, the author fails to see any astounding results in the way of improved methods of treatment; not that this is in any sense an argument against the microbial character of the disease, but it certainly signifies its self-limitation. The investigations of bacteriologists who unhesitatingly accept the gonococcus of Neisser have shown that the germ of the disease infects the entire thickness of the mucous membrane and the sub-mucous cellular tissue so completely that repair cannot take place in well-pronounced cases until the layers of affected cells have been replaced by new and insusceptible connective-tissue cells from beneath (see Plate 2, Fig. 1). This condition of affairs proves positively that nothing short of caustic applications capable of destroying the entire thickness of the mucous membrane can by any possibility abort a virulent urethritis when once it is thoroughly established. As a corollary, it is obvious that attempts at the abortion of a virulent urethritis should be made only in the very incipency of the disease—before, in fact, it is possible to determine whether or not we have to deal with a simple or virulent case of inflammation; for, inasmuch as the different grades of urethritis often begin in precisely the same manner, it is impossible to tell for a few hours or perhaps several days, without the microscope, whether or not we have to do with a virulent type of the affection or with the simpler and more curable variety. Any form of treatment the efficacy of which is supposed to depend upon the action of antiseptics on the specific germs of the disease must, in order to shorten the duration of the affection, be applied within a few hours of its inception. The disease can be aborted, if the term abortion is proper as applied to something which does not already exist, but the germs begin to produce irritation of the epithelium of the urethral mucous membrane very soon after their introduction into the canal, and if the germs be destroyed *in loco*, the disease not having yet fairly begun, it may be said to have been prevented rather than aborted.

In concluding the general consideration of the treatment of urethritis the author takes occasion to impress upon the practitioner the fact that urethral inflammation is very rarely treated upon sound and rational therapeutic principles. Our patients expect more from us, and we expect more from our remedies, than in almost any other disease that could be mentioned. The prevalent notion of the simplicity of gonorrhœa and its congeners has proven very disastrous, not only to the laity, but to the over-confident physician. The practitioner should never lose an opportunity to impress upon the mind of the patient the undoubted fact, as supported by clinical observation and laboratory investigation, that gonorrhœa is one of the most severe and perhaps the most far reaching in its results of all the infectious diseases. It is not only worse than a bad cold, contrary to the lay opinions upon the subject, but it is far worse than its much-dreaded rival for venereal popularity,—syphilis.

Abortive Treatment.—The abortive method of treatment has been generally understood to imply the substitution of a simple for a specific inflammation. This practice is a relic of bygone days, which has impelled surgeons of excellent reputation, and undoubted wisdom in other directions, to rub the pure crayon of nitrate of silver in eyes affected by virulent conjunctivitis. It is even possible that there are surgeons at the present time who advocate

PLATE 2.

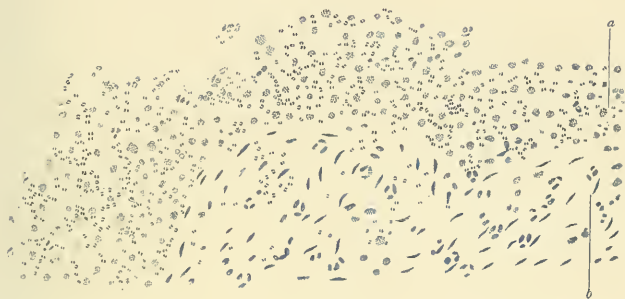


FIG. 1.—Anatomy of acute urethritis: *a*, epithelium infiltrated with pus-cells and gonococci; *b*, pus-cells and gonococci in the connective tissue (Finger).

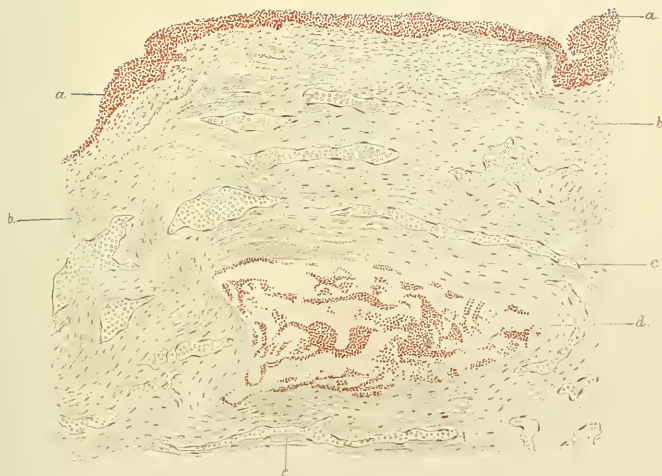


FIG. 2.—Beginning stricture: *a*, many-layered plate epithelium; *b*, shrunken connective tissue; *c*, narrowed cavities of the corpus cavernosum; *d*, remains of a Littre gland, destroyed by periglandular and shrunken connective tissue (Finger).

this method of treatment for this particular disease. During the author's term of service as hospital interne he saw pure nitrate of silver applied on several occasions, and in every instance it was followed, not by the substitution of a simple for a specific inflammation, but by complete destruction of the eye as far as its visual capacity was concerned. The author remembers asking one of the hospital staff who applied this method of treatment in a case of virulent ophthalmia, under the advice of a prominent specialist, how he knew which had destroyed the sight, the disease or the treatment. He replied that it was impossible to say positively, but that it must be the disease, because "they all went that way, anyhow." Arguments are useless as opposed to such logic as this, but it is hoped that it is unnecessary to protest against such pernicious doctrines as applied to the treatment of urethritis.

The abortive method of treatment as applied to urethritis should properly imply, not the fossilized and fallacious idea of the substitution of one type of inflammation for another, but (1) the removal as far as may be of the virulent germs that have been deposited upon the surface of the mucous membrane, and which, although they have begun to manifest their presence by slight irritation of the meatus or just within it, have not yet deeply penetrated into the substance of the mucous membrane and infected the subjacent cells; and (2) the neutralization or destruction of the germs and their products by means of antiseptics or germicides, which in this instance imply all chemical substances capable of destroying or inhibiting the activity of the germs of urethritis without destroying the mucous membrane.

These requirements are the more readily fulfilled because the disease begins at the meatus or, at most, in the fossa navicularis, and gradually affects contiguous areas of mucous membrane. The substance most generally used in the abortive method of treatment is nitrate of silver. This may be used in two ways: (1) By the injection of a mild solution at frequent intervals; (2) by means of a single injection of a comparatively strong solution. If properly done and at an appropriate period in the incipency of the disease, either one of these methods is usually safe and is not likely to result in stricture—the principal danger of the abortive method. A solution of nitrate of silver, fifteen grains to the ounce, may be thrown into the canal by means of a small drop syringe, which is passed into the urethra for about 2 inches, the fluid being ejected as the syringe is slowly withdrawn. It is held in the urethra for a few seconds, and a weak solution of sodium chloride or bicarbonate is then thrown into the canal, the patient being instructed to urinate immediately thereafter. If this be carefully done when slight discharge and itching at the meatus are first observed, the method is likely to prove successful and is devoid of danger. In lieu of the strong preparation a solution of one-half grain of nitrate of silver to the ounce of water may be used every two hours for twenty-four hours or less, the treatment being stopped as soon as pronounced smarting during micturition develops.

That nitrate of silver is efficacious in destroying the germs of virulent inflammation is shown by the excellent results obtained by Credé in the prophylaxis of ophthalmia neonatorum by the instillation into the eyes of the new-born infant of a 2 per cent. solution. While the use of the nitrate of silver in careless hands is dangerous, the author is satisfied that, if properly used, its dangers are greatly exaggerated. Injections in a strength of thirty grains to the ounce may often be used in chronic urethritis with the best possible results. Such injections, however, should only be given by the deep syringe.

The method that the author prefers for the abortion of urethritis is the

prolonged and systematic irrigation of the anterior urethra with a solution of permanganate of potassium in a strength of from 1 in 10,000 to 1 in 5000. This should be used as warm as can be comfortably borne by the patient, and kept up for one-half or three-quarters of an hour at a time, the process being repeated twice daily for three or four days, after which time the treatment should be given once daily for two or three weeks. Care should be taken not to use the water too hot, as destruction of the urethral epithelium may easily be produced: this is a point too often forgotten. The patient may occasionally receive benefit from this same treatment if self-administered by

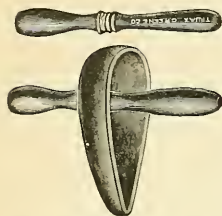


FIG. 43.—Short nozzle for urethral irrigation.

means of the ordinary penis syringe, although irrigation viâ the short nozzle at the hands of the surgeon is best. Long nozzles for irrigation should not be used. The author has found a short nozzle of his own device (Fig. 43) to be the most satisfactory of all the irrigating appliances that he has used. The irrigation should be made by means of the ordinary fountain syringe, care being taken not to have the elevation of the douche-bag too great, as injurious pressure upon the urethral walls may be thereby produced. During the continuation of this treatment the patient should be placed upon the usual internal treatment with alkalis, and suitable restrictions regarding diet and exercise should be imposed. It is sometimes advantageous to combine the internal administration of oil of sandalwood with the irrigation method. The author would especially enjoin caution in the matter of too speedy cessation of treatment. As a rule, no discharge will be noticeable after the first twelve or twenty-four hours; hence it is very often difficult to convince patients of the necessity of several weeks' careful treatment. Experience shows, however, that unless prolonged treatment be instituted the development of the disease will be simply retarded, not aborted.

Where it is impossible for the patient to submit to frequent irrigations of the urethra the permanganate of potassium may be used by means of ordinary urethral injections. The patient can tolerate much stronger solutions with this method of administration than where irrigation is employed. It is well to begin with a solution of 1 in 5000, the patient being instructed to use it every two hours in copious quantity, the treatment concluding by filling the urethra full of the solution and holding it in the canal for ten or fifteen minutes. The strength of the permanganate solution can be increased up to 1 in 2000.

Rational or Methodical Treatment.—General Management.—The rational method of treatment is of necessity the one that we are most often called upon to prescribe, for the reason that, as a rule, the patient rarely seeks advice until urethritis is well established.

The term "rational" is used in contradistinction to the expectant method of Fournier, Diday, and others, which consists chiefly in the administration of placebos.

In cases of simple urethritis mild measures of treatment may be directly curative, which cannot be said of the virulent type of the disease. Attention to genito-urinary hygiene, regulation of the diet, the administration of mild laxatives, and the use of weak astringent injections usually suffice for the cure of the milder cases within a few days; at least such measures check the discharge. From what has been said of the causes of the simple forms of

inflammation of the urethra, it is obvious that in the majority of instances surgical treatment is necessary for a complete cure, either in conjunction with medical treatment or following the cessation of the urethral discharge. Thus dilatation or cutting operations are required for stricture; the contracted meatus must be cut, and congested and granular patches must be stimulated to repair by means of applications through the endoscope, or other measures applicable to the treatment of certain forms of chronic gleet must be instituted.

So intimately connected are simple urethritis and chronic pathological conditions of the canal that it is unnecessary to discuss further at this point the treatment of what must obviously be in the majority of instances merely a symptom.

The most important principle in the management of severe urethritis is the maintenance of physical and sexual rest. It is an unfortunate circumstance that individuals with gonorrhœa labor under the fatuous idea that the disease is in itself not a serious one, and it is consequently difficult, indeed it is impossible in the majority of cases, to induce them to take complete rest. They wish to be cured promptly, but upon entirely different principles from those that govern the management of other acute inflammatory affections. A man with a sharp attack of urethritis is certainly very sick, yet how seldom can he be induced to take to his bed and be treated upon the same rational principles that are carried out in other inflammations! A man with a fractured limb is of necessity compelled to rest, and, independently of the mechanical obstacle to movement, it is not difficult to convince him that absolute quiet is necessary for cure. There is little or no danger in a simple fracture, yet the patient is perfectly tractable. There is great danger, usually, in cases of virulent urethritis, yet it is seldom possible to convince the patient that quiet is necessary. A moment's reflection will convince the practical clinician of the truth of the assertion that there are few diseases indeed which are characterized by so many and such severe pathological possibilities as is that under consideration.

It needs but a casual survey of the morbid possibilities of urethritis to convince one that it is a serious affection. It is an undeniable fact that gonorrhœa is the most dangerous of the venereal diseases, for through the medium of its sequelæ and complications the disease is the cause of more deaths than can be justly attributed to the direct or indirect influence of syphilis. By comparison, chancroid is essentially a benign disease. Subtract the evil effects of gonorrhœa from the list of human ills, and the resulting increase in the longevity and happiness of the race would be something marvellous.

It is the author's belief that every patient with a severe urethritis should be confined to his bed for from one to two weeks or more, and that, if this could be accomplished, the majority of cases would not only be subdued within two or three weeks, but stricture and other complications and sequelæ would be almost unheard of, providing the medical and surgical treatment adopted in conjunction with rest were not in itself productive of injury. In the comparatively few instances in which the author has been able to carry out this plan the results have invariably substantiated this opinion. Sexual rest is a positive necessity, and it is hardly necessary to state that this implies both mental and physical sexual repose. The mind must be kept free from sexual impressions and ideas of all kinds.

Second only in importance to rest is attention to diet. A restricted regimen is necessary, not only because of its beneficial effects from an antiphlogistic standpoint, but for the purpose of limiting the waste products excreted by the urine. It is upon the amount and character of these waste products

that the irritating properties of the urine depend, and there is nothing so efficacious in diminishing its acidity as attention to diet, the ideal regimen being bread and milk. Stimulants, such as alcoholics of all kinds, tea, and coffee, should be interdicted. The more closely a vegetable diet is adhered to the better, providing a bread-and-milk regimen be not acceptable. Asparagus and tomatoes, however, are to be avoided.

It is not considered necessary by the majority of surgeons to restrict the patient in the manner of indulgence in tobacco. Chewing is probably not injurious, but this cannot be said of smoking. Practical observation shows that smoking, unless in extreme moderation, is decidedly inimical to the cure of inflammatory troubles of the genito-urinary tract. It is well, therefore, to prohibit it as a matter of routine. Tobacco in excess certainly makes the nervous system irritable and tends to promote sexual excitability. The evil influence of smoking upon the mucous membranes is probably not limited to those of the nose and throat, but also extends to all the mucous tracts of the body through the constitutional effects of the weed.

The alkaline mineral waters should be given for the purpose of diluting and increasing the bulk of the urine. To these mineral waters may be added potassium citrate, acetate, or bicarbonate, with the object of still further lessening the irritating properties of the urine by neutralizing its acidity. Profuse diuresis, providing the urine is bland and non-irritating, is highly desirable, for the urethra is like an infected wound in a certain sense, and requires frequent irrigation for the purpose of cleansing the infected surfaces.

Cleanliness is absolutely essential, and individuals with a long prepuce should be particularly cautioned to cleanse the parts beneath it thoroughly, and, if possible, to retract it and bathe the glans several times daily, to prevent balanitis and further cultivation of the products of virulent inflammation.

Some attention is necessary to the dressing of the penis. One of the most pernicious practices that can be adopted is to bind absorbent cotton or other material over the meatus—a plan that is frequently followed by patients with a long prepuce, in the orifice of which absorbent cotton or lint can be packed with great facility. Common sense should teach the surgeon that, inasmuch as the inflammation of the urethra is due to the inoculation of successive areas of the mucous membrane with the virulent products of inflammation, the process extending gradually from the anterior to the deeper portions of the urethra, any dressing which dams back the discharge must necessarily feed the pathological process and enhance the danger of its extension into the deeper portions of the canal. Improper dressing is frequently the cause of serious complications. A very simple plan is for the patient to roll the shirt up in front out of harm's way and to pin upon the tail of that garment a soft white handkerchief or napkin, which is drawn through beneath the perineum and up over the penis in such a manner that one corner of the napkin may be tucked down each leg of the trousers, with numerous folds of the soft cloth resting in the crotch of that garment in such a way that the penis rests therein, the meatus at the same time being unobstructed. Another very excellent plan is to pin the toe of a stocking upon the drawers in such a manner that the penis may hang therein, without the meatus coming in contact with the improvised bag. In the bottom of this receptacle a little absorbent cotton may be placed and frequently changed. There are several cloth gonorrhoea-bags upon the market that answer the same purpose. The penis should never be dressed and allowed to remain in the upright position. By attention to these little details cleanliness may be secured, and at the same

time free drainage of the affected membrane facilitated. Rubber protectives should never be used.

Inasmuch as it is impossible for us to abort the inflammation when it has already frankly begun, it is obvious that we must content ourselves with a not too officious management of the case until the normal process of repair begins.

One of the best measures for facilitating resolution of inflammation is the application of heat, and it is nowhere more efficacious, if properly applied, than in inflammations about the sexual apparatus. It will be found that heat applied by means of the sitz-bath of from a half to one hour's duration several times daily will materially assist in the successful management of urethritis, particularly if there exists any irritation about the prostate or neck of the bladder. When the patient will consent to keep perfectly quiet, it is the most valuable auxiliary method of treatment at our command. The value of the hot sitz-bath has been questioned, but the author is convinced of its efficacy.

In lieu of the general application of heat by means of the bath, prolonged soaking of the penis in hot water will be found to be beneficial. When urination is very painful, relief may be obtained by passing the urine while the organ is immersed in a vessel of hot water. The use of remedies, both internal and local, should be guided not only by a knowledge of the natural course of the disease, but by the conditions present at various stages of the affection in each individual patient. It would be absurd as well as pernicious to treat a case complicated in the stationary stage by inflammation of the bladder or prostate in the routine fashion prescribed for the average uncomplicated case at the same period of the disease.

Internal Medication.—The range of application of internal medicaments in acute urethritis is not very extensive, the so-called specific remedies being especially limited in number. During the increasing stage of the disease there is sometimes considerable fever, and the tincture of aconite or veratrum viride will be found to be useful. The author believes that these remedies are not used sufficiently often.

Alkaline diluents should be given throughout the course of the disease, either alone or in combination with other drugs. The fluid extract of pichi (*Fabiana imbricata*) appears to have an excellent effect in lessening the irritating properties of the urine and soothing the inflamed mucous membrane. Combinations of buchu, slippery elm, uva ursi, linseed, etc. are all beneficial, especially if given in infusions, their action in this disease being essentially the same as in inflammation of the bladder. The ergot of rye and the ergot of corn (*Ustilago maidis*) have been recommended as exerting a specific effect upon the disease. In the early stages of the affection ergot does not seem to be of any particular service, and, moreover, is very disagreeable to take. In the later stages of the affection, however, it undoubtedly exerts an astringent influence upon the inflamed surface, and may be given in quite liberal doses, with marked benefit in some cases.

The fluid extract of corn silk (*Stigmata maidis*), in doses of one dram every two or three hours, has been highly recommended in the treatment of the acute stage of gonorrhœa. The author has failed to notice any special benefit derived from this remedy in acute gonorrhœa. It has, however, seemed to be beneficial in some cases of catarrhal gleet.

It is desirable to administer some anaphrodisiac during the height of the disease for the purpose of allaying sexual excitement and producing a direct sedative influence upon the inflamed part. A dose of twenty to sixty grains

of potassium bromide at bed-time has usually the desired effect. If a more powerful effect is desired, the following mixture will be found serviceable :

R. Fl. ext. ergotæ,	℥xv ;
Tr. gelsemii,	℥v ;
Potassii bromidi,	gr. xx ;
Tr. hyoscyami,	℥xxx ;
Syr. aurantii,	q. s. ad ʒss.—M.
Sig. At bed-time.	

The following is also serviceable :

R. Chloralis hyd.,	gr. v ;
Tr. aconiti rad.,	℥iij ;
Sodii bromidi,	gr. xv ;
Aq. camphoræ,	q. s. ad ʒss.—M.
Sig. At bed-time.	

Either of these combinations will usually allay sexual excitability and prevent or relieve severe chordee. It may be necessary, however, in some cases in which erections are painful and troublesome to administer an opiate. Opium has a certain degree of stimulating effect upon the sexual organs that rather detracts from its efficacy as an anodyne in these cases. This objectionable feature may be avoided by combining the deodorized tincture of opium in moderate doses with either chloral or potassium bromide. Where these various remedies prove unsuccessful the cold-water coil will invariably afford relief, and has in addition a decidedly beneficial effect upon the inflammation. If the patient sleeps on a hard bed, with a knotted towel applied about his waist in such a manner that he cannot comfortably lie upon his back, painful erections are not so apt to occur.

Morphine is sometimes necessary, and is best given by suppository, alone or in the following useful combination :

R. Morph. sulph.,	gr. $\frac{1}{2}$;
Ext. hyoscyami,	gr. $\frac{1}{2}$;
Camphor. monobromidi,	gr. v.—M.
Ft. suppos. No. 1.	
Sig. At bed-time.	

The remedies most relied upon in the treatment of gonorrhœa are the various balsamic preparations. These should not usually be given during the increasing stage of the disease, and it would seem that more benefit is to be derived from them when they are not used early. There is, perhaps, no objection to the administration of oil of sandalwood in the increasing stage ; cubebs and copaiba, however, are more stimulating, and consequently inadvisable at this time. Sandalwood oil is best administered in the form of capsules containing from ten to fifteen minims. Of these from four to ten may be given daily. In lieu of the capsules the pure oil may be given in doses of ten to fifteen drops upon a lump of sugar, this dose being repeated four or five times daily. The limit of tolerance is usually indicated by stomachic disturbance or quite frequently by pain in the back resembling lumbago, this being probably nephralgia dependent upon over-stimulation and consequent irritation of the kidneys. Sandalwood is much more likely

to produce this result than are copaiba and cubeb. During the stationary and declining stages copaiba and cubeb may be given alone or in combination. Of these two drugs, cubeb is most stimulating to the mucous membrane of the urethra, but least irritating to the stomach. Copaiba occasionally exerts an unpleasant effect in the form of an efflorescence or rash upon the skin, which is sometimes so pronounced as to simulate measles. The cause of this action of copaiba is not known. It would appear, however, that the eruption is produced through the medium of idiosyncrasy, an impression being made by the drug upon the sympathetic nervous system analogous to that produced in some individuals by the ingestion of shellfish, over-ripe tomatoes, etc. Quinine and several other drugs have been observed to produce a similar reaction of the skin, probably in the same way. It is possible that defective renal elimination and vicarious skin action have something to do with these cases.

Cubeb and copaiba may be given in doses of ten to twenty drops of the oil four or five times daily, either in capsules or in the form of an emulsion. The author prefers the emulsion where the patient does not object to its taste. The doses of the balsams may be increased to the limit of tolerance, but it is wise not to give them too liberally until the disease begins to decline. There are no better combinations in the way of balsamic emulsions than the following:

R. Liq. potassii,	ʒj;
Bals. copaibæ,	ʒj;
Ol. gaultheriæ,	℥x;
Ext. glycyrrhizæ fl.,	ʒss;
Saccharin.,	q. s.;
Muc. acaciæ,	q. s. ad ʒiv.

Sig. A teaspoonful every two or three hours.

R. Ol. cinnamomi,	℥x;
Ol. cubebæ,	
Sp. æther. nit.,	āā. ʒss;
Muc. acaciæ,	q. s. ad ʒvij.—M.

Sig. A tablespoonful three or four times daily.

Cubeb may be given in powder in doses of one drachm two or three times daily. This method of administration sometimes agrees with the stomach very much better than either the emulsion or capsule. The formulæ given are more or less illustrative, and may be varied according to the judgment of the practitioner. Vidal advocates the use of gurjun balsam in doses of two grams before each meal. Dr. R. W. Taylor speaks favorably of the tincture of cannabis sativa in doses of ten to fifteen drops in water three or four times daily.

In the later stages of gonorrhœa, in which there is a tendency to chronicity, turpentine is occasionally of value, the white or Canada turpentine being the best variety. The author has obtained benefit in some cases from the administration of the following:

R. Terebinth. alb.,	ʒj;
Res. podoph.,	gr. ss;
Camphor. monobromidi,	ʒj.—M.
Ft. pil. No. 30.	

Sig. One pill four times a day.

In some instances in which the patient is debilitated the addition of iron to the balsamic preparations is advisable for its tonic and astringent effect. Matico and other vegetable preparations containing tannin are recommended for internal administration, but the author has failed to note any benefit from these drugs, with the possible exception of *hydrastis canadensis*, which has seemed to be of service in some cases of chronic urethritis.

The beneficial effect of the balsams when administered internally is rather peculiar, inasmuch as when locally applied by means of injections they have apparently no action whatever. It would appear that in their passage through the digestive tract and circulation they undergo some chemical change by virtue of which they exert a special soothing effect upon the inflamed mucous membrane. That they exert any specific (microbicidal) influence over the poison of virulent urethritis is highly improbable. Their effect is certainly not constitutional, as they are of absolutely no service in gonorrhœa in the female unless the urethra is involved.

The local use of copaiba in its natural state does not seem to be beneficial. As a matter of curiosity, however, it may be mentioned that it has been recommended for local use in vaginitis. M. Baratier¹ recommends the use of copaiba in the form of vaginal suppositories for gonorrhœa in the female, these suppositories containing also the extract of opium. Inasmuch as this drug is said to cure "in about twenty days," it is hardly necessary to comment upon it as a means of specific medication, for certainly a remedy which will not bring about a cure in less time than this can hardly be said to be very efficacious as a specific.

Raquin of Paris has prepared a solution termed by him copaibate of soda, which is said to be useful as an injection as well as internally. Salol and eucalyptus in combination are often very serviceable for internal administration in urethritis. Salol should be given in doses of from ten to twenty grains three or four times a day, the eucalyptus being administered in combination with it in doses of ten minims. The benzoate of soda often acts better than other preparations of the alkalies.

Aperient medicines are beneficial throughout the course of urethritis, particularly during the acute stage. The saline laxatives are especially beneficial, the various natural mineral waters, notably the Apenta water, being the best of these. The Carlsbad salts are also of service. It should be remarked in this connection that constipation is invariably attended with more or less congestion of the prostate and urethra, and its correction is therefore desirable. Bruising of the prostate during a difficult stool may constitute the point of departure for prostatic complications in the course of acute urethritis.

Naphthol is a remedy recently recommended in urethritis. This agent is claimed to act by becoming decomposed and thereby converted into some modification of phenol (or carbolic acid), which, coming in contact with the mucous membrane of the genito-urinary tract, is supposed to destroy the germs of the disease. It has been given in doses of from two or three to fifteen grains several times daily; it would appear to be indicated in chronic vesical inflammations rather than in urethral troubles, inasmuch as it probably makes the urine less putrescible. It is apt to disturb the stomach, and, as the process in gonorrhœa is an active mixed infection rather than a septic process, the writer cannot appreciate its advantages over some other drugs.

Local Medication.—Local medication in acute urethritis is best accomplished by means of injections.

¹ *Thèse de Paris.*

A great deal of discussion has been evoked regarding the advisability of the injection method of treatment in gonorrhœa. There is a deep-grounded—and in many instances, it must be confessed, justifiable—prejudice against its use entertained by the laity, and incidentally by some surgeons. It is supposed by many that the injection method is usually responsible for stricture and other untoward complications and sequæ of urethritis. While this prejudice is undoubtedly founded upon a substantial basis in some instances, the author ventures to assert that it is the abuse, and not the use, of injections that is responsible for their unpleasant results. Injections of simple water, if improperly used, may produce injury, and it is certainly true that strong astringent or antiseptic drugs will, as a rule, produce unpleasant results. Any injection of a strength sufficient to produce severe pain is probably strong enough to destroy the already partially devitalized epithelium upon the surface of the mucous membrane, and as a consequence there must necessarily occur at various points localization and intensification of the inflammatory process. Given at the proper time and in the proper manner and strength, injections are not only harmless, but very beneficial, and really prophylactic of stricture and other complications by limiting the severity and duration of the inflammatory process. Any form of injection that is given for the purpose of cutting short the disease during the height of the inflammation is apt to produce injurious results. It is an unfortunate fact that many surgeons have joined in the popular prejudice against injections; as a consequence, nearly every patient who has stricture resulting from a gonorrhœa that has been treated by the injection method, no matter how skilfully and beneficially, attributes the permanent injury of the canal to the treatment of his urethritis, and should he consult a surgeon of anti-injection proclivities, he is certain to have his erroneous ideas confirmed, much to the detriment of the reputation of his former surgeon, who perhaps treated his urethritis upon strictly scientific and conservative principles.

One of the most important points in connection with the injection method of treatment is the selection of an appropriate syringe. The ordinary glass syringe or the hard-rubber syringe with a long nozzle is perhaps responsible for more prolonged cases of urethritis than anything that could be mentioned. The introduction of such instruments, even when performed very carefully, invariably excites more or less mechanical irritation, and it is not unusual to detect in long-standing cases a congested and granular patch of mucous membrane precisely at the spot upon which the nozzle of the syringe impinges during injection. Very few surgeons devote much attention to the instruction of the patient in the proper use of the syringe or to the selection of an appropriate form of this instrument. The author has seen not a few cases of chronic urethritis that subsided immediately upon the cessation of the use of faulty syringes. In some cases a cure will result from the use, with a proper syringe, of the same astringent solutions which have failed to produce any effect whatever when injected with one of the long-nozzled abominations. The best form of syringe is that with a conical point, known as the "Excelsior P." The instrument must be of moderate capacity in order to accomplish any benefit. If it does not contain sufficient fluid thoroughly to distend the urethra when thrown into the canal with a moderate degree of force, the medicament is never brought in contact with the entire diseased surface. In using the syringe the patient should be instructed to urinate first, and thus clear away the purulent secretion as far as possible, and then to inject the fluid slowly and steadily into the canal. Too great or spasmodic force is liable to drive the fluid—and with it germ-infection

—into the deep urethra and produce prostatic, vesical, or testicular complications.

During the increasing stage of urethritis injections, if used at all, should be very mild; they may usually with advantage be dispensed with altogether at this time. A solution of mercury bichloride in a strength of from 1 : 30,000 to 1 : 15,000, in combination with a small amount of glycerin, is about the best routine injection for use at this period. Some cases appear to be materially benefited by it, but in many it will be found to be too irritating and, temporarily at least, harmful. Even in the cases in which it is beneficial it appears to lose its effect in from two or three to ten days, and it becomes necessary to substitute for it some of the ordinary astringents in mild solution. It is possible that its evil effects are due to a peculiarly destructive influence upon the epithelium. It is always more markedly beneficial in simple than in virulent urethritis.

It has sometimes occurred to the author that astringents often serve to prevent the normal evolution of urethritis by condensing the tissues and sealing up, so to speak, the avenues of germ-elimination.

In lieu of the bichloride injection during the increasing stage an anodyne injection may be given, the following being useful formulæ :

℞. Atropinæ sulph.,	gr. ij ;
Bismuthi subnit.,	ʒiv ;
Muc. acaciæ,	
Aquæ dest.,	āā. ʒij.—M.

Sig. Shake well, and inject three times daily.

℞. Tr. opii deod.,	ij ;
Bismuthi subnit.,	iv ;
Muc. acaciæ,	
Aquæ dest.,	āā. ʒij.—M.

Sig. Shake well, and inject three times daily.

℞. Morph. sulph.,	gr. viij ;
Cocainæ,	gr. iv ;
Muc. acaciæ,	ʒj ;
Aquæ dest.,	q. s. ad ʒij.—M.

Sig. Inject three times daily.

There is no objection to the use of a mild and sedative astringent in combination with the anodynes :

℞. Plumbi acetatis,	gr. iv ;
Vini opii,	ʒij ;
Aquæ rosæ,	q. s. ad ʒiv.—M.

Sig. Inject three times daily.

℞. Sodii biboratis,	gr. xx ;
Morph. sulph.,	gr. vj ;
Aquæ rosæ,	ʒiv.—M.

Sig. Inject three times daily.

In the stationary stage of the affection the strength of the astringent injections may be slightly increased. It would appear that it is not so much

the form of astringent as the method of its use that determines the beneficial effects. It will be found that a number of different astringents will give about the same average results when properly used, although in some cases it will be found necessary to vary them. The most popular astringent drug is the sulphate of zinc, and this will be found beneficial in quite a large proportion of cases. The author prefers the sulphocarbolate or iodide of zinc to the sulphate. The nitrate of silver in the strength of one-eighth to one-half of a grain to the ounce of water is often of great service. Some recommend it as the best routine injection.

The following illustrative combinations will be found to be useful :

Ry. Zinci sulphat. (acetat.),	gr. xij ;
Morph. sulph.,	gr. x ;
Glycerini,	ʒij ;
Aquæ rosæ,	ʒiij.—M.
Sig. Injection.	

Ry. Zinci sulphocarb.,	gr. xvj ;
Glycerini,	ʒij ;
Aquæ rosæ,	ʒiij.—M.
Sig. Injection.	

Ry. Zinci iodidi,	gr. viij ;
Ac. carbol.,	gr. iv ;
Aquæ dest.,	ʒiv.—M.
Sig. Injection.	

The acetate of lead is also a serviceable astringent :

Ry. Plumbi acet.,	gr. xx ;
Tr. opii,	ʒij ;
Aquæ rosæ,	q. s. ad ʒiv.—M.
Sig. Injection.	

The vegetable astringents are often to be preferred to the mineral. Matico, hydrastis, catechu, kino, and like drugs are very popular, and are dependent upon the tannic acid which they contain. The muriate of hydrastin is especially popular and very often efficacious. A favorite vegetable astringent in the author's practice is the fluid extract of hamamelis virginica. The following formula has proved of great service :

Ry. Hydrastin. mur.,	gr. x ;
Ext. hamamelis fl.,	ʒij ;
Glycerini,	ʒj ;
Aquæ dest.,	q. s. ad ʒiv.—M.
Sig. Injection.	

As the inflammation begins to decline the strength of the injection selected may be increased, sometimes to double the proportions given. This should be done very cautiously, however, and in no instance should an injection be continued when it is found to produce considerable pain. Nothing more than slight smarting is warrantable. In some cases the use of the injection does not produce much immediate discomfort, but it is found that smarting during

micturition increases. Under such circumstances either the strength of the injection should be diminished or some other form of medicament substituted for it. This proposition is especially pertinent as applied to injection of the mercury bichloride: it will be found that with this drug in a strength of even one-sixteenth of a grain to the ounce patients will complain in a day or two, not of pain following the injection, but of severe smarting in micturition.

Sulphate of thallin is often of service in a strength of 20 grains to the ounce of rose-water.

Iodoform has been used to a considerable extent in the treatment of acute urethritis, but, as far as the author's experience goes, it does not seem to be superior to, or even as efficacious as, many other drugs, and its disagreeable odor more than counterbalances any possible beneficial effects. In the chronic forms of the disease, however, it may be used with advantage if the patient can be induced to disregard its telltale odor.

A form of treatment that has been highly recommended is the insertion of soluble bougies of various types of medication. The author is satisfied that this method of treatment is not only illogical, but is very injurious in acute urethritis, for any suppository of sufficient stiffness to permit of its introduction into the urethra is capable of producing mechanical irritation. As an additional objection there is no form of soluble bougie that can be practically applied by the majority of patients. There exists, also, the not inconsiderable danger of exciting inflammation of the deep urethra. The author has seen in consultation a number of cases of prostatic and vesical complications which he has been inclined to attribute to the use of the bougies, and in experimenting with them in his own practice he has had on several occasions unfortunate results. It is certain that it is impracticable to combine germicide drugs with the bougies in sufficient strength completely to destroy the germs of the disease, and, inasmuch as the bougie necessarily carries with it more or less secretion into the deeper portion of the canal, it is obvious that an extension of inflammation is apt to result. The author does not wish to be understood as absolutely condemning the use of soluble bougies, for in the chronic forms of urethritis they are often of service. It must be confessed, however, that even in these cases the bougie is of benefit chiefly through a primary increase of irritation of the canal as a consequence of the mechanical stimulation it produces. The author, therefore, rarely uses them, excepting in exceedingly chronic cases in which he considers it necessary to "wake up," so to speak, the inactive mucous membrane.

One of the most popular modern methods of treatment of urethritis is that by retro-injection of hot water or antiseptic solutions through a soft-rubber catheter or some of the various forms of tubes devised specially for this purpose. Many of those who have tried this method are very enthusiastic in its praises, but the author is free to say that these surgeons must either have a knack in the application of the method which he has been unable to acquire or his patients are characterized by very sensitive urethræ. The method is open to the same objections as the use of soluble bougies, for in the introduction of the tube infection is carried into the deeper portions of the canal, and it is questionable whether the injection fluid can be safely given in a strength sufficient to neutralize it. More or less mechanical irritation is produced, and in very acute cases this is likely to be a serious matter. On the other hand, in certain cases that exhibit a tendency to chronicity the retro-irrigation method is decidedly beneficial.

The author has found that a soft, open-ended catheter is as useful as anything for deep irrigation of the urethra. Under ordinary circumstances, and

always in acute cases, a short nozzle is sufficient. This is to be used without a urethral tube, and has a concave shield to catch the return flow. There are several varieties of injection-tubes that are more or less useful.

A late fad in the treatment of urethritis is what is termed the dry method. This consists in the introduction of dry antiseptic powders into the canal through a special and patented device. This method is open to the same objections as is the use of soluble bougies and retro-irrigation in acute gonorrhoea. It is apt to be of service, however, in less acute forms of the disease.

Blistering the perineum and penis by means of cantharidal solution is a favorable remedy for acute gonorrhoea with some surgeons. Milton, in particular, favors this method of treatment, but applies the blister in the form of cantharidal plaster wrapped about the penis. The author has found that most patients object to fly-blisters, and has compromised by applications of the tincture of iodine along the course of the urethra with apparent benefit. Milton recommends what he terms a "caustic plug" in the treatment of obstinate cases of gonorrhoea. This consists in a strip of linen, saturated in a five-grain solution of nitrate of silver, which is inserted into the urethra through a tube similar to an endoscope; the latter is then removed, the cloth being allowed to remain until it comes away with the urine.

It is not the writer's purpose to present all of the various methods of treatment and specifics that have been recommended for urethritis. This would be an onerous as well as unprofitable task. The list of specifics recommended runs well into the hundreds. The foregoing is intended only as a practical outline of urethral therapeutics.

CHRONIC URETHRITIS.

Chronic urethritis embraces all those various phases of secretion-forming inflammations of the urethra which are generally included under the generic term of gleet. For the sake of accuracy the latter term, if it be used at all, should be applied with the understanding that it merely implies a symptom, and only to those chronic forms of inflammation which come on, at a greater or less interval, after the acute urethritis is apparently cured, as a consequence of various pathological changes of a chronic character due to the antecedent acute inflammation. It is better, however, to use the term first suggested.

Causes.—The causes of chronic urethritis are as follows:

1. Idiosyncrasy. This consists in this instance of a predisposition to mucous fluxes and catarrhs characterizing certain individuals. This is a particularly important factor in certain climates. The variable temperature and barometric pressure characterizing our Lake region are an illustration of this, and seem to have an influence in aggravating and perpetuating urethritis.
2. The gouty and rheumatic diatheses.
3. Dyscrasia of various kinds, particularly syphilis.
4. Cachectic conditions resulting from various constitutional diseases of an acute or chronic character.
5. Intemperance in eating and drinking.
6. Improper treatment, involving usually the use of too powerful injections, with resultant destruction of the epithelium of the mucous membrane.
7. Too active exercise during the acute stage of urethritis.
8. Prolonged and ungratified sexual desire.
9. Sexual excesses and masturbation.
10. Privations of various kinds and unhealthy hygienic surroundings.

11. Localization of the acute inflammation at some particular point, with a consequent patch of local disease involving stricture or a granular and congested condition of the mucous membrane. This is the most important factor of all.

It will be observed from a survey of these various causes that the influences which tend to the perpetuation of urethritis are numerous and varied.

Varieties.—Chronic urethritis presents itself under three different forms :

1. The acute inflammation subsides to a certain extent, but remains sub-acute, with occasional acute exacerbations accompanied by a thick, purulent discharge for an indefinite period. In this form of chronic inflammation there is continual discomfort, with more or less pain and smarting on urination. Generally, too, the prostate is involved to a certain extent, giving rise to a feeling of fulness and tension in the perineum, with frequent urination.

2. The discharge becomes thin and watery, being sometimes so scanty that nothing is visible save a drop or two of muco-purulent fluid escaping from the meatus in the morning. This is the most frequent form of the disease, and is not usually attended by discomfort. It may depend upon—*(a)* A simple catarrhal condition of the mucous membrane, such cases involving the element of constitutional and local predisposition ; *(b)* Congested and granular patches in the mucous membrane ; *(c)* Organic stricture ; *(d)* Urethral polypi and papillomata. These are very rare conditions, but cases in which polypoid growths were removed through the endoscope are reported by Grünfeld and others. The author has operated several times for urethral papillomata with a resulting cure of obstinate gleet. *(e)* Abscesses or fistulæ resulting from acute urethritis, and becoming chronic ; *(f)* Dilatation and pocketing, with chronic inflammation of the lacuna magna ; *(g)* Urethro-prostatic catarrh ; *(h)* Posterior urethritis—*i. e.* chronic follicular prostatitis ; *(i)* Folliculitis ; *(j)* Cowperitis ; *(k)* Tubercular infection.

3. In this form of chronic urethritis the inflammation is apparently recovered from, but after a variable period of time, during which possibly the individual does not have his attention called to his urethra, there develops, as a consequence of sexual excesses, intemperance, or the like, a thin muco-purulent discharge.

The distinctive features of the various phases of chronic urethritis are dependent upon differences in the degree of activity of the inflammatory process : such differences do not warrant a distinct differentiation of chronic urethritis and gleet. As a rule, however, the danger of contagion is directly proportionate to the degree of purulency of the discharge. It must, however, be considered in this connection that it is possible that the discharge of gonococcal urethritis may lose its purulent and ordinary infectious qualities as far as its capacity for imparting acute vaginitis is concerned, but may nevertheless become transformed in such a manner that it is still capable of setting up various uterine, periuterine, salpingian, and ovarian troubles in the female.

Some of the cases of so-called gleet consist in the appearance, under sexual excitement, and almost uniformly on rising in the morning, of a slight, sticky moisture at the meatus. In most of these cases the annoyance produced by the disease is entirely of a mental character. The author is sometimes inclined to think that such patients would experience a feeling of disappointment if they failed to detect on rising in the morning the usual tear of urethral secretion. The appellation of psychic gleet, although a little far-fetched, would not be inappropriate as applied to such cases. Some of these patients are unable to detect the secretion, except on squeezing the

urethra. The pertinacity with which such individuals will vigorously "milk" the urethra for the purpose of exhibiting a drop or two of mucus as an evidence of their alleged deplorable condition is worthy of a better cause. Probably 50 per cent. of these cases are kept up by this pernicious practice. Most individuals, upon being questioned, will acknowledge that they are in the habit of seeking for the discharge a number of times daily, and they are considerably surprised when informed that their enthusiastic search for something they do not wish to find is mainly responsible for their woes. The pathological condition in this variety of gleet is simple hypersecretion of mucus by the follicles of the urethra. The author is convinced, moreover, that quite a proportion of cases in which the discharge is more pronounced are dependent upon a catarrhal state of the mucous membrane, with a coincidental hypersecretion of mucus, as a result (1) of habitual overstimulation of the glands and (2) of their enlargement.

The discharge in most cases is thin, rather watery, and of a whitish color. It becomes thick and yellowish, however, under the influence of the various causes enumerated as productive of chronic urethritis. A patient suffering with gleet is continually liable to acute exacerbations of his urethral difficulty upon the occurrence of the slightest exciting cause. The origin of the discharge is the numerous mucous follicles lining that portion of the urethra corresponding to the site of the chronic inflammation. There is more or less epithelium mingled with the discharge, and it will be found that one of the characteristic features of gleet is a rapid formation and removal of the deli-

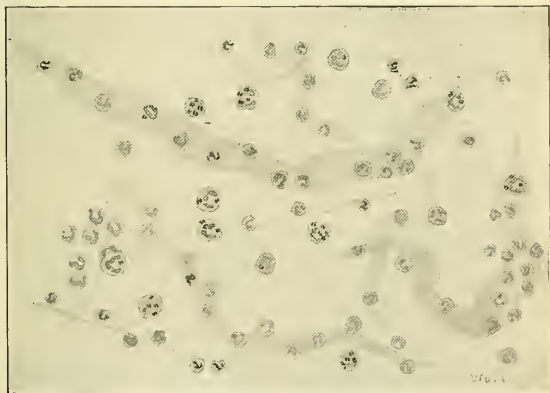


FIG. 44.—Pus taken from an old case of gleet with a recent reinfection, showing old threads and pus-cells with gonococci (Wood).

cate epithelial cells lining the urethra. This is particularly pertinent as applied to those cases of chronic inflammation dependent upon chemical or traumatic interference with the canal, such as is afforded by strong injections and injudicious instrumentation. When congested, granular, or abraded patches exist, there is a constant hypersecretion of mucus or muco-pus, with exfoliation of the epithelium upon the surface of the lesion. In this condition, as well as in stricture, the current of urine, as it passes over the diseased portion of the canal, rolls up into strings or threads the desquamated epithe-

lium and muco-purulent deposit upon the surface of the diseased membrane. These strings appear in the urine as the delicate thready filaments—*tripper-fäden* (Fig. 44)—which, as every practical surgeon is well aware, are invariably indicative of urethral disease. The majority of surgeons attribute this appearance of the urine to stricture, but this is a mistake, for it will be found in many cases in which stricture cannot be detected, being dependent upon urethral catarrh and general desquamation of epithelium. In stricture a condition of chronic inflammation exists posterior to the narrowing of the canal: as a result of obstruction at this point there is more or less pouching of the urethra at the posterior surface of the stricture. This dilated portion of the canal loses its elasticity and contractility, and, as a consequence, forms a more or less passive pouch upon its floor, in which a drop or two of urine almost invariably remains and decomposes. As a consequence of this decomposition the inflammation and consequent mucopurulent secretion are enhanced. It is from this point that the gleety discharge and thready urinary filaments characterizing stricture are derived.

The author desires to emphasize particularly the influence of powerful injections in the production of chronic urethritis. The obstinacy of some cases is undoubtedly dependent upon chemical destruction of the epithelium lining the canal. This, being repeated from day to day, eventually results in a permanently abraded condition of the entire mucous membrane, that necessitates the rapid proliferation of epithelium for the purpose of repair; this epithelium being, however, of a low grade, and, moreover, governed to a certain extent by the influence of physiological habit, is thrown off as rapidly as formed, and as a result the canal remains in a perpetually raw and inflamed condition. It is by no means necessary that to accomplish this untoward result injections should be acutely painful when used.

Still more important factors in the production of chronic urethritis are intemperance and faulty sexual hygiene. The use of alcohol predisposes all of the tissues of the body to inflammatory processes, this being particularly true of the mucous membranes, which become highly irritable; it has, moreover, a special effect in over-stimulation of the sexual apparatus, both through the medium of the nervous system and more directly by the production of irritating properties in the urine. The majority of individuals contracting urethritis are more disturbed by the interruption of their customary fornication than by any immediate or remote danger or inconvenience produced by the disease. They are possessed also with the fatuous idea that any form of sexual stimulation short of actual intercourse is not injurious; as a consequence, they associate intimately with women of loose character, whom they can caress and take liberties with, and, as a result, keep the sexual system in a constant state of excitement. This is fully as disastrous in its effects as natural sexual indulgence, if, indeed, it is not worse. As soon as our patients are satisfied that a discharge no longer exists, or in many instances as soon as the discharge has greatly diminished in quantity, they begin their sexual indulgences. They come to us in the fault-finding manner of the average venereal patient, and ascribe the unfavorable progress of the urethritis to improper treatment; seldom will they acknowledge sexual excitement or indulgence or the use of alcoholic beverages. Were it not for the sexual and alcoholic elements in the production of gleet, the author is satisfied that comparatively few cases of urethritis would last over six or eight weeks.

A lack of rest is another important element favoring chronic urethritis. In every case of virulent inflammation in which the patient is so situated that he is compelled to be on his feet the greater part of the time, to walk

about, or indulge in muscular strains, lifting, etc. we may expect a stubborn course of the disease. As a corollary it is to be inferred that patients enjoying facilities for comparative quiet will recover promptly in the majority of instances.

Duration.—The duration of chronic urethritis is very uncertain: it depends mainly upon the curability of the various pathological conditions of the canal upon which the perpetuation of the chronic urethral inflammation depends. In some instances a complete cure is impossible, judging by the frequency with which cases are encountered that have undergone every known method of treatment for a number of years without success.

Some cases of alleged gleet cannot be cured simply because of the pertinacity with which the patient clings to the idea that he is in a serious condition, over-treatment being the most natural result. One meets with numerous cases in which the patient is practically cured, but in which it is impossible to convince him that such is the case. These cases of psychopathic gleet go from surgeon to surgeon, vainly seeking a cure for something which does not exist.

Too prolonged and energetic treatment is often responsible for the perpetuation of chronic urethritis. Many cases are observed in which improvement occurs only upon complete cessation of treatment.

Cases of chronic urethritis are occasionally seen that defy all measures of treatment.

Treatment.—The treatment of chronic urethritis requires more radical measures than are warrantable in the acute stages of the affection, and incidentally a greater variety of remedies, these being necessitated by the varying character of the special causes that tend to the perpetuation of the inflammation.

The first step to be taken is to explore the urethra, and thus determine, if possible, what particular local condition is keeping up the difficulty. For ordinary purposes the bulbous flexible French bougies will be found to be all that is necessary for this purpose, for in the majority of instances a knowledge of the existence of a localized spot of inflammation or stricture is all-sufficient, ocular inspection being of little or no advantage. In the hands of the expert

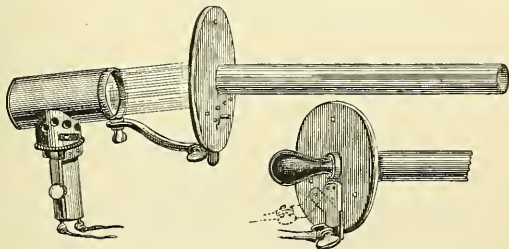


FIG. 45.—W. K. Otis's "perfected" urethroscope.

the bulbous bougie readily determines with a great degree of accuracy the condition of the urethra. Otis's acorn-tipped metallic sounds may be used, but the soft instruments are preferable.

The endoscope (Fig. 46) bears a somewhat similar relation to urethral exploration that the stethoscope does to the diagnosis of disease of the thoracic viscera. The physician who becomes expert in physical diagnosis finds that the unaided ear is all-sufficient for practical purposes in the exploration of

the chest, the stethoscope becoming necessary only in very obscure cases or those in which critical and hair-splitting differentiation of objective signs becomes necessary. There have been numerous elaborate endoscopes devised, but for practical purposes the ordinary straight hard-rubber or silver tube, with the addition of a strong light reflected from a laryngoscopic reflector or



FIG. 46.—Klotz's endoscope.

from one of the modern small reflecting electric lamps, is sufficient. It is well to have a series of tubes, in order that an instrument may be selected which is as large as the capacity of the urethra will permit.

In case stricture exists, preliminary dilatation may always be practised prior to endoscopy, and it thus becomes possible to use relatively large tubes for exploratory purposes. The mistake is often made of having these tubes made too long; by crowding the penis well down around the tube a short tube can be used much more effectively than larger ones.

We will first consider those cases the chronicity of which depends chiefly upon constitutional conditions or a general predisposition to catarrhal fluxes of various kinds, and in which exploration fails to detect any local condition that will explain the discharge. Cases frequently arise in which all forms of internal and local treatment fail of their object because of inappreciation of the constitutional peculiarities of the patient. Debilitated and strumous subjects and those who are cachectic from any cause whatever require the administration of tonics, such as quinine, iron, cod-liver oil, and various preparations of *nux vomica*. In cases of this kind the tincture of the chloride of iron or the mineral acids sometimes accomplish wonderful results by improving the general systemic condition, toning up the relaxed and flabby mucous membranes, and inhibiting excessive secretion. It is in these cases, too, that we are apt to have excellent results from the internal administration of vegetable astringents, ergot, etc. Turpentine in moderate doses is occasionally of decided advantage; the tincture of cantharides may also be of service.

Local measures of treatment are often unnecessary. In fact, it will be found that it is in just such patients that the prolonged use of injections and balsamic preparations are inclined to perpetuate gleet. In some instances, however, in conjunction with measures to improve the general health it will be found advantageous to make local applications. One of the best preparations is the pure fluid extract of *hamamelis*, applied by a cotton-wrapped probe through the endoscope tube. This will never be found to be too strong, and it is a singular circumstance that patients who are unable to bear an ordinary injection in the strength of one part of *hamamelis* to four of water make no complaint of the application of the pure fluid extract in this manner. It is sometimes necessary to alternate the applications of this astringent with the use of an ointment of nitrate of silver, ten grains to the ounce, in combination with stramonium or belladonna, by means of the cupped sound. Tannin may be used in the same manner. In making any of these applications the patient should first be directed to urinate; a full-sized sound should then be passed

to press out the contents of the dilated follicles of the urethra, after which the medicated application is made.

A plan that has proved efficacious in some instances is the prolonged use of hot water in combination with the acetate of lead, the patient being instructed to inject the urethra for fifteen or twenty minutes, night and morning, with water as hot as can be borne. The treatment is to be concluded by syringing the canal with fifteen drops of a saturated solution of the acetate of lead in a teacupful of hot water. This is to be thrown into the canal four or five times in succession. In a few instances of catarrhal gleet the author has succeeded in checking the discharge by the use of a watery solution of ordinary alum, in the strength of a dram to eight ounces night and morning.

It may be considered absurd to advocate a change of climate for patients with this form of chronic urethritis, yet when the general condition seems to demand it this plan may be advised, and will be found to be productive of marked benefit.

The rheumatic, gouty, syphilitic, and tubercular diatheses will be found to be responsible for some cases of chronic urethritis. These conditions require the same remedies as under other circumstances; the combinations of mercury, iodide of potassium, and colchicum are apt to be particularly serviceable in the three former conditions. The various balsamic preparations may be continued during the course of treatment for chronic urethritis, providing the stomach and kidneys are tolerant of these drugs.

Stricture of the urethra is the most frequent cause of chronic urethritis. Its treatment will be considered in a subsequent section.

Congested and granular patches require local applications by means of the endoscopic tube. It should be remembered in this connection that general and powerful applications to the canal are apt to be productive of injury. It is an unfortunate fact that the surgeon seldom localizes his efforts to cure the complaint, but continues the use of caustic and astringent applications and the internal administration of the balsams in a futile effort to relieve something that perhaps a single well-directed application will cure. It is necessary to determine the precise location of the diseased area and to measure accurately its distance from the meatus, with or without ocular inspection of the part. The passage of a steel sound upon alternate days for a few weeks will cure a large proportion of these cases by crushing the minute granulations, emptying pus-distended follicles, producing local absorption of the infiltrated material in the mucous membrane, toning up the latter, and stimulating repair. When this method of treatment has been proven to be ineffectual, strong applications of the nitrate of silver or the sulphate of copper may be made directly to the diseased spot through the endoscope. The pure crayon of sulphate of copper or nitrate of silver is safe if very cautiously used. The silver may be fused upon the end of a blunt probe and touched to the spot very lightly. In lieu of the pure caustic, strong solutions of copper or silver may be used, thirty to sixty grains to the ounce being admissible, but great care is necessary not to leave an excess of the caustic fluid upon the mucous membrane. When the diseased point is within three inches of the meatus the urethral speculum is often serviceable in making applications. The meatoscope may also be useful. It is in cases of chronic urethritis that the methods of treatment by soluble bougies and retro-injection are apt to prove of the greatest service.

Experience has shown that many cases of urethritis are perpetuated by a contracted meatus, behind which urine and inflammatory products accumu-

late and produce irritation. It is advisable to perform meatotomy as a matter of routine in every case of chronic urethritis in which the meatus will not admit a full-sized sound. The incision should be made with a straight, blunt-pointed bistoury and kept open by the frequent introduction of a short sound or a fossal bougie.

In some cases of gleet dependent upon congested and granular patches of mucous membrane there exists a slight thickening of the underlying mucous membrane, hardly of sufficient importance to be termed a stricture, yet requiring the same treatment, and eventually terminating in a constriction of the lumen of the canal. These patches of tough and resilient infiltration are usually found in the pendulous portion of the urethra, and in such cases the gleet is absolutely resistant to all measures of treatment until a urethrotomy is made and the thin layer of thickened tissue divided. When this process extends entirely around the circumference of the canal it necessarily constitutes a stricture of large caliber, but it is well to remember that the relation of the thickened tissue to gleet is precisely the same in those cases in which, on account of the circumscribed limitation of the process, no pronounced narrowing of the canal is evident, as in those where an acknowledged stricture exists. It is to be remembered, furthermore, that in many cases which are termed "stricture of large caliber" there is really not a strictured condition of the canal, but as the instruments pass over a thickened, granular, and hyperesthetic patch there occurs, just at the location of the lesion, spasm of the accelerator urinæ and compressor urethræ muscles that gives rise to the same objective symptoms as stricture. It is probable that urethrotomy is performed many times for the relief of strictures of large caliber in which true organic stricture does not exist, and there is only the condition of affairs just described to explain the obstruction to the introduction of instruments and the grasping of the bulbous bougie as it is withdrawn from the canal. This fact, however, is no argument against the necessity for urethrotomy.

When the inflammatory process has extended to the deep or prostatic urethra deep injections are absolutely necessary. The instrument of Ultzmann or one of its modifications (Fig. 47) may be used for this purpose.



FIG. 47.—Keyes-Ultzmann syringe.

The author has devised a more capacious syringe than that of Ultzmann, which he prefers to any he has seen. Nitrate of silver, sulphate of copper, and sulphate of thallin are the best drugs for use in these cases of deep inflammation. Soluble prostatic bougies and astringent ointments are occasionally of great service in posterior urethritis—*i. e.* follicular prostatitis.

As far as his own experience goes, the author has found the sulphate of thallin in a 15 to 20 per cent. solution the best antiseptic and astringent application for routine use in the posterior urethra. His usual plan is to alternate the thallin with irrigations of nitrate of silver or potassium permanganate in varying strength. In some cases in which there is chronic inflammation of the bulbous urethra we may succeed in exciting healthy action by

irrigating the canal with hot iodized water of the strength of one dram to the pint. In quite a number of obstinate cases the author has had excellent results from the use of a mixture of balsam of Peru, compound tincture of benzoin, and iodoform introduced through the endoscopic tube:

R. Iodoformi,	ʒiv ;
Tincture benzoini compositæ,	
Balsami peruv.,	āā. ʒj.—M.

The following is also useful, applied in the same manner :

R. Iodini resub.,	gr. xx ;
Eucalyptol.,	gr. ij ;
Potassii iodidi,	gr. ij ;
Glycerini tannat.,	gr. ss ;
Ac. carbol.,	gr. xx ;
Boroglyceridi,	q. s. ad ʒij.—M.

Mild solutions of iodine and glycerin are often of great value in the treatment of chronic urethritis, the urethra being painted, *viâ* the endoscope, with solutions of from three to ten grains to the ounce. Stronger solutions may be used in selected cases, but it is well to be cautious in their application.

All measures of treatment of chronic gleet will fail if the surgeon does not advise his patient against various sexual, dietetic, and other general causes of perpetuation of urethritis, and if the patient does not follow instructions to the very letter. It is an unfortunate fact that the average patient with chronic urethral disease lays the responsibility of his case upon the shoulders of the surgeon, and expects a cure to be accomplished without the slightest co-operation on his own part. The capacity for deceit on the part of the average patient with urethral disease is something astonishing. It is certainly a discouraging thing to have a patient present himself with acute or subacute urethritis a month or six weeks after he has apparently been cured of stricture and gleet, and have him solemnly vow that he has not played the glutton or *roué* during that time. It is possible that a few such patients do not lie to the doctor, but it would be difficult to convince the expert that, in the absence of an exciting cause, a canal which has been thoroughly dilated and the secretion of which has been entirely checked can spontaneously lapse into an acute inflammatory state so long after an apparent cure.

It is possible that patients with sexual difficulties are no more deceitful than those who present themselves for the cure of other affections, but this is not the impression the surgeon is likely to derive by observation of such cases. It might be supposed that the average individual has sufficient respect for his own physical interests to be entirely frank and honest with his physician, and it has been aptly said that "The man who deceives his doctor is a fool." But, as far as his experience goes, the writer is inclined to believe that if this proposition be true, imbecility is largely prevalent in our community. Whether the moral turpitude of the venereal patient is due to a sense of shame, akin to that which impels him to apply the water-closet theory to the origin of his disease when he is well aware of the true origin, or to a desire to lessen his financial responsibility to his surgeon, is a question that it would be difficult to answer. To say the least, it is safe to assume that there is no class of patients so unreliable as those met with in genito-urinary practice.

Treatment of the Complications of Urethritis.—It is necessary to say a few words regarding the special treatment of the complications of urethritis.

Severe Chordee and Urethral Hemorrhage.—This is best controlled by the administration of the anaphrodisiac remedies already recommended and the application of the cold-water coil or a balloon-rubber ice-bag. The danger of hemorrhage is lessened by the proper management of the chordee. When severe bleeding does occur as a consequence of rupture of the corpus spongiosum from forcible straightening of the penis, it may be controlled in most instances by the cold coil. If this is unsuccessful, a gum catheter may be passed into the urethra beyond the point of rupture, and the cold-water coil wrapped tightly around the penis; a firm bandage may be applied without the catheter. The oil of turpentine is often of great service in urethral hemorrhage.

Folliculitis and Peri-urethral Phlegmon.—These conditions are best treated on conservative principles in the majority of cases. As soon as either of these complications manifests itself, injections and all stimulating methods of treatment should be stopped, and, if possible, the patient should be kept perfectly quiet. Hot applications will usually bring about resolution of the swelling after a time. Some cases are very stubborn, but, as a rule, the little tumors characteristic of folliculitis become absorbed; sometimes, however, they remain as small circumscribed indurations and appear to keep up irritation. Under such circumstances they should be excised. Excision is recommended by some authorities as routine practice, under the supposition that the tumors inevitably suppurate, and that there is great danger of rupture into the urethra, followed by extravasation of urine, etc. The author thinks, however, that, as a rule, when the inflammation of the urethra subsides to such an extent that the duct of the follicle becomes patent, the little tumor discharges its contents into the canal, and the wall of the follicle eventually shrinks down to its normal size, this discharge of its contents being usually evidenced by a sudden increase in the urethral discharge. The follicles may refill and again discharge an indefinite number of times, and cause a succession of reinfections of the canal. Should the swelling be marked or painful, or if the fluctuation be evident in peri-urethral phlegmon, an incision must be made at once; this has not been necessary, however, in a number of cases which the author has seen. Conservatism, it is true, may be carried too far, but it is presumed that the intelligent surgeon will know when to cut.

Conservatism is not so applicable in case of peri-urethral phlegmon in the perineal portion of the urethra as in cases involving the pendulous portion of the canal. When the perineum becomes hard and brawny, it is best to make an early incision, the operation being in itself harmless. If in such instances an abscess has formed and opened into the urethra before the patient comes under observation, the case should be carefully watched and free incisions made. If at any time a marked increase in the perineal swelling, chills, hectic, and general constitutional disturbance should occur as evidences of new purulent foci or urinary infiltration, or if the swelling in the perineum is extensive and there is a disposition to pointing of matter at any particular spot, external perineal section is required. In such cases a fistula results that is likely to heal spontaneously, but may require surgical attention later on.

Retention of Urine.—The conditions producing retention are to be considered carefully in dwelling upon its treatment. We must remember that the factors in its production are several—viz. (1) inflammatory swelling of

the mucous membrane and consequent diminution of the caliber of the urethral tube; (2) irritation produced by the acid urine; (3) prostatic congestion; (4) muscular spasm. In patients who have suffered from previous attacks there may be stricture to which the foregoing factors are superadded as plus conditions. A prostatic abscess may exist, causing retention by simple pressure.

The indications for treatment are plain—sedatives, derivatives, antispasmodics, alkaline diluents, and rest comprising the main features.

A full dose of morphine hypodermically or per rectum, and a hot sitz-bath to be repeated as occasion demands, are useful. Ice in the rectum sometimes assists in relieving local congestion. Leeches to the perineum and anus are often very effective. Hot demulcent infusions are of service. If prostatic abscess exists, incision is necessary.

An injection of cocainized oil into the urethra may be of service. The dread of painful micturition and the reflex effect of the irritating urine is often an important factor in the production of retention; cocaine may possibly relieve this. The catheter should be used only as a last resort. It is far better, in the author's opinion, to tap above the pubes than to use the catheter, other things being equal. If for any reason it is decided to catheterize, an anesthetic should generally be given; cocaine, however, may be used. The greatest gentleness should be exhibited in the passage of the instrument. Before passing it the urethra should be thoroughly and deeply flushed with a mild, warm antiseptic solution. By these means we may possibly avoid infecting the deep urethra and bladder. In the author's experience instrumental interference has rarely been necessary.

Prostatitis.—The treatment of prostatitis is considered in the section on Diseases of the Prostate.

Cowperitis.—Cowperitis requires rest, the application of leeches, and the prolonged use of hot applications. Should the perineum become tense and brawny, or should there be severe pain and retention of urine, an incision into the swelling must be made without waiting for the formation of pus. If at the end of a week or ten days improvement does not occur, an incision is warrantable in any case. It will be found, however, that in many instances the inflammatory process will resolve without the formation of pus, particularly if the cellular tissue of the perineum is not extensively involved. Cowperitis is not always the result of gonorrhœa. The author has seen a typical case of the disease in a tuberculous patient who had no urethral difficulty. Even when allowed to break spontaneously, the pus usually appears externally. It may, however, open into the urethra and result in the formation of fistula or infiltration of urine, abscess, and sloughing.

Acute Cystitis.—The indications for treatment in this complication of urethritis are simple and exceedingly plain. Rest, a milk diet, anodynes per rectum, per os, or hypodermically, hot sitz-baths, hot rectal irrigations, saline laxatives, with or without mercurials, alkaline diluents, plenty of pure water, and demulcent drinks, comprise the principal therapeutic resources in this condition. Hot fomentations, turpentine stupes, or poultices over the hypogastrium are often serviceable in general cystitis.

The list of drugs for internal administration comprises such preparations as pichi, kava-kava, uvi-ursi, cubeb, sandalwood oil, pareira brava, triticum repens, linseed, and slippery elm. Some of these medicaments are available only in the form of infusion, others in that of fluid extracts. Acetate of potassium, benzoate of sodium, liquor potassæ, salol, boracic acid, and salicy-

late of sodium are all serviceable drugs for their antacid, antiseptic, and soothing effect.

Epididymitis and orchitis will be considered in another section.

Gonorrheal Rheumatism.—The treatment of this complication is not satisfactory, being of a palliative rather than a curative character. The treatment for urethritis should usually be persisted in, for, as a rule, the sooner the local condition improves the sooner the rheumatism will yield. If, however, the discharge has ceased, it is best to let the urethra severely alone. When patients are debilitated, tonics, such as strychnine, quinine, arsenic, iron, and cod-liver oil, are of advantage. The skin and bowels should be kept active and elimination favored by the use of pilocarpine hypodermically. Pain should be relieved by the use of opiates; hot applications and fixation of the inflamed joint are essential for the same purpose. Should the knee be involved, Buck's extension apparatus should be applied. The application of fifteen or twenty leeches to the joint will often prove serviceable. Flannels wrung out of hot water and sprinkled with turpentine are useful. As the inflammation subsides blisters or iodine will be found to promote resolution. Mercury and iodide of potassium internally are of great service in the chronic stage of the disease. The author has had excellent results from intra-articular injections of iodoform emulsion. It is well in all cases to try the effect of the salicylates, inasmuch as the rheumatic or gouty diathesis may exist as a predisposing cause. The more important joints, such as the knee, are best treated by the plaster-of-Paris bandage as soon as the acute inflammation has subsided. Passive movement and perhaps measures to break up the ankylosis are required later. Turkish and electric baths, static electricity, friction, and massage are serviceable adjuvants. Static electricity is particularly beneficial. The author has been much impressed with the value of this remedy in neglected cases of chronic enlargement of the joints. During the acute stage of gonorrheal rheumatism a milk diet is very essential.

The ocular complications of gonorrhea belong to the province of ophthalmology, and their treatment does not concern us here.

Bubo.—The slighter forms are curable by rest and the application of iodine. In the severer forms the patient should take to his bed and apply hot linseed-meal poultices sprinkled with laudanum every two hours. The hot poultice is the best pus-prophylactic at our command. Should resolution not occur promptly, extirpation of the enlarged glands is indicated. If we operate aseptically before peri-adenitis and infection of the surrounding tissues have occurred, healing is generally quite prompt. This may seem radical, but the author has become thoroughly disgusted with the tiresome method of waiting for a bubo to suppurate, and then waiting for weeks or months for it to heal. If prompt healing does not follow a radical operation, the tissues are still in much better shape for subsequent granulation and cicatrization than if a distinct abscess be allowed to form.

Balanitis and Vegetations.—Circumcision will prevent balanitis in cases of redundant and phimosed prepuce. In default of circumcision, absolute cleanliness may prevent balanoposthitis. When this complication comes on the indications are to keep the parts clean and dry. Astringent and antiseptic lotions and absorbent powders are useful. The iodide, sulphate, or acetate of zinc, alum, bichloride of mercury, permanganate of potassium, and many other drugs are serviceable in mild solutions. Finely triturated bismuth, calomel, lycopodium, oxide of zinc, and oleate of zinc are valuable. The last-named drug is perhaps the best of all if a good preparation be used. The stearate of zinc is another elegant preparation. Severe balanitis may

require a dorsal incision of the prepuce to expose the parts for inspection and treatment.

Vegetations should be cut away with the scissors and their bases cauterized with fuming nitric acid or the actual cautery. Cleanliness, dryness, and perhaps circumcision, are necessary to avoid their recurrence. The same principles of treatment should govern here as in balanitis.

STRICTURE OF THE MALE URETHRA.

Stricture of the male urethra is by far the most important of all the surgical diseases of the genito-urinary apparatus. It is of importance not only because of its extreme frequency—the special condition that most often gives rise to it affecting sooner or later a large proportion of male humanity—but because of its important relations to secondary pathological conditions of organs more vital than the structure primarily affected.

Stricture of the urethra may be defined as an abnormal diminution of the lumen of the canal at one or more points or throughout its entire course, due to any cause whatsoever, whether temporary or permanent. Thus it may arise from any of the following conditions :

1. Pressure from without, due to—(a) neoplastic formations ; (b) extravasations of blood or urine from injury ; (c) purulent collections and infiltrations ; (d) fracture of the pelvic bones.

2. Spasm of the muscles in and about the urethra, due to—(a) direct irritation by lesions of the canal ; (b) direct or reflex irritation from foreign bodies in the canal ; (c) reflex irritation from more or less remote pathological conditions ; (d) the introduction of instruments ; (e) emotional excitement ; (f) malaria (?) ; (g) highly acid and concentrated urine, and occasionally oxaluria and gravel.

3. Congestive or inflammatory engorgement of the urethra, due to—(a) acute urethritis ; (b) traumatism of the urethra ; (c) inflammation in and about organic obstructions.

4. Thickening of the urethral walls, due to—(a) congestive and granular patches in the mucous membrane—*i. e.* superficial infiltration from chronic inflammation ; (b) plastic infiltration and formation of connective tissue in the meshes of the corpus spongiosum from severe and long-continued inflammation ; (c) cicatricial deposit in the corpus spongiosum and urethral walls incidental to traumatism ; (d) cicatricial deposit incidental to the action of various caustics and powerful irritants ; (e) cicatricial deposit incidental to ulceration or sloughing from impaction of foreign bodies.

5. Deficient elasticity of the urethral walls and corpus spongiosum—(a) from congenital sparsity of elastic and muscular fiber and a preponderance of fibro-connective tissue ; (b) from inflammation.

6. Congenital narrowing of the urethra or slight atresia from defective fetal development.

7. Polypi of the urethral mucous membrane.

From a clinical standpoint strictures may be divided as regards their origin into—(1) congenital ; (2) acquired : (a) traumatic ; (b) chemical ; (c) acute inflammatory or congestive ; (d) chronic inflammatory ; (e) neurotic.

As regards the essential condition producing the obstruction they may be divided into—(1) Spasmodic ; (2) congestive or inflammatory (circumscribed or general) ; (3) organic or fibrous (permanent)—*i. e.* neoplastic.

Those varieties of stricture the nomenclature of which depends upon real or supposed differences in the condition producing the obstruction are not

always to be differentiated clinically, because of the fact that the several conditions may coexist and be blended in varying proportions in any given case of the disease. Thus inflammatory or congestive narrowing of the urethra, although sufficient *per se* to produce obstruction in some cases, is nearly always complicated by spasmodic narrowing of the canal. Simple spasmodic stricture is relatively rare, occurring only as a result of reflex irritation of a remote character, mental impressions, or instrumentation where the urethra is very sensitive. On the other hand, spasmodic stricture dependent upon acute or chronic organic changes in the urethral mucous membrane is very frequent. Again, there are few cases of organic stricture that are not complicated at one time or another by inflammation, congestion, or muscular spasm: in fact, all of these elements—which the author styles plus conditions—and particularly spasm, are apt to require attention at various times during the treatment of organic stricture.

SPASMODIC STRICTURE.

Spasmodic stricture—or, as it may justly be called, pseudo-stricture—may be defined as a diminution of the caliber of the urethra due to spasmodic contraction of the muscular fibers in and about the walls of the canal. Its existence was for a long time denied. It would appear that every-day experience should have taught the practical surgeon at a very early period that such a condition as spasmodic urethral stricture was possible. It seems, however, that such was not the case for some time. The varying caliber of the urethra during the progress of a course of treatment for stricture, or during the natural course of that disease unmodified by treatment, is very strikingly suggestive of the element of spasm, for it will often be found that a stricture which will at one sitting admit a sound of fair size will at another time permit the passage of a very small instrument or perhaps none at all. Complete retention may occur at any time as a result of such exciting causes as acid urine, intemperance, sexual indulgence, and so on. To be sure, spasmodic contraction is associated very often with congestion and inflammation, but in most instances spasm is the preponderating condition in the case. Again, an instrument may be obstructed during its passage into the urethra until after gentle pressure is exerted, when it will pass the point of contraction quite readily. The grasping of the instrument by the urethral walls as it is withdrawn proves conclusively the existence of spasmodic contraction.

Notwithstanding the facility of demonstration of spasmodic stricture, the profession did not accept the existence of this condition until Hancock and Kölliker demonstrated the existence of muscular fibers in the urethral walls. The researches of these investigators, although valuable, unfortunately led to the erroneous inference that contraction of these fibers was the most important element of spasmodic stricture. A comparison of the mechanical effects produced by spasmodic stricture with the power of the muscular fibers which were supposed by them to be chiefly concerned in the production of the spasm will readily demonstrate the fallacy of this belief. The planes of muscular tissue are chiefly longitudinal, and so sparse that, no matter how firmly they might contract, they would be incapable of seriously obstructing the passage of instruments or producing retention of urine. We must, therefore, look farther for the seat of spasm in pronounced cases, and seek for structures the function of which is normally to obstruct the canal and prevent the escape of urine. A group of such structures is found in the cut-off muscle of Cruveilhier, and it is at a point in the urethra corresponding

to this muscle or group of muscles that the principal spasm occurs. The last few drops of urine and semen are extruded under normal conditions by the accelerator urinæ and compressor urethræ muscles; simultaneously with this expulsion of fluid the cut-off muscle closes the deep urethra and the neck of the bladder. Spasmodic stricture is merely an intensification of this physiological function, in which, from various sources of irritation, the muscle is spasmodically contracted and the volitional power of the patient over the act of urination is for the time being held in abeyance. The accelerator urinæ and compressor urethræ muscles play but a minor part in the production of such spasm, the chief factor being the contraction of the voluntary cut-off muscle: a certain amount of spasm, however, due to contraction of the circular fibers of the urethra, may occur at any portion of the canal, and probably constitutes a certain proportion of the obstruction experienced in the introduction of instruments in cases of stricture of large caliber located in the pendulous urethra. It is this spasm that facilitates the exploration of the urethra by means of bulbous instruments, inasmuch as it is through it that the sensitive urethra resents at certain diseased points the introduction and withdrawal of the bulb, and thus gives evidence of obstruction.

The site of spasmodic stricture varies. There are nearly always two points of spasmodic contraction: (*a*) At the point of irritation; and (*b*) in the musculo-membranous urethra.

1. When a foreign body is introduced into the canal the urethra resents the liberty at any point of irritation, and there occurs simultaneously with the slight contraction at the point irritated a reflex spasm of the cut-off muscle. The same is true in cases of organic stricture in the penile portion of the urethra or at the meatus. The introduction of an instrument produces stretching and irritation of the lesion in the anterior portion of the canal, and excites reflexly spasm of the deep urethra, so that we find, in quite a large proportion of cases of stricture, at least two points of obstruction—one in the diseased portion of the canal against which the instrument impinges, and another when the instrument strikes the deep urethra. The same spasmodic contraction results when the anterior obstruction is a congenital stricture or point of normal contraction. This is an important point, for it has been established that, simultaneously with the removal of the anterior point of obstruction and irritation, the supposed deep organic stricture disappears.

2. The entire canal may be spasmodically contracted and resent the introduction and withdrawal of instruments.

3. The musculo-membranous region may alone be involved. This happens in cases in which an organic lesion exists in the deep urethra and those in which spasm is due to reflex causes.

Causes.—The causes of spasmodic stricture may be classified as—

1. **Predisposing Causes.**—(*a*) General hyperesthesia; (*b*) local hyperesthesia. Both of these conditions are modified by a nervous temperament, debilitated and cachectic states of the system, the rheumatic and gouty diatheses, intemperance, high living, faulty sexual hygiene, etc.; (*c*) acute or chronic disease of the urinary organs. The latter is the most frequent predisposing cause, and it is rarely indeed that a case of spasmodic stricture is met with in which a more or less damaged state of the canal does not exist. So uniformly is it present that it is always to be suspected until organic disease has been excluded by exploration. Congested and granular patches, erosions of the mucous membrane, acute and chronic urethritis, and stricture of whatever degree constantly predispose to spasmodic contraction, both at the point

of irritation and at the cut-off muscle; such predisposing causes are almost always effective in its production during the passage of an instrument. A congenital narrowing of the meatus or other parts of the canal may give rise to reflex spasm of the deep urethral muscles in any case in which an instrument is passed of sufficient size to produce stretching of the sensitive tissues at the point of contraction. As already noted, when instruments are introduced under the pathological conditions alluded to there is a spasm at the site of the lesion and another deep down in the canal.

2. **Exciting Causes.**—1. Passage of instruments; 2. sexual excitement or excess; 3. injury to the canal, chemical or traumatic; 4. a debauch; 5. cold-taking; 6. foreign bodies; 7. drugs, such as cantharides and turpentine; 8. reflex irritation; 9. malaria (?); 10. mental emotions.

A survey of the various exciting causes of spasmodic stricture is sufficient to indicate the fact that in nearly all instances the element of spasm is associated with congestion and inflammation—conditions that such special causes are most apt to excite. Spasm due to drugs is usually associated with considerable inflammation and attended by frequent and painful micturition, perhaps associated with urethral hemorrhage. The most frequent exciting causes are intemperance, exposure to cold and wet, and sexual excess. Highly acid urine in gouty patients is said to act as an exciting cause *per se* in some cases, but it is in the highest degree doubtful if such a condition of the urine can bring about obstructive spasm in a perfectly healthy canal. It is, however, an important element in spasm produced by excesses of various kinds and cold-taking. Instrumentation of a sensitive canal, especially if organic disease exists, may develop spasmodic stricture lasting for some days or weeks.

Cases of intermittent spasm due to malaria and curable by quinine are recorded, but it is questionable whether malaria alone can act directly as an exciting cause; that it may predispose to spasm is admitted.

In passing instruments into the virgin urethra in delicate and nervous patients—whether organic disease exists or not—the instrument is apt to meet with obstruction in the deep urethra. This will generally pass off under gentle and continuous pressure with the beak of the instrument. As the instrument is withdrawn a sense of biting or grasping upon it is experienced by the hand of the operator, and the patient may himself feel a sensation of traction in the urethra.

It is a matter of common observation that some individuals are unable to urinate in the presence of others. This has been in all probability due not to spasm *per se*, but to inhibition of volitional power over the cut-off muscle and normal involuntary contraction of the detrusor urinæ muscle.

Reflex spasm of the cut-off muscle is most apt to arise from irritation of structures bearing a more or less direct relation to the genito-urinary tract through community of nervous supply; thus diseases of the bladder, kidneys, rectum, and anus are very apt to produce it. Retention is by no means uncommon after forcible stretching of the sphincter ani in operations for hemorrhoids, fistula in ano, and rectal stricture. Inflammation in and about the perineum may produce urinary obstruction through the medium of spasm, independently of pressure.

The practitioner should consider the possible occurrence of deep spasmodic stricture in every vesico-urethral disease, acute or chronic. The point from which irritation is reflected may be above or below the site of the spasmodic contraction—*i. e.* the perineo-urethral muscles.

During a gonorrhœa the urinary flow may be greatly lessened, yet suf-

ficient for all practical physiological needs, when suddenly retention occurs, and this without the slightest involvement of the deep urethra or bladder. Ordinarily retention means a deep extension of inflammation, but retention from this cause is not so sudden, and is preceded by symptoms of prostatic or vesical irritation. In chronic prostatic irritation and in chronic cystitis with or without calculus acute retention may occur. In such cases congestion constitutes the primal condition of obstruction; but it is the reaction of the muscular structures to irritation that brings about the sudden and final occlusion of the urinary way, with resulting complete retention. Spasm plays the principal rôle and congestion the preparatory.

In hypertrophy of the prostate the least disturbance of the usual regimen or the slightest venereal or dietetic excess or exposure causes congestion of the deeper parts of the urethra. This may excite reflex contraction of the surrounding muscles, with consequent retention.

Some interesting examples have been cited where irritation of neighboring parts has produced spasmodic retention. Thus, Le Dentu cites a case of testicular neuralgia the exacerbations of which were accompanied by spasmodic retention. The same author calls attention to the providential spasmodic retention that often prevents urinary extravasation in wounds of the urethra and perineum.

Uterine affections in women have been known to give rise to spasmodic retention, and it is probable that post-partum retention often has a strong spasmodic element.

It has been held that injuries of parts very remote from the urinary apparatus may produce spasmodic retention; thus, a fall upon the knees, fractures of the ribs, surgical operations (such as laparotomy), and many other accidents of a traumatic character are sometimes associated with retention. That this retention is due to spasm the author does not believe. Inhibition of the detrusor urinæ or of volitional power over the cut-off muscle, due to shock, *commotio cerebri*, or *commotio spinalis*, seems a much more logical explanation. There may, indeed, be an apparent retention due to reflex inhibition of renal secretion, especially after abdominal operations. In some cases obtunding of the sensory supply of the bladder from shock or concussion may have much to do with the temporary retention. In some of the slighter cases exaltation of emotional sensibility may be a causal factor. A patient who has been operated upon or seriously injured is compelled to use a duck or bed-pan, often with an attendant close at hand; the result is a temporary inhibition of the power to relax the cut-off muscle.

There is a condition that Dr. Fessenden Otis has termed *urethrimus*, or chronic spasmodic stricture, which is by no means infrequently seen, and may result from various sources of irritation more or less remote. This condition may be due to chronic abscesses in and about the genito-urinary organs. Dr. Otis has reported a very interesting case of this kind due to fistula and chronic abscess of the scrotum and testicles of long standing.

Dr. Otis's remarks upon the subject of *urethrimus* are well worth repetition: "The term spasmodic stricture has usually been applied to all temporary contractions of the urethra which interfere in any degree with either the passage of instruments into the bladder or the voluntary discharge of urine from it. As thus understood, it has been described as varying in degree from the slight localized muscular spasm, which but momentarily arrests the progress of an ingoing instrument, to the firm, close contraction which more or less persistently resists its introduction in skilled hands, or from that which occasionally diminishes the strength of the outgoing stream

of urine in micturition to that producing complete and enforced retention of urine.

"In whatever degree present in any case, it is claimed by all authorities to be characterized by its transient duration and its readily yielding to remedial measures. In accordance with this teaching, all permanent or habitual interference with urination or the passage of instruments (except in some rare instances complicated by vesical paralysis) must have an organic cause, and depend either upon the presence of an intravesical growth, an enlarged prostate, or close organic stricture. It is also within the experience of many surgeons to see supposed subjects of close organic stricture placed upon the operating table for the performance of external perineal urethrotomy, which, when fully anesthetized, astonish the operator by permitting the full-sized exploratory staff to slip easily into the bladder. In other cases the entire absence of that peculiar resistance to the knife which the experienced surgeon recognizes when dividing cicatricial tissue, and the failure to locate with exactness the contracted point, will suggest to the memory of some that occasional patients, similarly affected, have not escaped so easily.

"Not infrequently, persistent difficulty in urination, and perhaps retention of urine requiring the habitual use of the catheter, has been observed by surgeons where no proofs of intravesical growths were present and the easy passage of an ordinary catheter precluded the idea of enlargement of the prostate or of close organic stricture.

"If it can be proven that purely spasmodic urethral contraction may, and not infrequently does, present all of the important diagnostic features of the true close organic stricture, and, further, if it can be shown that polypoid and prostatic obstruction is often simulated by chronic spasm of the accelerator urinæ muscles, producing obstruction and persistent closure of the membranous urethra, then it will be conceded that failure to appreciate so important a complication will conduce to grave errors in diagnosis, terminating possibly in an operation for conditions which exist only in the mind of the surgeon."

It must at once be apparent to every experienced and practical surgeon that Dr. Otis has given us in the foregoing remarks a most valuable and practically reliable principle in genito-urinary surgery. So evident, too, is the point involved that one is inclined to wonder that it remained for Dr. Otis to discover. It is found, for example, that in quite a large proportion of cases of penile stricture a sound which is large enough to put the contraction on the stretch either will not enter the bladder or does so only with great difficulty. A bulbous, flexible bougie of any size will not enter at all, and even if a small one does succeed in passing the deep urethra, it is firmly grasped on withdrawal, the sensation imparted to the hand being not always deceptive to the expert, but to the surgeon of little or moderate experience constituting irrefutable evidence of deep organic stricture.

The association of spasmodic contraction of the deep urethral muscles with disease of the kidneys has not attracted special attention. It is an element, however, of the painful and frequent micturition incidental to nephritic stone and pyelitis. The author has a case now under observation in which there was marked urinary obstruction coincidental with an acute exacerbation of pyelitis, although the urethra had previously been entirely free from obstruction. In such cases there may be associated with the reflex spasm more or less neuralgic pain of a reflex character in the back, groins, hypogastrium, and thighs. The author recognizes the fact that in these cases there exists the special irritating factor of a morbid condition of the urine.

Diagnosis.—The diagnosis of spasmodic stricture is usually comparatively simple, particularly in those cases in which retention comes on suddenly. It is obvious that the sudden occurrence of retention in a case of organic stricture or other obstructive lesion of the genito-urinary tract, in which the stream of urine has been previously only moderately lessened in size, must depend upon some complicating condition—either inflammation and congestion at the site of the organic lesion, spasmodic contraction of the cut-off muscle, or both conditions in combination. A certain degree of inflammation or congestion is to be inferred in every case of spasmodic retention of urine, and requires due consideration; the predominating element of spasm is, however, the principal feature. As a rule, in cases of sudden retention of this kind there is a history of some one or more of the exciting causes that have been enumerated.

In determining the dependence of retention of urine upon spasm it is necessary to remember that in by far the majority of cases there is some organic foundation for the condition. When in the course of treatment for organic stricture of small caliber retention suddenly occurs, the predominating condition is usually congestion or inflammation. The occurrence of acute urethritis during the course of severe organic stricture is apt to superinduce sudden retention. The condition in these cases, although a spasmodic element exists, is mainly congestion and inflammation at the site of the stricture, which produces sufficient swelling completely to close it for the time being. Urethritis produced by the introduction of instruments brings about retention in the same way. Cases of stricture of large caliber in which there is little or no obstruction to the passage of urine may suddenly develop retention from spasm. It is doubtful whether congestion or inflammation even produces closure of the canal in such cases.

It is sometimes difficult to determine during instrumentation how much of the obstruction to the passage of instruments is due to organic contraction and how much to spasm. For example, after an instrument has passed a stricture of large caliber in the penile portion of the urethra or an inflamed and irritable meatus it will be found to be obstructed in many cases as it enters the membranous region. A steel instrument is less likely to be obstructed than a soft bulbous one, and the spasm is more likely to yield to steady and gentle pressure against it with the point of the sound than to a soft bulb. If there be organic contraction in slight degree at the bulbo-membranous junction, a steel instrument small enough to pass the stricture in the anterior portion of the canal will, in all probability, slip by and fail to detect it. A large bulbous instrument will usually fail to pass altogether, but if a small bulbous bougie (Fig. 48) be introduced, it will be found that



FIG. 49.—Bulbous bougie.

the spasm of the surrounding muscles, although insufficient to obstruct the passage of the instrument into the bladder, will at the same time pucker the stricture together, so to speak, so that the shoulder of the instrument impinges upon it as it is withdrawn. The peculiar feel imparted to the bougie and the sudden snap produced by the passage of its shoulder through the organic contraction will determine the exact nature of the case.

It will thus be seen that a comparatively small bulb may detect an organic contraction with predominating spasm in the deep urethra where a very large steel sound fails to do so. The peculiar sensation of elasticity imparted

to the instrument as it impinges against the portion of the urethra that is spasmodically contracted will usually give an expert a tolerably accurate idea of the real condition of affairs. On account of the spasm that is usually encountered there are very few individuals indeed in whom a stricture in the deep urethra cannot be demonstrated by the bulbous bougie. If, however, a small instrument be passed and carefully and slowly withdrawn, organic contraction may usually be excluded. The ordinary sound cannot be relied upon for a diagnosis.

There are some exceptional cases of chronic spasmodic stricture in which the real condition can only be demonstrated by the subtraction of all sources of irritation, direct or reflex, after which the supposed organic stricture disappears.

Treatment.—Obviously, the first indication in the treatment of spasmodic stricture is to remove all predisposing causes as far as possible. Such conditions as the gouty and rheumatic diatheses require correction. General nervous irritability and hyperesthesia may require nervine tonics or sedatives and antispasmodics, or both, according to the special indications present. The principles of genito-urinary and sexual hygiene should be thoroughly impressed upon the mind of the patient. Once succeed in disabusing his mind of the fallacious notion that his penis and testes constitute the axis around which his earthly existence revolves, and the surgery of the case is much simplified. Every possible source of local and reflex irritation must be removed. This necessarily involves, in the majority of cases, the cure of organic lesions of the urethra. The urine should be kept bland and non-irritating by dietetic measures and the administration of alkaline remedies. Careful study should be given in each case to the degree of tolerance of the urethra for instrumental manipulations. The amount of irritability of the urethra and the degree of spasm excited by the passage of instruments is a fair criterion of the frequency with which they should be introduced in the systematic treatment of organic stricture.

When retention comes on as a consequence of spasmodic stricture, an attempt should be made to relieve the condition by derivation—with the view of removing possible congestion—and antispasmodics. The passage of instruments should be avoided, if possible, as tending to increase irritation and spasm. The full hot bath and morphia by the mouth or hypodermically should be depended upon as far as practicable. Very often the patient will succeed in passing urine while in the hot bath. When it is found that these simpler measures fail to relieve, a small soft catheter should be carefully introduced—while the patient is in the bath, if possible. If necessary, chloroform or ether may be given to the extent of full anesthesia for the purpose of relaxing the spasm and facilitating the passage of instruments. Whenever retention comes on in the course of organic stricture, it must be remembered that the accident is not due to the organic contraction *per se*, but to certain plus conditions—*i. e.* spasm, congestion, and edema of tissue in varying proportions. The relief of the retention depends upon the subtraction of these plus conditions from the primary predisposing factor of organic contraction. The treatment of urethrisms is chiefly operative. After all sources of reflex irritation have been removed the urethrisms disappears.

CONGESTIVE OR INFLAMMATORY STRICTURE.

This is usually a complicating condition rather than a pathological entity, being much less frequently met with as a prime factor in the case than spasm.

Even the rare existence of congestive and inflammatory stricture as an essential condition is denied by many surgeons, but it would at least appear to be the main feature of a minor proportion of cases of urinary obstruction with or without retention. This congestive or inflammatory obstruction may occur—(1) as the result of occlusion of the urethra by extensive infiltration of the mucous membrane, periurethral connective tissue, and corpus spongiosum in severe or virulent urethritis; (2) at the site of an injury to the mucous membrane produced by instrumental or accidental trauma from within or without the canal; (3) as a consequence of acute urethritis affecting strictures of large caliber or congested and granular patches of the mucous membrane.

Necessarily, the most frequent variety of congestive or inflammatory stricture occurs in connection with organic stricture. It is often a difficult matter to determine in exactly what relative proportion the elements of spasm and congestion exist.

Some cases of congestive stricture exhibit a marked hemorrhagic tendency, either as a consequence of instrumental interference, sexual indulgence, or in rare instances without apparent cause. The author has noticed this symptom with especial frequency in syphilitics and patients with a tendency to varices.

Treatment.—The indications for treatment of congestive or inflammatory stricture are the same as in spasmodic stricture, which is usually a complicating factor, with the exception that in cases in which it is believed to be a prominent element or the predominating condition the application of leeches in the course of the urethra, particularly in the perineal region, is advisable.

ORGANIC STRICTURE.

Organic, permanent, or fibrous stricture is that form in which the narrowing of the urethral caliber is due to an aggregation of connective-tissue elements, either congenital or acquired. It is most often acquired and most frequently met with between the ages of twenty-four and forty-five.

Very rarely does a stricture give trouble for the first time after the age of forty. It may occur at any time after the period of puberty. The frequency of stricture between the ages mentioned is easily explained by the fact that it is at this period of life that the individual is most subject to urethritis—the most frequent cause of stricture.

Traumatic Stricture.—Traumatic organic stricture may occur at any age. The youngest case that has come under the author's observation was a boy of thirteen, who was operated upon several years ago by external perineal section. In this case the stricture recontracted, probably from neglect on the part of the patient, and is now with difficulty kept open. Another operation will eventually be required. Erichsen records a case of traumatic origin in a boy eleven years of age.

Traumatic stricture is usually located at the triangular ligament. It is at this point that the urethra is most likely to be injured by blows or falls. A fall astride a hard object or a kick in the perineum is the usual cause. The bulbo-membranous urethra is caught between the impinging body and the sharp knife-like lower border of the subpubic ligament, and a very slight degree of force may therefore produce permanent injury. It does not require a very great degree of violence to sever the urethra completely in this situation. The pendulous urethra, on the other hand, is rarely involved in traumatic stricture on account of the difficulty with which it can be caught between two impinging bodies.

No matter what the location of traumatic stricture may be, it is composed of cicatricial tissue, the extent of which depends upon the degree of destruction of the urethral walls that has given rise to the stricture. Obviously, such a stricture is the worst with which we have to deal. It is rarely amenable to dilatation and usually requires a perineal section.

Urethral Stricture in the Female.—It is obvious that the female sex enjoys relatively great immunity from stricture of the urethra. This is explicable by the shortness and simple structure of the canal and the extreme rarity of urethritis in the female. The author has never seen but one case of the kind, and that occurred in a masturbator, probably as a consequence of laceration by the introduction of foreign bodies. Erichsen records a case occurring in a woman, but does not state the probable cause. Van de Warker, however, has shown that stricture in the female is more frequent than is generally supposed, and has reported a number of interesting cases.

Otis has also asserted that stricture of the urethra is more often seen in women than is generally believed. Symptoms which in men would be at once attributed to a stricture of the urethra are in women attributed off-hand to an irritable bladder. It has been asserted that stricture may occur in lithemic female patients independently of any infectious or inflammatory process, and require the same treatment as in men.

Congenital Stricture.—The congenital form of stricture is rare, if we exclude narrowing of the meatus. The existence of congenital stricture below a point one-fourth of an inch from the meatus is denied by the majority of surgical authorities. If, however, we take into consideration the occasional occurrence of congenital atresia of a part or the whole of the urethra, the possible occurrence of localized congenital narrowing of the canal seems logical. The author has seen a number of cases of linear stricture of the pendulous portion of the canal that he believes to have been of congenital origin. It may be asserted that such cases are traumatic and due to masturbation. This is admitted to be possible. In speaking of cases of congenital stricture points of slight relative contraction that may be demonstrated in nearly all subjects are not included.

Congenital stricture of the meatus is a relative affair, inasmuch as it is not, *per se*, productive of discomfort in by far the majority of cases. An individual with a meatus narrower than the average is not likely to be annoyed thereby, providing he never contracts gonorrhœa.

As has already been said in the section on anatomy, there is a wide variation in the size of the meatus in different individuals, and there is very frequently not only a narrow meatus, but a distinct linear contraction of the canal about one-fourth of an inch within it. When a urethra with such an external orifice becomes affected by inflammation, or when it is found necessary from any cause whatever to explore the urethra or bladder, the meatus at once assumes a position of pathological importance, inasmuch as it is impossible to explore satisfactorily—and more difficult, if possible, thoroughly to treat—a urethra of moderately large caliber if the meatus is narrow, even by the use of the urethrometer.

In order to determine the condition of the urethra or to treat organic disease of the mucous membrane the meatus must admit instruments of a size corresponding to the largest mean diameter of the canal. Obviously, when the normal caliber of the urethra is 38 French, it is impossible satisfactorily to explore or treat it when the size of the meatus is only 30 French. Otis's urethrometer in the hands of the expert has obviated the difficulty of exploration in such cases, but it is by no means as satisfactory or as safe an

instrument for routine exploration as the bulbous bougie. Whenever, therefore, there exists a suspicion of urethral, prostatic, or bladder disease and the meatus is contracted, it should be enlarged by incision to a sufficient size to admit an instrument that will thoroughly distend the canal.

In by no means exceptional instances a contracted meatus of congenital origin has been known to induce reflex neurotic disturbances in very much the same manner as does a phimosed prepuce. Irritability of the bladder with frequent micturition, and perhaps other symptoms more suspicious of stone, have been known to arise from this cause. The author has met with a number of cases of this character, and one more interesting still in which atony of the bladder resulted. The connection between the vesical atony and the contraction of the meatus was demonstrated by the success that followed meatotomy.

A congenital narrowing of the meatus may be due, as already mentioned in connection with the anatomy of the urethra, to partial occlusion by a thin membranous septum at its inferior commissure, the fossa navicularis terminating in a pouch behind it. In others, however, the narrowing is due to exceptional thickness of the tissues of the glans below the meatus. In the first of these conditions the meatus may stretch easily when instruments are passed. In the latter, however, the introduction of an instrument of sufficient size to distend the meatus produces spasm—in some cases of the entire canal and in any event of the cut-off muscle. It will be seen, therefore, that it is not alone the size of the meatus that is important, but its dilatability and degree of tolerance of instrumentation. Whenever, during the passage of an instrument, the meatus is drawn tightly about it in a thin white line, it is safe to conclude that that particular instrument cannot be introduced into the deep urethra without the exhibition of unwarrantable force.

Varieties of Organic Stricture.—According to conformation, organic acquired stricture occurs in four principal varieties—viz. (1) The first and simplest form is known as the linear stricture, the obstruction corresponding to that which would be produced by tying a narrow cord about the canal. (2) The second variety is wider, and is known as the annular form, the condition being mechanically similar to that which would result from tying a flat band or piece of tape about the canal. (3) The third form—which is divided by some authorities into several peculiar sub-varieties—involves a considerable extent of the urethra in an irregular contraction, and is known as tortuous stricture. For practical purposes these three varieties are sufficiently distinctive.

As regards their clinical features, strictures may be described as—(a) simple and readily dilatable; (b) irritable, involving local hyperesthesia and hyperemia; (c) resilient or elastic; (d) recurrent. This classification necessarily depends largely upon the behavior of the stricture under treatment.

Linear strictures present themselves in several different forms. In some cases there exists one or more membranous septa occluding the canal to a greater or less extent. These are sometimes known as bridle or pack-thread strictures. There may be a number of these bridles, the orifices of which may or may not correspond. In some cases the bands are transverse, and in others oblique in direction. Their orifices may correspond to the center of the canal or may be located at one side. Occasionally the septum or band has a crescentic form and involves only a portion of the canal. The precise method of formation of these bridles and bands is open to question. It is not generally supposed that it is possible for inflammatory lymph to become exuded upon the surface of the mucous membrane. This question would be

difficult to settle, however, in the absence of abundant post-mortem evidence. It may be accepted as a possibility in cases in which the mucous membrane has been injured by instruments or by chemical irritation. The theory has been advanced that in some cases the bridges are due to the fusing together of the natural rugæ of the flaccid canal. In some instances the condition results from a tearing up of the valvular flaps of the mucous membrane by the careless introduction of instruments. In others it is possible that a certain amount of atrophy of the submucous connective tissue and mucous follicles occurs, giving rise to a loose flap of mucous membrane. That the natural folds of the mucous membrane may fuse together, so to

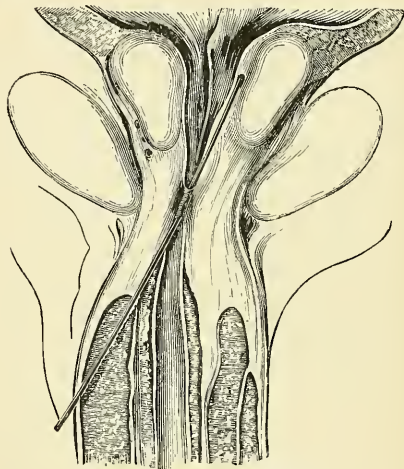


FIG. 50.—Annular stricture (Dittel).

speak, and form part of a stricture mass, the author firmly believes from conditions found in some cases of perineal section.

Annular stricture (Fig. 49) may be due to thickening of, and interstitial deposit in, the mucous membrane or to submucous inflammatory infiltration. Probably in some few instances of apparent annular stricture of large caliber, observed clinically, superficial thickening of the mucous membrane exists in the form of congested and granular plaques at a point of normal relative inelasticity of the urethra. This lesion need not necessarily involve the entire circumference of the canal, although it apparently does so on account of the coincident spasm, for as soon as the bulbous bougie impinges upon such a sensitive spot the urethra contracts down in front of the shoulder of the instrument, giving the same sensation as it is withdrawn as would be imparted by a decided narrowing of the canal. Obviously, it would be impossible to determine whether such a lesion involves the entire circumference of the canal or only a circumscribed patch except by endoscopic examination.

Tortuous strictures are made to include all strictures above one-fourth to one-half inch in width. They are irregularly contracted—*i. e.* narrower at

some points than at others, as a rule. The whole pendulous urethra may be involved, but always in a varying degree. The fact that an extensible tortuous stricture is narrower at certain points than at others is explicable upon the same ground as the localization of congested and granular patches and stricture of large caliber in the pendulous urethra—viz. the existence of normal points of relative inelasticity at which the inflammatory process is necessarily more aggravated than in other portions of the canal. As already remarked, the formation of some tortuous strictures may perhaps be explained by the fusing together of the natural folds of the canal. If we admit the spiral or rifled form of the urethra in the flaccid condition of the penis, it is conceivable that pronounced infiltration of the corpus spongiosum may permanently fix it in its tortuous conformation.

The number of strictures is variable. It has most generally been accepted that stricture is usually single, but it will be found that in by far the majority of the cases—if the urethra be carefully explored—more than one stricture exists. The surgeon who believes that a urethra which will admit a good-sized sound is necessarily free from stricture is apt to recognize only the more marked cases occurring in the bulbo-membranous region, whereas if familiar with the occurrence of strictures of large caliber he might discover by careful exploration in a given case several strictures in the penile portion of the canal. Dr. Otis's investigations, while perhaps tending to exaggerate the frequency and multiplicity of strictures, have certainly shown not only that a stricture of large caliber may exist in cases in which the urethra will admit of a sound of good size, but that strictures of the pendulous urethra are much more frequently seen than has commonly been supposed. Some of these so-called multiple strictures consist of irregular contractions of a long, tortuous stricture.

The amount of contraction in cases of stricture varies greatly between those of large caliber, in which there is but superficial thickening with loss of elasticity of the mucous membrane, and those severe forms of long-standing stricture in which the lumen of the urethra is so contracted as to resist the introduction of a fine bristle, even when the stricture is exposed post-mortem. The contraction is seldom sufficient completely to prevent the passage of urine. It has been claimed by excellent authorities that in this sense impermeable stricture does not exist. This statement, however, is probably incorrect, for it is conceivable that the urethra might be so completely destroyed from traumatism that the resultant stricture would close completely. The same is true of any organic stricture in case fistula form behind it and divert the urine from its normal channel.

The explanation of the rarity of strictures impermeable to urine is a very simple one. Every intelligent practitioner knows how difficult it is to heal a fistula in the tissues that communicates with the secreting structures or a cavity containing materials that escape and enter the lesion. Urinary fistula, fistula in ano, and salivary fistula are familiar illustrations. The patency of urethral stricture is not only facilitated by the passage of the urine, but also by the fact that the mucous membrane is usually intact, or at least in part. The inflammatory deposit, as a rule to which there are few exceptions, occurs in and beneath the mucous membrane, and produces obstruction by pressure upon it, instead of by fusing the opposing surfaces of the urethral walls together. Just so long as an intact strip of mucous membrane, however narrow, exists in the track of even the most tortuous stricture, just so long is it permeable, strictly speaking.

Strictures impermeable even to instruments are also very rare, particu-

larly in the practice of surgeons who exhibit sufficient patience, gentleness, and skill in instrumentation. A stricture should not be pronounced impermeable because at one or perhaps a dozen attempts it is found impossible to pass an instrument, for sooner or later, particularly if appropriate general measures of treatment be instituted, an instrument will usually be found to pass; and, no matter how small it may be, the successful passage of a bougie at once gives the surgeon almost complete control of the case. The most competent andrologist may fail to pass a stricture, but it must be remembered that impermeability of a stricture at one end of the bougie may mean a lack of tact or patience at the other.

Location of Stricture.—The location of stricture has been the subject of much controversy. Dr. Otis's investigations in particular have modified in certain quarters the existing ideas of the relative frequency of stricture at different points in the urethra. That the views of Otis have not been allowed to pass unquestioned goes without saying.

Until recently the dicta of Sir Henry Thompson and others of his school upon the location of stricture have been universally accepted. Thompson found in 320 cases of stricture, examined clinically, 212 that were located at the bulbo-membranous junction, 51 in the spongy portion of the canal, at variable points between 1 inch anterior to the opening of the triangular ligament and $2\frac{1}{2}$ inches posterior to the meatus, and 54 at the meatus or within $2\frac{1}{2}$ inches posterior to it. In 270 cases examined post-mortem he claimed a decided preponderance of stricture in the bulbo-membranous region, which he describes as the space included between a point 1 inch anterior to the triangular ligament and another $\frac{3}{4}$ of an inch posterior to it. H. Smith examined 98 preparations of stricture in the London museums, and found only 21 in the membranous urethra, the other 77 being anterior to it. The majority of the latter were situated in the bulbous urethra or just in front of it. Otis claims—and the author thinks correctly—that stricture is most frequently found in the penile portion of the canal. It is obviously impossible for the Thompson and Otis schools to arrive at harmonious conclusions as long as their standards of stricture and methods of exploration remain so widely different. Post-mortem evidence is only relatively valuable. The surgeon who reasons from clinical experience and skilfully uses the urethrometer and bulbs can never agree with Thompson, and must acknowledge the accuracy of Otis's methods, even though he may consider his conclusions somewhat overdrawn.

It has been the author's experience that the most frequent site of stricture appears clinically to be at the meatus or just within it, most of these cases, however, being congenital. The next most frequent point is the junction of the bulb and fossa navicularis, or just posterior to it—*i. e.* $2\frac{1}{2}$ to 3 inches from the meatus. The next most frequent location is the bulbo-membranous junction, and the next about 1 inch anterior to it. It seems to occur with varying frequency in the intermediary portions of the canal.

As Otis remarks, it will be found that strictures occur, as might naturally be expected, with greatest frequency where the inflammation begins the earliest and rages the hottest, the frequency gradually diminishing in the deeper portions of the canal.

From a clinical standpoint the author has come to regard stricture as any condition of the urethra that is capable of producing friction by obstructing the flow of urine to however slight an extent, providing said obstruction and friction are productive of pathological disturbances, or, if the latter have already begun, tend to perpetuate them. A point of normal contraction or

relative inelasticity becomes a stricture only when the urethra assumes a pathological state; the previously normal lack of distensibility is then of great pathological and surgical importance, and its removal may be imperatively necessary.

Believing, as the author does, that any point of contraction or inelasticity in the urethra in the presence of a pathological condition of the mucous membrane constitutes a stricture, he can unhesitatingly reiterate his firm conviction that stricture of the urethra is most frequent in the pendulous portion of the canal. If care be taken to exclude the element of deep urethrisms—which exclusion is not as easy as some authors would have us believe—the proportion is, he thinks, at least ten to one. That great variance of opinion exists upon this point is well known, and Bumstead and Taylor long ago called attention to the fact that there could be no harmony of results between those who studied the subject upon the living and those whose estimates were formed entirely upon observations of the cadaver. Folet (in 1857) called attention to the frequency of fibrous stricture in the pendulous urethra, and its comparative rarity in the bulbo-membranous region. This author claimed that deep obstruction existed in all cases of stricture of the spongy portion, but that the deep stricture was nearly always spasmodic and secondary to the trouble in the anterior portion of the canal. In 1866, Verneuil coolly appropriated Folet's thunder, and expressed essentially the same views and in very nearly the same language. Otis, writing at a later period, while not so radical as his French predecessors, has promulgated similar views, but in a much more comprehensive and thorough manner. The relation of urethrisms to reflex irritation, more or less remote, as shown by Otis, is one of our most important contributions to the literature of genito-urinary pathology, and is decidedly complimentary to the genius of American surgery.

In estimating the frequency with which deep spasmodic stricture complicates obstruction in the pendulous urethra attention is called to a frequent source of error in diagnosis, although at the risk of repetition of some points previously outlined. While a deep stricture may be demonstrated in nearly if not quite all cases, it does not necessarily follow that such deep strictures exist at other times. The tender urethra resents a foreign body quite as vigorously as does the eye, and as soon as the sound touches a tender spot or sensitive stricture, even of large caliber, in the pendulous urethra, a pronounced reflex contraction is observable throughout the entire canal. This is, of course, most pronounced in the deep portion. A spasm of the pendulous portion is not usually regarded as of importance; indeed, some surgeons discredit it altogether. It will be found, however, that the spongy portion often contracts so closely about the sound that it is felt to be firmly grasped during withdrawal all along the canal. This "clonus" in the pendulous urethra is of great assistance in diagnosis, as it serves to force diseased portions of the canal down in front of the shoulder of bulbous instruments of a caliber much smaller than the stricture will readily admit. Thus it often happens that a good-sized sound will pass by obstructions upon which quite small bulbs will catch.

In some cases, as already stated in the discussion of spasmodic stricture, deep spasm exists more or less constantly; but in many of these cases there is an actual organic change at the site of the spasmodic stricture; this may be true organic deposit, an erosion, or a congested and granular patch. Under such circumstances it is often very difficult to determine, even approximately, the proportionate relation of spasm to organic lesion. Oftentimes the true

condition of affairs can only be determined by subtracting the sources of reflex spasm in the anterior urethra by urethrotomy.

The prostatic portion of the urethra is never involved in true stricture, so far as known. Thompson says on this point: "I may confidently assert that there is not a single case of stricture of the prostatic portion of the urethra to be found in any of the public museums of London, Edinburgh, or Paris."

The dicta of authorities on this questions are correct only as regards acquired stricture. The author has dissected several specimens in which congenital narrowing and distortion of the distal portion of the prostatic urethra existed. In one case a distinct musculo-membranous bridle extended across the prostatic urethra.

Pathological Localization of Stricture.—The predilection of stricture for different portions of the canal has not, apparently, been satisfactorily, or at least clearly, explained. The explanation usually given for the relatively greater frequency of occurrence of stricture in various portions of the canal, more particularly in the bulbo-membranous region, is that there is in these situations a greater amount of erectile tissue and a more marked tendency to localization of inflammatory processes than in other portions of the canal.

There are several points to be considered in the explanation of the occurrence of stricture in any particular location, and in some instances there are certain special elements in its production that are worthy of attention.

Acquired strictures at or just within the meatus are favored by the existence of congenital narrowing at this point. There is a constant obstruction to the passage of urine, and the friction thereby induced inevitably enhances inflammation. There is, moreover, a tendency to pocketing of secretions behind it, and these secretions—primarily acrid in the case of virulent products of inflammation—are likely to decompose very speedily and aggravate the existing inflammation. The introduction of the nozzle of the ordinary syringe in injecting the urethra necessarily produces considerable irritation when the meatus is very narrow. These considerations explain the frequency with which acquired stricture is found just within the meatus. Long-nozzled syringes often produce stricture at a little distance within the meatus by the frequent impact of the point of the instrument against the inflamed mucous membrane. At such a spot of irritation the inflammation will necessarily become localized and chronic.

The relative dilatation of the bulbous portion of the spongy urethra and of the fossa navicularis undoubtedly favors the retention of a small quantity of urine and of pathological discharges at these points, but this element in the causation of stricture is not very important until actual obstruction by inflammatory thickening of the mucous membrane occurs just in front of the dilated area. Under ordinary circumstances these expanded portions of the urethra are thoroughly flushed out from time to time by the urine. When, however, stricture begins to form there will inevitably be a small quantity of decomposable fluid left in the canal in these situations. The author thinks, however, that this condition is of little importance until the stricture becomes very thick, as the residual urine is not allowed to remain undisturbed for any great length of time. The urethra is relatively somewhat expanded just behind the juncture of the fossa navicularis with the spongy urethra, and at this point also similar conditions prevail.

Strictures produced by injury to the canal during the passage of instruments necessarily occur at the site of the lesion thereby produced. Inasmuch as

the principal obstruction to the careless passage of instruments, even in the normal urethra, is found at the opening in the triangular ligament—*i. e.* the bulbo-membranous junction—it is at this point that such strictures are most apt to be found.

Traumatic strictures produced by falls and blows upon the urethra correspond to the site of the injury. It is very difficult, however, to catch the pendulous urethra between two impinging bodies unless it is done with deliberate intent to produce injury. In the case of the deep or fixed urethra, however, injury is very readily produced by falls and blows upon the perineum. Strictures produced in this way occur most frequently at the bulbo-membranous junction, for, as already stated, this point corresponds with the opening in that tense fibrous septum, the triangular ligament, and with the sharp lower border of the subpubic ligament; this latter structure is of a semi-cartilaginous consistency, and its edge is almost as firm and resisting as a narrow border of bone. It is between this hard tissue and the impinging body that the urethra is usually caught in injuries of the perineum, and it takes but slight force to produce sufficient injury to the canal to result in traumatic stricture. Comparatively slight force may sever the urethra completely. Injuries unnoticed in early life may produce organic stricture later on. Traumatic strictures are, on the average, the worst variety with which we have to deal.

The location of stricture due to the introduction of strong chemical or caustic substances into the urethra may be determined by the same normal anatomical conditions as in the case of ordinary virulent urethritis. They may, on the other hand, occur at the point chiefly affected by the caustic or chemical substance.

Foreign bodies in the urethra may produce localized inflammation, and perhaps ulceration, which determines the site of a subsequent stricture. Most often a foreign body lodges in one of the dilated portions of the canal. Under such circumstances the foreign material produces the most pressure and irritation at that point in the mucous membrane at which its outward passage with the flow of urine is obstructed.

Injury incidental to chordee is often responsible for the localization of stricture. This condition interferes with the normal distensibility and elasticity of the urethra, and during erection produces a strain upon the tissues of the corpus spongiosum and urethra at some particular point or points. The point of greatest convexity of the curve produced by the chordee is, as a rule, the point at which the greatest strain is experienced. The irritation produced by this straining of the tissues is apt to induce the localization of stricture at this point. In some instances the corpus spongiosum or mucous membrane of the urethra yields to the tension and is lacerated to a greater or less extent. This may be produced by the patient forcibly bending the penis with the fatuous idea that rupture of the chordee will cure his gonorrhoea. The author believes, however, that in marked cases it may result from frequent and vigorous erections, the occurrence of laceration being unrecognized, save perhaps in some cases in which the patient calls the attention of the surgeon to the fact that there has been more or less hemorrhage during the night. This, in his opinion, is a frequent cause of stricture. Under the circumstances mentioned the subsequent stricture occurs at the site of the injury. Whenever any appreciable quantity of blood appears in a gonorrhoeal discharge such minute traumatism may be inferred. These slight injuries often form the groundwork for future stricture-building.

By far the most important element in the determination of stricture at

special points in the urethra is the existence of certain normal anatomical peculiarities of the structure of the canal. These are the chief bone of contention among the warring factions whose *casus belli* is the question, To cut or not to cut? It has been shown by Weir, Sands, and others that there are certain points of narrowing in the spongy portion of the canal that have been termed by them normal contractions, these being distinct from the normal points of contraction usually recognized—namely, the meatus, the bulbo-membranous junction, and the point of union of the spongy urethra with the fossa navicularis. This description appears to the author to be somewhat misleading. The urethra is an elastic tube susceptible of considerable dilatation. Its elasticity, however, is not uniform throughout, but as a consequence of sparsity of elastic tissue, with a preponderance of connective and fibrous tissue in the erectile structure of the corpus spongiosum and a deficiency of areolar tissue beneath the mucous membrane, there exists at various points relative inelasticity and limited dilatability of the urethra. It is well known that in certain portions of the canal relative inelasticity and limited dilatability are due to certain anatomical peculiarities of the surrounding structures. For example, at the opening in the triangular ligament the urethra is not only narrow, but is surrounded by dense and unyielding tissues. The meatus is comparatively inelastic in most individuals, even when it cannot be said to be congenitally contracted. The corpus spongiosum is a little thicker at the junction of the fossa navicularis with the spongy urethra and at the junction of the latter with the bulb. At these various points, moreover, the areolar tissue beneath the mucous membrane is disproportionately scanty, and the latter is more closely applied to the tissues upon which it rests. It would seem also that, as there is normally more strain at these points of narrowing than at any other portion of the canal, the urethra is here reinforced by an increased density of fibro-connective tissue.

In explaining the localization of stricture we will take as our point of departure the fact that the urethra is a dilatable tube, the elasticity of which varies at different points in the canal. Through this tube water at a certain pressure and in a certain volume is forced at more or less frequent intervals. Obviously, the greatest friction is produced at the various points of normal contraction and relative inelasticity. Against the strain and friction produced at these points nature has provided a certain amount of reinforcement of tissue, and under normal circumstances, with a healthy mucous membrane, the pressure and friction do not produce injury. When, however, the canal is inflamed, as in acute urethritis, its lumen and elasticity are decreased. Urine is nevertheless pumped through the tube in as great a volume and with as great frequency as under normal circumstances, producing by its mechanical pressure, friction and chemical effects considerable irritation, as evidenced by the subsequent pain and smarting. Obviously, the greatest amount of irritation from friction, chemical action, and pressure occurs at the points of relative inelasticity of the canal, and as a consequence it is here that inflammation tends to localize itself, and persists, perhaps long after the remainder of the mucous membrane has returned to a condition to a greater or less degree approximating the normal. This continual friction and irritation is interpreted by the controlling centers and nervous supply of the part as a demand for reparative material, and as a consequence there must inevitably be more or less plastic deposit at these points. This plastic deposit is a conservative effort on the part of nature to prevent injury by the increased strain and irritation and secure physiological rest. Unfortunately, however, this conservative process is in this instance misapplied, for if complete absorp-

tion does not occur, the exuded inflammatory material remains, organizes, contracts, and constitutes a stricture.

The existence of the points of relative inelasticity referred to also explains abraded, congested, and granular patches of the mucous membrane in all instances in which they are not due to the frequent contact of instruments. The relatively greater amount of friction at such points tends to produce abrasion of the mucous membrane and removal of its epithelium more frequently than at any other points of the urethra. Rapid removal and re-formation of cells results in impaired vitality and a vicious habit of cell-formation. This is one of the most important factors in chronic urethritis.

To sum up: The process of formation of stricture may be illustrated by a rubber tube of delicate structure and small caliber through which water is pumped in a certain volume at more or less frequent intervals and at a certain degree of hydrostatic pressure. If this tube be compressed at certain points, or if it be tied in such a manner that, although not compressed, it is prevented from distending perfectly under the strain of the water, it is easy to see that it is at the point of obstruction that the tube is most apt to give way, or, after a time, to wear out. If the lumen of the tube be diminished, the volume of water that is poured through it remaining the same, the strain upon its texture at these points will be greatly increased, and it will give way much sooner. When, as a consequence of localization of inflammation upon the surface of, and infiltration of the areolar tissue beneath, the mucous membrane it becomes less elastic, as is the case when congested and granular patches occur from any cause whatever, there exists the same relative inelasticity and obstruction, and as a consequence a deposition of young connective tissue, with resulting formation of stricture, is apt to occur sooner or later. The friction produced by the urine is the principal explanation for the steady increase in thickness and contraction of organic strictures. The extent of stricture-deposit depends on the degree of strain and friction present.

The physiological and biological elements in the localization of stricture must not be forgotten: the vicious habit of cell-formation already alluded to is of great importance. In the course of acute urethritis there is a tendency to rapid formation of epithelium of a low grade. This is a reparative, a conservative, process, but, unfortunately, a certain biological law comes into play here—viz. in inverse proportion to the degree of differentiation of cells is their rapidity of proliferation and their tendency to degeneration. The consequence of this law is an erosion at the point of friction, and, secondarily, a plastic deposit to resist strain. The subsequent metamorphosis into fibro-connective tissue of this deposit is well understood. In the pendulous urethra especially—and probably also in the fixed portion—the plastic deposit may absorb, but the friction remains and a gleet is often kept up. The points of normal contraction and relative inelasticity have now become of pathological importance.

Now, the author wishes to ask, at this juncture, what difference it makes whether these points were primarily present in the canal as normal conditions or not, as regards their surgical relations from the standpoint of treatment. The question is not, whether they are adventitious, as claimed by Otis, or normal, as claimed by Weir and Sands, but what are their relations to the abnormal state of the canal? The difference between the two conditions is one of degree and not of kind, and there would seem, therefore, to be no logic in the dispute on either side.

From what has been said, the author believes, contrary to the usual

opinion, that the direct relation of stricture to the severity of the primary urethritis may be clearly seen.

It is a self-evident proposition that if what has been said regarding the relation of stricture to friction be true, the same holds good with relation to granular, congested, and eroded patches in the canal. Within certain limits the indications for treatment may be the same. In addition to the element of friction in producing stricture and other lesions of the urethra, a varying degree of importance of retained secretions and inflammatory products at points of narrowing is acknowledged.

Regarding the importance of the element of friction, Otis says: "It is only necessary to establish the fact that the normal resiliency of the urethra is diminished at a given point to prove that during micturition a perturbation of the stream must occur at such point, even if it is not sufficient to attract attention in any way. Hence the slightest contractions assume an importance which could not be inferred from the apparent freedom from trouble in passing the urine. They establish a localized point of friction, and of necessity an increased excitement in the vessels of the part, possibly only enough to disturb the complete elaboration of epithelial material and to cause a shreddy deposit to take the place of the clear normal secretion; and this may occur with very slight or without the least abnormal sensation being present. The presence of the mucoid shreds in the urine may be the only evidence of commencing trouble. But a permanent point of friction once established, greater than the natural conservative power of the surrounding parts is able to counterbalance, the obstruction is inevitably increased by the aggregation of plastic material at the point of irritation. In this way the tendency to recovery is combated and an area of chronic inflammatory action is established.

"Thus the difficulty, that commenced simply as an obstruction to the resiliency of the urethral walls, progresses certainly and naturally, to the point of narrowing, to a greater or less degree, the caliber of the urethral canal."

When the views of Dr. Otis first appeared they gave rise to much opposition. Among those who most vigorously combated the teachings of Otis was the author's lamented friend, the late Henry B. Sands. Among other arguments, Dr. Sands presented some very carefully prepared casts of inferentially normal urethra that showed great variation of caliber. What struck the author as most peculiar was the controversy on the question of the normal or abnormal character of many of the penile strictures diagnosed by Otis. Taking into consideration the purely mechanical effects of stricture of the urethra, it is difficult to understand how quibbling was possible. What difference in the results and in the line of treatment could be maintained between a gleet perpetuated by the normal points of friction in the urethra and a gleet perpetuated by acquired stricture? Sooner or later, true adventitious deposit occurs and the point of normal relative indistensibility merges into an acquired neoplastic contraction. Points of relative inelasticity or contraction and points of acquired contraction may be precisely the same from a clinical standpoint in the presence of a pathological condition of the mucous membrane. The cure of the case demands their removal independently of their origin.

Morbid Anatomy of Stricture.—When inflammation becomes localized at any point in the urethra there results an extension of the process to the submucous tissue, or there is an increase in a pre-existing periurethral thickening. This is due to a submucous infiltration of embryonal cells, that soon forms a zone of periurethral sclerosis more or less dense. This

may or may not, at the beginning, comprise a distinct thickening of the corpus spongiosum. This process constitutes the *début* of stricture, and is the condition most frequently detected by the bulbs or urethrometer in chronic urethritis. Obviously, it is upon the loss of elasticity at the affected point that the detection of the lesion depends. The same loss of elasticity explains the symptoms and tendency to increasing growth of stricture.

In some instances there will be found a slight thickening of the mucous membrane, with little or no submucous proliferation of connective tissue, the epithelium being more or less denuded and covered with muco-purulent secretion. The follicles of the urethra at this point are dilated, thickened, and disposed to hypersecretion. When the process is a little farther advanced the mucous membrane is thickened, congested, and perhaps covered with fungous granulations, with more or less infiltration and thickening of the submucous connective tissue and the structure of the corpus spongiosum (see Plate 2, Fig. 2). In older and more pronounced cases the corpus spongiosum is extensively infiltrated and of a semi-cartilaginous consistency, often so dense that perfect erection is impossible. This condition is really chronic interstitial inflammation of the corpus spongiosum, which acts precisely like a localized acute inflammation of the same tissue in that it gives rise to chordee. Bridles, bands, or flaps of thickened mucous membrane may be found in different cases.

The degree of occlusion of the lumen of the canal is variable. In some strictures of large caliber superficial infiltration and thickening of the mucous membrane are localized to a very small spot in the urethra—perhaps not involving the entire circumference of the canal—and its lumen is contracted little if any. In the severer forms occlusion may be almost complete.

The secondary results of stricture are chiefly incidental to the urinary obstruction it produces, and vary greatly in degree. In extreme instances all the conditions incidental to urinary obstruction and chronic inflammation of the urinary way have been found post-mortem.

The urethra anterior to organic stricture may be somewhat contracted as a consequence of chronic inflammation of the mucous membrane associated with comparative disuse. The stream of urine that passes through the stricture not being of sufficient size to dilate perfectly the anterior portion of the canal, contraction should naturally be expected. It has been said that the urethra anterior to a stricture is in rare cases dilated. It is difficult to understand, however, how this could occur, unless possibly as a result of extensive atrophy of the submucous follicles and connective tissue.

The obstruction to the flow of urine necessarily first affects the urethra posterior to the stricture. At this point the canal becomes more or less dilated and in extreme cases thinned. As a consequence of interference with the wave of contraction of the accelerator urinæ and compressor urethræ muscles produced by the plastic deposit constituting the stricture, in combination with the dilatation behind it, this part of the canal is never free from urine, a drop or so invariably remaining after the act of micturition; this residual urine finally decomposes and enhances the chronic inflammation. The inflammation is also aggravated by the friction of the urine, and in extreme cases by the straining efforts incidental to its expulsion. As a consequence of the inflammation there will be found at this point a muco-purulent secretion of pasty consistency. This secretion constitutes the discharge in most cases of gleet incidental to stricture. As the urine flows over the diseased part the secretion, in combination with more or less desquamated epithelium, is rolled up in little thready filaments (*tripper fäden*) that may be seen floating about

in the urine. There may be considerable congestion of the mucous membrane, so that the secretion is sometimes mingled with more or less blood. This, in the author's experience, is especially apt to be the case in syphilitics.

As a result of urinary decomposition there is likely to be found behind a tight stricture of long standing a deposit of more or less earthy material, perhaps in the form of a calculus. A small calculus of renal or vesical origin may become lodged at this point. In a recent perineal section the author found a calculus of some size behind a tortuous stricture.

As the case advances the mucous membrane behind the obstruction becomes very thin and fragile, and perhaps ulcerated; sometimes, as a consequence of a straining effort during micturition, it gives way, and a drop or two of germ-laden urine escape into the peri-urethral cellular tissue. Abscess with inevitable fistula—or perhaps, as a consequence of burrowing, a number of fistulae—and infiltration of urine with resultant sloughing and death are possible results. Wherever such fluid as is extruded under these circumstances comes in contact with cellular tissue it inevitably destroys its vitality, with the results just mentioned. It resembles in its destructive effects upon cellular tissue the germ of erysipelas; it produces, in short, a septic cellulitis.

The various glandular structures that open into the urethra posterior to organic stricture are invariably affected to a greater or less extent in marked cases by the urinary obstruction and mucous inflammation. The urethral follicles, prostatic glands, and Cowper's ducts become dilated, thickened, and inflamed as a consequence of infection combined with frequent and straining efforts at micturition. Even anterior to the stricture the sinuses and follicles will be found to be dilated—often sufficiently so to obstruct the passage of fine instruments. This dilatation is due to successive distention with, and evacuation of, inflammatory products. The prostate becomes more or less congested from the frequent bruising incidental to spasmodic and difficult urination. It is possible that this condition is one of the causes of enlarged prostate in advanced life.

The bladder is always more or less involved even in strictures of moderate degree. As a result of the continual obstruction to expulsion of urine the detrusor urinæ muscle becomes hypertrophied. As the obstruction increases the viscus may rarely become dilated, and portions of its walls, where the bundles of muscular fibers are deficient in quantity, become dilated and thinned, as a consequence of which condition sacculi are produced. In these sacculi urine collects and decomposes, and as a result calculi may form. In some rare instances the bladder, instead of being dilated, is enormously thickened from interstitial cystitis, and so contracted that it will hold but a very small quantity of urine.

The mucous membrane becomes the seat of chronic inflammation and assumes a characteristic dusky or slaty hue. It is covered by muco-purulent secretion, perhaps mingled with sabulous material, and is usually greatly thickened and perhaps rugose. Calculi may form in the bottom of the bladder in the same manner as under other circumstances involving urinary obstruction.

Inflammation and dilatation of the ureters and pelves of the kidneys occur sooner or later in extreme cases. Pyelitis, with or without the formation of renal calculi, will be found to exist under such circumstances. Nephritic or perinephritic abscesses may occur. The secreting structure of the kidneys undergoes those changes which are described under the omnibus term surgical kidney.

One of the characteristic conditions observed in surgical kidney is an interstitial proliferation of connective tissue and a deficiency of the elements of the normal stroma. Nature is very prodigal in her supply of reparative material to relieve strain, prevent irritation, or repair breaches of tissue. Obstruction to the urinary outflow results in the accumulation of a physiological army of proliferating cells sent to the renal tissue or developed *in loco* for the purpose of resisting strain, and this strain is interpreted by the trophic centers as a threatened breach of tissue. Unfortunately, this tissue-reinforcement develops no qualities of elasticity as it organizes, but as the strain goes on yields before the pressure and enhances the passive dilatation. Moreover, it not only absorbs almost as rapidly as it is formed, after a certain point has been reached, but it displaces, strangulates, and produces absorption of the normal secreting elements of the renal structure.

In some of the more marked forms of surgical kidney associated with pyelitis, pyelo-nephritis, or pyo-nephrosis we find disseminated suppurative foci in the secretory structure—*i. e.* the cortex of the kidney. These foci may form in two ways: by direct infection—*i. e.* by contiguity of tissue—or indirect infection by pyemic infarcts. Whether this is due to toxins or to germs is not pertinent at this point.

In fatal cases of uremia following operations for stricture the secreting structure is usually found to be intensely congested and swollen from reflex hyperemia, produced by the shock of the operation or the anesthetic.

It is to be remembered that these various consequences of stricture are not due to any specific quality of the lesion, but are the typical results of extreme and prolonged obstructive disease of the genito-urinary tract. As far as stricture is concerned, we have possible pathological results sufficiently numerous and severe to convince the most skeptical that through the medium of stricture gonorrhœa is indeed a serious disease. The results of stricture and the operations necessary for its cure are often directly fatal to life. It is this fact that makes gonorrhœa a much more dangerous disease than syphilis.

The density of stricture necessarily varies considerably according to the duration of the case, its origin, the habits of the patient, and the amount of irritation present. In old and pronounced cases it may be almost cartilaginous in consistency. Strictures of traumatic and chemical origin are very hard, because a greater or less amount of the normal tissue has been completely destroyed and replaced by true cicatricial tissue.

Causes of Stricture.—The most frequent cause of stricture is urethritis, and it has been said that it is the duration rather than the severity of the inflammation which determines its occurrence; in other words, that a long-continued inflammation of a low grade is the most usual cause. This, however, is open to question, for, while stricture results many times from chronic urethritis, it must be acknowledged that in the majority of cases the symptoms of chronic inflammation are dependent upon the stricture, and the stricture itself upon antecedent virulent inflammation; in brief, it is the stricture that perpetuates the inflammation, and not the reverse.

The author believes it may be safely assumed that the danger of subsequent stricture and of chronicity of urethritis is directly proportionate to the severity of the acute inflammatory process. Repeated attacks of inflammation almost inevitably lead sooner or later to organic stricture. It is probably exceptional that the urethra assumes its normal condition throughout its entire extent for a long time after a virulent urethritis, as there exist in most instances one or more damaged spots in the mucous membrane which in many

cases will sooner or later form a foundation for stricture. They will inevitably do so if the patient has a succession of gonorrhœas.

Stricture may result from traumatism produced by instruments within the canal or by injury from without. Severe injuries to the perineum usually involve the urethra, and are inevitably followed, as already indicated, by the worst form of organic stricture. When the urethra is entirely cut across or severely bruised the loss of tissue is replaced, as in other situations, by cicatricial deposit. It is disproportionately dense, on account of the lack of rest incidental to urination and sexual excitement. This tissue contracts and constitutes a stricture. Injuries which were apparently trivial at the time, and have perhaps been long forgotten, are not infrequently the source of stricture. It takes but little force to injure the deep urethra, and an accident that has apparently produced little or no injury is liable to produce stricture later on.

Injury to the perineal urethra may result from kicks, blows, and falls astride such objects as a wall or a fence. The author has met with a case occurring in an athlete as a consequence of falling astride a horizontal bar. Fracture of the pelvic bones, gunshot and stab wounds have been known to produce traumatic stricture.

Rupture of chordee often superadds traumatism to the usual inflammatory causes of stricture. Careless instrumentation is sometimes responsible for stricture. It is very easy to force a catheter or sound through the urethral walls, or to produce sufficient injury by bruising and laceration to result in cicatricial deposit and stricture. Cicatrices from chancre and chancroid, occurring at the meatus or within the urethra, inevitably produce stricture.

Urethral injections are popularly supposed to be responsible for a large proportion of cases of stricture, and this belief, it must be confessed, has some foundation in fact; for some surgeons, in their enthusiasm and desire for a speedy cure of their cases, are apt to forget that the urethra is lined by a very delicate mucous membrane, which is normally extremely sensitive to irritants, and is certainly more sensitive than ever when inflamed. Injections of a mild character, given in a proper manner and at the proper period, will not produce stricture, but, on the contrary, tend to prevent it by their beneficial effect upon the inflamed membrane. The prejudice that exists in the minds of the laity regarding the use of injections is to be deplored, as the method is often a very useful one. Although the surgeon may sometimes be responsible for the occurrence of stricture, it is safe to say that in the majority of instances the disease is due to aggravation of the inflammation by a lack of rest, sexual indulgence or excitement, intemperance, and self-treatment. The counter-prescribing in vogue among a certain class of druggists is often responsible for stricture. This is a matter which physicians would do well to take under advisement. There is no disease with which the counter-prescriber takes so many liberties as with gonorrhœa. The results are oftentimes very disastrous.

Independently of the strength of injections, it is to be remembered that the blandest of fluids may, when a urethritis is very acute, produce irritation by their mechanical action alone.

It is probable that individual peculiarities are sometimes predisposing causes of stricture. Thompson believes that heredity is a factor in its formation in some instances.

The theory that members of certain families present a marked tendency to connective-tissue and fibrous thickenings in various situations as a result

of chronic inflammation is a plausible one, yet it would be difficult to trace the relation of heredity to stricture.

Cachexiæ of various kinds certainly act as predisposing causes of stricture, in so far as they tend to perpetuate and enhance the severity of inflammation in any situation. It has occurred to the author that persons with syphilis are more likely to develop stricture than other individuals. This is probably because a localized proliferation of syphilitized cells is apt to occur at any point of local irritation which develops during the active course of syphilis. This is a practical point, as it is obvious that specific internal medication may sometimes be a very useful adjunct to strictly surgical measures. The same considerations apply to the gouty and rheumatic diatheses. Any condition that favors hyperacidity of the urine predisposes to stricture. Patients who are habitual drinkers are more liable to develop stricture than total abstainers. The constant ingestion of alcohol makes the tissues in general irritable and prone to inflammation.

Symptoms of Stricture.—One of the earliest symptoms of stricture of the urethra is disturbance of urination. The decomposition of the small quantity of urine that collects behind the obstruction after the process has become moderately advanced gives rise to organic compounds that are very irritating to the mucous membrane, as evidenced by the chronic inflammation found at this point. This condition causes reflex or direct irritation of the neck of the bladder, with a resulting frequent desire to urinate. Some patients first consult the surgeon regarding an increased frequency of micturition, sometimes occurring only at night. Under normal circumstances the bladder will tolerate its contents during the hours of sleep, but in the presence of irritating affections of the genito-urinary tract it becomes intolerant of the urine and must be frequently evacuated. It is not unusual to meet with strictured patients who have been annoyed by several calls to urinate during the night for a number of years, but have never been troubled in any other way. Oftentimes such patients have a stricture at the meatus only. A stricture at the meatus may give rise to frequent urination by producing reflex irritation of the neck of the bladder, the rest of the urethra being free from disease.

A very frequent early symptom of stricture consists in dribbling of urine after micturition. This is due to interference with the contraction of the accelerator urinæ and compressor urethræ muscles, the function of which is to expel the final drops of urine or semen from the canal. As soon as the penis is allowed to hang downward the residual urine escapes. It is not unusual, even in stricture of large caliber, for imperfect ejaculation of semen to occur, with dribbling after the penis becomes flaccid.

The stream of urine may be forked or twisted, corkscrew-fashion, according to the form of the stricture. In some instances a straight stream will be projected from the meatus, while a second stream falls perpendicularly downward. The size and form of the meatus modifies the form of the stream. In stricture of large caliber a narrow meatus may counteract the effect of the obstruction and maintain the natural form of the stream. When the meatus is large and its lips turgid the stream may present a fan shape, or there may be several streams running in different directions. This occurs in some persons who are free from stricture.

A little later on more or less straining effort is required during the act of micturition, the abdominal muscles being unconsciously brought into play to supplement the action of the detrusor urinæ. As this goes on, more or less atony of the detrusor occurs, and a still greater effort is required to empty

the bladder. So severe does the strain become in pronounced cases that hemorrhoids, prolapse of the rectum, and swelling of the prostate may occur.

After a time the stream of urine becomes extremely small, perhaps escaping a few drops at a time, and necessitating the expenditure of considerable time in the act of urination. Ejaculation of semen may now be so interfered with that the fluid, instead of escaping into the vagina as under ordinary circumstances, is forced backward, overcoming the resistance of the *veru montanum* and passing into the bladder. If this condition of affairs lasts for a long time, the function of the *veru montanum* may be inhibited completely and permanently, so that the individual ever after ejaculates the greater portion of the seminal discharge into his own bladder. Very often little or no semen will be discharged during the orgasm, for the reason that the increased turgescence of the *corpus spongiosum*, in conjunction with obstruction produced by the stricture, is sufficient completely to occlude the urethra during erection. The semen under such circumstances may remain in the urethra to dribble away as soon as the organ becomes flaccid. Under such circumstances sterility is an inevitable consequence. Partial or complete impotency may result from stricture as a consequence of the local and reflex enervating influence of the disease. In many instances the irritation of the stricture produces obstinate priapism and excessive desire.

Neuroses from Stricture.—While the majority of cases of stricture are unattended by pain, there are in quite a proportion of instances both direct and reflex symptoms of a painful character. Neuralgic pains in the groins or shooting up and down the spermatic cord, the front of the thighs, and in the lumbar region are not unusual. Neuralgic pains in remote situations are occasionally experienced. The author has met with numerous cases of this kind. One case in particular was very interesting in that an obstinately recurring angina pectoris was apparently cured by a urethrotomy.

The remote or direct nervous disturbances incidental to stricture of the urethra are too often lost sight of in the strictly mechanical aspect of the condition. The decidedly complex relations of the genito-urinary apparatus to the sympathetic nervous system should receive more attention than is usually accorded them. The observations of the reflex neuroses from genital irritation in children are a key to the solution of many problems in the urethral pathology of the adult.

There is a general impression that a stricture is of little importance unless it produces distinct symptoms of urinary obstruction. When, however, one meets with cases of vesical atony, incontinence of urine, impotency, neuralgia of the cord and testes, lumbo-hypogastric and lumbo-sacral neuralgia, profound mental depression and other neuroses, entirely relieved by urethrotomy of strictures of large caliber, the importance of this question is brought before one in a forcible manner. The relation of such conditions to congenital or acquired stricture at or near the meatus is especially marked.

General malnutrition, hypochondria, and malaise are often noted in stricture. Nervous irritability is often a prominent feature. Local pain, referred to the neck of the bladder, rectum, perineum, and hypogastrium, is sometimes experienced.

As the stricture increases in density and narrowness it becomes more irritable, and attacks of complete retention of urine are apt to occur as a consequence of spasm of the urethral and cut-off muscles, with or without congestion or inflammation at the site of the stricture. Acute cystitis may arise as a complication. The plus conditions that cause retention of urine

are usually superinduced by sexual excesses, intemperance, or exposure to wet and cold, often in combination with dietetic excesses.

Gouty and rheumatic patients are especially liable to retention. As a consequence of retention rupture of the urethra behind the stricture, or even rupture of the bladder, may occur, the urethra being most likely to give way.

Following retention acute cystitis may develop. The danger of this complication, however, depends to a great extent upon the degree of care exercised by the surgeon in relieving the distended bladder. Infection and traumatism are very easily produced.

Toxemia from Stricture.—The relations of stricture to uremia, so called, is not a new theme. Something will be said later on regarding the relation of the shock from surgical operations upon the urethra to toxemia and consequent urethral fever; the subject is too important for discussion at this point.

The relation of absorption of toxins from the site of the lesion in stricture, or from behind it, to the general results of stricture is unquestionably of great importance. The rapidity with which many constitutional symptoms disappear after cure of deep strictures is thus easily explained. Urethral chill following instrumentation is also explicable in the same way in some cases.

The possibility of mixed infection must be taken into consideration. The cases of cystitis, epididymitis, periurethral phlegmon, pyelo-nephritis, and other special phenomena secondary to stricture are not all dependent upon direct extension of inflammation, but are probably due in many cases to secondary infection. A recent case of the author's is strongly suggestive in this relation. A patient under treatment by dilatation for several irritable strictures of comparatively large caliber developed multiple nephritic and perinephritic abscesses. An interesting point was the fact that the formation of the abscesses was heralded by great increase of irritability and spasm in the deep urethra.

The all-important point is the apparent fact that all patients with serious strictures—particularly of the deep urethra—suffer from a greater or less degree of toxæmia, and that many cases develop secondary single or multiple infections of one kind or another.

That the passage of instruments may precipitate toxemia is granted. The danger is enhanced by uncleanness, but strictly aseptic instruments may cause trouble. It is a question, however, whether any instrument passed through a diseased anterior urethra can be aseptic by the time it reaches the deeper portions of the canal. It is the author's firm conviction that strictly aseptic surgery of the urethra would demand a flushing out of the canal prior to the introduction of even an ordinary sound. This, we know, is not ordinarily done, nor is it always practicable. We are most of us, therefore, as a matter of routine, committing cardinal sins from the standpoint of aseptic surgery.

The various complications and sequelæ of stricture produce special and characteristic modifications of the symptomatology and course of the disease. Thus there may occur a special set of symptoms dependent upon prostatic inflammation and abscess, vesical and perivesical inflammation, urethral rupture with infiltration of urine, and the various renal complications that occur so frequently in the course of stricture.

Diagnosis of Organic Stricture.—The diagnosis of organic stricture can only be made by instrumental exploration of the canal. The facility of examination depends largely upon the condition of the meatus. It is obvious that with ordinary instruments a thorough exploration cannot be made through

a narrow meatus. For example, if the canal be very large, its extreme capacity being 35 French, and stricture exists at different points, the canal being contracted at one or more of them to a diameter of 25 French, the condition cannot be readily detected through a meatus of a caliber of 20. Dr. Otis devised an instrument that has become very familiar to American surgeons for the purpose of overcoming the obstacle afforded by a narrow meatus. This instrument—the urethrometer (Fig. 50)—consists of a series of blades



FIG. 51.—Otis's urethrometer.

operated by a thumb-screw and connected with a scale-plate or dial, with an indicator that shows the exact degree of expansion of the blades as represented by the French scale. This instrument is especially useful when an accurate record of cases is to be kept.

With the soft bulbous bougie it is possible to accomplish almost as much from a practical standpoint as with the urethrometer. After a preliminary meatotomy the canal may be explored with a series of bougies about as accurately, and perhaps on the average more intelligently and safely, than with the urethrometer. Incision of the meatus is devoid of danger if properly done, and is almost invariably beneficial in cases in which symptoms of genito-urinary irritation exist, whether stricture be present or not. The author has seen, however, one case in which considerable sloughing had followed meatotomy. This was unquestionably due to instrumental sepsis. The danger of injury by the urethrometer may be obviated to a great extent by covering the end of the instrument with a thin sheath of rubber: this does not usually interfere with the separation of the blades, but does prevent the falling of the mucous membrane between them. With some patterns of the urethrometer, when the rubber sheath is thick, the blades of the instrument are apt to twist, corkscrew fashion, as they are opened. A valid objection to the urethrometer is that by its use strictures of large caliber can be found in practically every urethra. Some nicety of judgment is therefore necessary in estimating at their true value the points of narrowing demonstrated by the urethrometer. The author believes that in quite a large proportion of healthy urethra strictures may be detected with the urethrometer if Dr. Otis's method of examination is arbitrarily followed. This objection of course falls to the ground in cases in which there is more or less definite relation between the points of narrowing and existing pathological conditions. In such cases it makes little difference whether the points of narrowing were once physiological or not; they may have assumed pathological importance even though they be not of pathological origin.

Meatotomy should be considered as a necessary preliminary in both the diagnosis and treatment of urethral disease in any case in which the meatus is not of sufficient caliber to admit an instrument measuring at least 30 French. Some latitude, however, must be allowed, the size of the penis being taken into especial consideration. Dr. Otis adopts as his criterion of the normal size of the canal the circumferential measurement of the penis in its flaccid condition, believing that there is a constant relation between the size of this organ and the caliber of the urethra. This is probably true

within certain limits, but the size of the organ is so variable at different times that it seems hardly safe to adopt this as an arbitrary rule. The psychic effect of simple sounding often causes the penis to shrink to very small dimensions. The author has had patients who claimed that the very idea of exposing the organ was sufficient to produce this temporary shrivelling. In incising the meatus due deference should be paid to its form. When the orifice is situated low down upon the extremity of the glans it cannot be incised so widely as when it is located higher up, and, as a rule, it will be found that the lower its situation the more distensible it is apt to be and the less frequently does it require incision. When practicable the orifice should be cut larger than the size which it is desirable for it to retain permanently, as some cicatricial contraction is inevitable.

Several instruments have been devised for meatotomy, the most familiar being the *bistouri caché* of Civiale. This instrument is composed of two blades, one cutting and the other blunt, separable by means of a screw. Having been introduced for a sufficient distance within the meatus, the blades are separated to the required extent and the instrument is withdrawn, incising on the way the inferior commissure of the meatus. With this instrument more cutting is apt to be done than is intended, and it is, to say the least, a bunglesome device for the performance of a very simple operation. A straight-backed, probe-pointed, narrow bistoury (Fig. 51) is the best instru-



FIG. 52.—Straight, blunt-pointed bistoury.

ment for this purpose, and in expert hands an ordinary scalpel will do in lieu of a special instrument: the scalpel may be used in combination with a director or its point may be covered with a bit of wax, thus preventing accidental injury to the canal. The incision should be made directly downward, care being taken not to cut through the floor of the urethra. Under cocaine the operation may be made perfectly painless. A 4 per cent. solution in water or an 8 per cent. oleate may be injected into the canal by means of a small syringe, and retained for about five minutes, at the end of which time the part will usually be well anesthetized.

The hemorrhage following meatotomy is sometimes considerable. The author has experienced more trouble in this respect since using cocaine than formerly. The drug not only produces local anesthesia, but also appears to produce vasomotor paresis and venous congestion; the escaping blood will be found to be dark and of a more venous hue than under ordinary circumstances. Severe bleeding is not usual, however, at the time of the operation, as the drug seems to act primarily to a certain degree as an astringent. The next act of urination, however, after the astringent effect of the drug has passed off is apt to be attended by considerable bleeding. If oozing is obstinate at the time of operation, much inconvenience may be avoided by plugging the meatus. For this purpose the author uses a wedge-shaped piece of dental spunk. This is prepared by saturating it in a solution of bichloride of mercury, 1:1000, and drying. This substance swells somewhat when it is wet, and plugs the meatus sufficiently to check the bleeding. Should it escape at the next act of urination, as it is likely to do, the patient should be instructed to pinch the under surface of the glans at the site of the incision with the thumb and finger until the bleeding is arrested. Dangerous loss of blood cannot occur if this be done, and the pressure will usually check the

hemorrhage in a few moments. If the patient be nervous and excitable, he may become frightened by the occurrence of hemorrhage, and, losing his presence of mind, may not apply the pressure properly, as a consequence of which considerable loss of blood results. An instance of this kind occurred in the author's own practice, in which sufficient blood was lost to induce syncope. In this case he was obliged to introduce a small sponge-tent before he could finally check the bleeding. Aside from the trifling danger of hemorrhage of this character he has never seen any untoward results from meatotomy, excepting in the instance already mentioned in which sloughing of a portion of the glans about the incision occurred. Such accidents may usually be avoided by strict asepsis. The meatus should be dilated every day or two for about two weeks. Stitching of the edges of the quasi-mucous covering of the glans and the mucous lining of the urethra together for the purpose of ensuring the patency of the meatus is often of value. The author has frequently practised this with advantage.

If the meatotomy is a preliminary to treatment by dilatation, it is well to wait until the incision has healed before treating the deeper parts of the urethra. Exploration or internal urethrotomy may, however, be completed at the same operation. When the patient cannot visit the surgeon frequently, a loop of wire or a hair-pin may be bent to the required size and passed into the meatus several times daily. Careful stitching is of special service under these circumstances.

Aside from the mere fact of the existence of obstruction in the course of the canal, there are several other points that may be determined by expert exploration: this implies exploration by the urethrometer or bulbs, the ordinary sound being relatively worthless:

1. It is obvious that the degree of contraction of the stricture is quite readily determined.

2. By careful measurements the distance of the stricture from the meatus can be quite accurately estimated.

3. If the bulbous bougie or urethrometer be passed beyond the stricture and then withdrawn until it is caught, the distance of the posterior surface of the obstruction from the meatus may be determined. The space included between the two measurements corresponds very nearly to the width of the stricture.

4. The number of strictures is determined with only moderate facility with the bulbs, for the reason that the obstruction in the anterior portion of the canal may be sufficiently small to prevent the introduction of an instrument large enough to impinge upon the deeper strictures. This does not apply to the urethrometer, except in very tight strictures of the pendulous portion.

5. The condition of the urethra behind the stricture may be approximately determined by examining the secretion withdrawn from the canal on the shoulder of the instrument. When this is thick, with a preponderance of purulent qualities and containing sabulous material, the existence of a relatively pronounced degree of chronic inflammation may be inferred. When there is little or no secretion, or when such as is present is of a mucoid character, the stricture may be considered to be in a moderately passive condition and the urethra behind it comparatively healthy.

6. The degree of congestion present at the site of the stricture may sometimes be estimated. When blood appears upon the shoulder of the instrument or escapes from the urethra after its withdrawal, the exploration having been conducted with gentleness, a considerable degree of congestion at the site of the stricture may be inferred.

7. Resiliency or irritability of the stricture may be determined. These conditions are shown by the ready passage of a comparatively large sound, whereas the bulb of a much smaller bougie is obstructed. Irritability is demonstrated by the pain and spasm excited by the exploration and the subsequent occurrence of urethral chill.

After the exploration of the urethra for the first time ten grains of quinia, in combination with one-quarter of a grain of morphia, should be administered to obviate chill and fever. Dinretin has been recommended as meeting this indication. Should the patient be very sensitive or the stricture a severe one, it may be well to administer a dram of the fluid extract of jaborandi or a hypodermic of $\frac{1}{6}$ to $\frac{1}{3}$ of a grain of pilocarpine. On account of their derivative and eliminant effects these drugs are very useful, particularly in cases in which uremia is feared on account of the existence of renal disease.

The patient should be advised of the probability of pain and smarting at the next act of micturition, and also of the possibility of an increase of urethral discharge. Alkaline diluents, the balsams, and, if the stricture be severe with complicating cystitis, eucalyptus, salol, or boric acid, should be administered. No further meddling is advisable for several days after the exploration. Should urethral discharge be free, however, mild bichloride injections are admissible.

Prognosis of Stricture.—The prognosis of stricture involves two considerations: (1) Its curability; and (2) its danger to life.

The possibility of a radical cure of stricture is disputed by a majority of surgeons; indeed, the general opinion up to a recent date has been that without continual attention a stricture, once formed, will sooner or later give the patient trouble, no matter how skilfully his case may be treated. For example, it has been supposed that, as a rule, an individual who has been apparently cured of stricture during early adult life will again be troubled by the disease as he approaches middle age, unless he has in the mean time carried out more or less perfectly treatment by dilatation, the necessity for which increases with advancing age. Were it not for the labors of Dr. Otis and his disciples this old-time belief would probably never have been disputed, but through their labors it has been shown that quite a proportion of radical cures may be attained by dilating urethrotomy, providing such strictures are located in the pendulous urethra. No system of treatment that has yet been devised has been conclusively shown to produce a permanent cure of stricture of the fixed urethra, with the possible exception of a few cases of perineal section. It has been questioned whether even strictures in the penile portion of the canal have ever been radically cured, but as many cases operated upon by the Otis method have been examined upward of fifteen years after operation, and have been found healthy by careful urethrometry, it is fair to assume that in such cases a radical cure has resulted. The author bases his opinion not alone upon the claims of Otis, but upon sixteen years' experience with the operation, embracing about fifteen hundred cases of urethrotomy. This point will be expatiated upon in the discussion of urethrotomy.

It is not probable that in the instances of apparent cure by various methods, in cases in which the disease recurs sooner or later, the canal, if examined, would be found to be free from obstruction for any great length of time during the interim. If recontraction occurs after complete dilatation, rupture, or division of a stricture, such recurrence is probably discoverable by thorough exploration within a very short time after the cessation of treatment. Indeed, it will be found on careful exploration that recontraction, if it occurs at all, has usually begun within the first year following an apparent

cure. For example, an individual who at the age of forty presents evidences of recontraction of a stricture that was apparently cured some years before, if carefully examined during the interim would probably have been found to have a certain degree of narrowing of the canal. There are few cases in which recontraction does not commence within six months after the cessation of treatment; but this recontraction may progress very slowly or come to a standstill until some years have elapsed. At any time during this period, however, rapid recontraction may occur as a consequence of acute or subacute inflammation excited by intemperance or sexual excesses.

A recurrence of stricture occurs much more readily in cachectic, strumous, gouty, rheumatic, and syphilitic patients than in those of a perfectly healthy constitution. Necessarily, the habits of the patient have much to do with the prospect of recurrence.

It may be formulated as a practical rule—(1) That traumatic or chemical strictures invariably recur, no matter what form of treatment may be instituted; (2) That inflammatory strictures of the deep urethra recur sooner or later, and if the urethra be carefully explored they will be found to have recontracted to a greater or less extent within a comparatively short time after the cessation of treatment; (3) That strictures of the penile urethra rarely disappear completely under dilatation, and always recur unless operated upon by urethrotomy; they rarely, however, recur, in the absence of fresh gonorrhœal infection, when operated upon according to the Otis method if the operation be perfectly done.

It is usually possible to prevent recontraction of a simple stricture if we can obtain the co-operation of the patient. Strict adherence to the principles of genito-urinary hygiene, and occasional dilatation of the urethra by means of a moderately large steel sound, will generally prevent recontraction, at least to a degree appreciable by the patient.

When the patient is able to secure the services of a surgeon, it is unnecessary for him to be instructed in the art of self-instrumentation; under other circumstances, however, he should be taught the use of the sound and instructed to introduce the instrument at first once a week, later on once in two weeks, and finally once a month. When once an individual has suffered from organic stricture the introduction of the sound becomes an important item in his toilet.

The prognosis of stricture as regards danger to life varies greatly according to the duration of the disease, the severity of its complicating conditions and sequelæ, and the character of the operations undertaken for its cure. The most important factor in determining the prognosis is the condition of the kidneys. The renal structure and function are almost invariably impaired; in organic stricture of long standing such impairment is to be inferred. Pathological aberrations of the kidney are not only immediately dangerous to life—either through acute exacerbations of inflammation induced by intemperance or exposure, or by reflex inhibition of the function of the kidney produced by surgical shock in attempts to cure the stricture—but they bear an important relation to the welfare of the patient after that primary condition has been relieved. It is probable that a patient who has once suffered from secondary disturbance of the kidney incidental to organic stricture is rarely, if ever, a sound man again. His kidneys—and, for that matter, the structure composing his entire genito-urinary tract—are in a weakened, possibly degenerated, relaxed, and irritable condition that predisposes to congestion and inflammation. The slightest excess or exposure is apt to bring on acute Bright's disease of the ordinary form. Chronic nephritis may

supervene at any time; pyelitis may develop after the patient is apparently cured of stricture. In brief, a patient who has once suffered from severe organic stricture possesses ever afterward a *locus minoris resistentiæ* in the direction of the kidneys, that is liable at any time to lead to serious renal disease.

Stricture may result fatally by the supervention of uremia consequent upon complete inhibition of the already impaired function of the kidneys. Retention of urine, due to inflammation of the stricture, may lead to a fatal result through rupture of the urethra or bladder, with consequent extravasation of urine, or by occurrence of acute cystitis, perhaps with gangrene of the vesical mucosa. In these conditions, secondary to retention, the patient may sink into a typhoid state and die, the condition being modified by a greater or less degree of uremic intoxication. Septicæmia in its various forms may result. Debility and nervous exhaustion from pain and loss of sleep, in combination with the depressing effects of urinary intoxication or fever, are important elements in all fatal cases.

Notwithstanding the serious nature of marked types, it is surprising how rapidly some apparently desperate cases of stricture will improve when once the obstruction has been removed. Even when the kidneys are seriously impaired, the constitutional symptoms marked, and the secondary bladder changes severe, the patient often improves with wonderful rapidity as soon as the patency of the urethra has been restored. The improvement in the patient's general condition is oftentimes remarkable. The very gradual involvement of the upper portion of the genito-urinary tract in pathological conditions secondary to stricture probably explains the tolerance of the patient for severe renal and bladder-changes.

A condition not usually recognized in stricture is toxæmia due to the constant absorption of ptomaines and toxalbumin from behind the obstruction. This toxæmia has much to do with numerous little ailments of which the patient may complain, but which he rarely attributes to his stricture until the cure of the latter suggests them by the fact of their sudden and complete disappearance. This toxæmia, too, constitutes a constant predisposition to urethral chill. The nervous system is loaded with toxins, so to speak, and ready for the explosion that instrumentation is oftentimes sufficient to bring about.

Treatment of Stricture.—General Management.—The successful treatment of stricture depends not only upon the proper selection of surgical methods of management and skill in their performance, but upon the manner in which the general management of the case is conducted. Careful attention on the one hand, or neglect on the other, may determine the degree of success of surgical treatment. Thus, dilatation may fail of its object because of irritability or resiliency of a stricture which attention to certain details in the general management of the case might have avoided. Urethrotomy, division, or perineal section may result fatally, because of failure on the part of the surgeon to study carefully the conditions of other portions of the genito-urinary tract, and ignorance of the general and local conditions prevailing at the time of operation.

In no disease of the genito-urinary tract is attention to genito-urinary and sexual hygiene more essential than in the management of stricture of the urethra. Regulation of diet, temperate habits, sexual moderation, and avoidance of exposure to cold and wet are all-important. The use of tobacco should be interdicted as tending to induce general irritability and hyperæsthesia. The author believes, moreover, that it is especially irritating to the genito-urinary tract. Chilling of the feet and legs is apt to be especially injurious,

its effect upon stricture in the production of acute hyperemia and inflammation being precisely similar to its results in enlargement of the prostate, in which disease the disastrous effects of exposure are well known. The administration of alkalis for the purpose of neutralizing the urine is essential in the majority of cases. When pronounced cystitis exists, certain remedies will be found beneficial by preventing decomposition of the urine and consequently lessening its irritating properties. Oil of eucalyptus, boric acid in ten- or fifteen-grain doses several times daily, naphthol, creasote in small doses, benzoate and salicylate of soda, and small doses of turpentine are useful for this purpose. In the author's experience the oil of eucalyptus in ten-minim doses has been of especial value. The activity of the skin should be promoted by Turkish baths and rubbings. The effects of sudden atmospheric changes should be avoided by wearing warm flannel garments of uniform weight. Exercise should be taken in moderation; fatigue and over-exertion should be avoided; perfect rest may possibly be indicated.

Certain local measures are very essential in the management of stricture. A tendency to spasm and congestion at the site of stricture may be prevented by the daily use of hot sitz-baths or the occasional application of leeches to the perineum. As a matter of routine the author often advises a hot sitz-bath nightly. By proceeding in this manner it will be found that the majority of cases of stricture will be made much more tractable. In some cases of tough, resilient stricture the canal may be much more readily dilated if the patient be directed to take night and morning an injection of water as hot as can be borne. These injections should be kept up for half an hour at a time, and may advantageously be made antiseptic by the addition of bichloride of mercury, 1 in 20,000, or boric acid in saturation. Where manipulations of the canal tend to excite urethritis, hot bichloride irrigations, as recommended for chronic urethritis, may be cautiously employed. The various balsamic preparations are of service in such instances.

Pain and spasm may be excited by each attempt at dilatation, in spite of the general measures already recommended. Under such circumstances a small dose of morphia may be given hypodermically, by suppository, or by the mouth, a short time before the operation. When each operation tends to produce urethral chill or fever the administration of opium has a decidedly conservative and prophylactic effect. The author has found that in these cases of irritable stricture with a predisposition to urethral fever thorough irrigation of the canal with a hot bichloride solution before and after the introduction of a sound or before cutting operations, as the case may be, will generally obviate the difficulty. He desires particularly to call attention to the advantages of this procedure, as it will certainly tend to prevent the septic element in the production of urethral fever. Quinia, jaborandi, eucalyptus, and diuretin are probably all serviceable as prophylactics against chill, but eucalyptus is the most valuable of all.

Selection of Method.—The various forms of treatment that have been recommended for stricture are as follows:

1. Caustics;
2. Continuous dilatation;
3. Gradual dilatation;
4. Dilating urethrotomy, or a combination of section and rupture;
5. Divulsion or rupture;
6. Internal urethrotomy;
7. External perineal section or urethrotomy with a guide;
8. Internal perineal section without a guide;

9. Electrolysis ;
10. Subcutaneous section ;
11. Excision, with or without a plastic operation.

Caustics.—The treatment of stricture by caustics is a relic of surgical barbarism, and is hardly worthy of serious attention. The objects for which it was originally recommended were, (1) the destruction of the stricture, and (2) diminution of the sensibility of the mucous membrane for the purpose of allaying irritability and spasm of the canal. The substance used was generally caustic potash. Whatever the results may have been as far as temporarily restoring the caliber of the canal was concerned, the inevitable consequence of such atrocious surgery was necessarily the substitution of a chemical stricture for an ordinary organic one. As is well known, stricture due to actual destruction of tissue is the most severe form with which we are called upon to deal. All the other methods of treatment that have been enumerated have their advocates at the present day, either as a matter of routine or a variety of methods from which to make a selection, and may under proper circumstances be practised with advantage in different cases. The selection of the method is to a certain extent a matter of choice on the part of the individual surgeon. The various legitimate methods will receive special consideration after their applicability to the various forms of stricture has been outlined.

For practical purposes the surgical treatment of stricture may be divided into that of—

As regards location.	{	<ol style="list-style-type: none"> 1. Stricture of the meatus. 2. Stricture of the penile urethra. 3. Stricture of the deep urethra. 	}	As regards character.	{	<ol style="list-style-type: none"> a. Simple uncomplicated stricture. b. Irritable stricture. c. Resilient and elastic stricture. d. Recurrent stricture. e. Dense and hard, tortuous stricture. f. Complicated stricture. g. Traumatic stricture. 	}
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The treatment of each particular case is modified by the caliber of the contraction ; for example, in tight strictures which it seems advisable to treat by dilatation metallic instruments should not be used until a moderate amount of dilatation has been attained. The treatment is further modified by the occurrence of complications, such as false passages, retention of urine, severe cystitis and pericystitis, infiltration of urine, and abscess, fistulae, enlarged prostate, etc.

Stricture of the Meatus.—Irrespective of their causation, strictures at the external orifice of the urethra require free division by the knife. Attempts at dilatation are absolutely useless and produce irritation. The structure of the meatus is such that it cannot be permanently stretched, and attempts at dilatation not only produce local disturbance, but also reflex irritation and spasm of the deep urethra. The proper method of performance of meatotomy has been outlined as preliminary to exploration of the urethra. Any meatus that prevents the introduction of an instrument of sufficient size to distend the remainder of the canal to its extremest capacity must be considered as strictured. As already remarked, stricture of the meatus may be a relative affair: this is true particularly of the congenital form, which assumes surgical im-

portance only when organic or functional disease of the urethra exists behind it. In all cases of obscure nervous disturbance, with concomitant symptoms referable to the sexual organs, it is wise to perform meatotomy, for, whether apparent irritation at the meatus is present or not, the effect produced upon the nervous system is frequently very beneficial: that this effect may sometimes be a moral one is admitted; that it is not always psychic is indisputable.

In many cases of narrow meatus the urethra behind it may be demonstrated to be in a pouched condition by exploration with a bent probe. In this pouch inflammation goes on indefinitely, its perpetuation being facilitated by the accumulation and decomposition of a few drops of residual urine. Meatotomy therefore often cures a most obstinate gleet.

Stricture of the Penile Urethra.—Strictures in the pendulous portion of the urethra cause more annoyance to the patient and more perplexity to the surgeon, on the average, than those of the perineal portion, although they are less dangerous, and their direct and remote results less serious, than those occurring deeper down. They rarely contract so as to produce serious obstruction to urination, and where they form slowly we often meet with cases in which several tight strictures exist, yet have produced little or no trouble, having been discovered accidentally or during exploration for the purpose of determining the cause of an intercurrent simple urethritis. The author operated recently on a young man who had three strictures of the pendulous urethra, the tightest of which would barely admit the closed blades of the dilating urethrotome. These strictures had produced no inconvenience whatever, and probably would have remained undiscovered for some little time if the patient had not, at the suggestion of a friend, submitted himself to an examination for the purpose of ascertaining whether a gonorrhœa that he had contracted some years ago had left any permanent results. Such a passive condition of strictures in this situation is of course not to be expected, for, as a rule, they give rise to frequent attacks of so-called "bastard" clap or to an indefinite perpetuation of gleet discharge.

Although strictures in any portion of the canal are apt to cause vesical irritation, the liability to this annoying symptom seems to be in direct ratio to their distance from the meatus. Comparatively slight strictures in the deep urethra will produce by direct irritation, through contiguity of structure and nervous supply and by infection of the deep urethra, annoying frequency of micturition. In occasional cases, however, this symptom is the principal feature of a stricture at or near the meatus.

The degree of contraction in penile strictures is variable. It is exceptional rather than otherwise that such strictures are so markedly contracted as those in the deep urethra. This statement may seem to be at variance with the experience of many surgeons, but the discrepancy is explicable by the fact that the majority of surgeons do not make a diagnosis in many cases in which stricture of large caliber exists. When the author speaks of the relative rarity of stricture of small caliber in the penile portion of the urethra, he means as compared with the total number of those which may be observed by careful exploration with the bulbous bougie.

Stricture of the pendulous urethra is very apt to be multiple. Indeed, there are few cases in which a full-sized bulb or the urethrometer fails to detect two or more points of contraction in different parts of the canal. These strictures are frequently irritable, and almost always resilient. They are a potent cause of chronic urethritis and gleet, and explain the obstinacy of very many apparently incurable cases of urethral discharge. Even when they are not, strictly speaking, the cause of the chronic inflammation, they

invariably tend to perpetuate it. If the profession had nothing else for which to thank Dr. Otis, it would be under lasting obligations to him for his demonstration of the true pathological condition in the majority of those obstinate cases of gleet that have so long been the *bête noir* of the surgeon. When such strictures are irritable, as they are very apt to be, a very slight exciting cause is sufficient to excite urethritis, the severity of which depends upon the degree of irritation. In short, penile strictures of large caliber may be said to constitute a constant predisposition to both virulent and simple urethritis.

The more important of the conditions which, in addition to stricture, must be taken into account in estimating the causes of gleet are as follows:

1. Constitutional debility;
2. Intemperance, alcoholic and sexual;
3. The gouty and rheumatic diatheses;
4. Tuberculosis of the genito-urinary tract;
5. Chronic superficial urethritis, with or without distinct erosions;
6. Peri-urethritis with loss of elasticity, nascent stricture;
7. Folliculitis and chronic inflammation of lacunæ;
8. Cowperitis;
9. Posterior urethritis, *i. e.* prostatitis folliculosa;
10. Chronic abscesses from peri-urethral phlegmon;
11. Urinary fistulæ;
12. Neoplasms.

Admitting stricture to be the most frequent cause of gleet, the above etiological factors are still worthy of the most discriminating attention.

There is one point that should be constantly borne in mind—*viz.*, the fact that the urethra will permit the introduction of a large-sized steel sound does not militate against the existence of stricture, for it will often be found on exploration with the bulbous bougie that one or more strictures of large caliber exist.

The tendency to irritability and resiliency on the part of strictures of the pendulous urethra constitutes the principal obstacle to successful treatment by dilatation. The author has found that dilatation in cases of stricture in this portion of the canal is usually disappointing, and that the patient either does not get entirely well of his gleet, or he apparently does so only to experience a recurrence of urethritis upon the supervention of the slightest exciting cause. He ventures the opinion that very few cases of stricture of this kind are ever thoroughly cured except by cutting, and experience has impressed upon him the necessity of radical interference and the uselessness of temporizing by dilatation. He therefore would advise urethrotomy in all marked cases and in the slighter forms where the contractions do not readily yield. When stricture is young and soft—*i. e.* of recent date and not yet fully organized—dilatation offers a good prospect of a cure, and it is but just that the patient be given the benefit of the doubt and an attempt made to cure the condition without a radical operation. In old cases, no matter if they be apparently slight, dilatation is not apt to be successful.

The prospect of cure of penile strictures by dilatation is apparently proportionate to their distance from the meatus. Strictures located anywhere between the meatus and a depth of $2\frac{1}{2}$ inches bear almost the same relation to dilatation, as far as the prospect of cure is concerned, as do strictures at the meatus.

When a stricture of the penile urethra is of small or moderate caliber—that is, below 15 or 16 French—it is often advisable to begin the treatment by dilatation with soft instruments, just as would be done in stricture of the

fixed urethra. If desired, the dilatation may be carried up to a point where the resiliency of the stricture begins to manifest itself; urethrotomy then becomes necessary. Some cases will apparently dilate readily at each sitting, but little progress can be made, as recontraction takes place during the intervals between the operations of dilatation. The canal may be dilated apparently to its fullest capacity, so that it will admit a large-sized sound, and the patient may be discharged, yet in a short time return to his surgeon complaining of a recurrence of urethritis. In such cases exploration with the bulbous instrument from time to time will show whether the stricture is really absorbing or not. When improvement is not steady and permanent, resiliency of the stricture may be suspected, no matter how large a sound the urethra may admit. The recourse in such cases is a cutting operation. Resiliency and elasticity are rarely met with in strictures of the deep urethra. They are, however, the rule in those occurring in the penile portion of the canal. The fact that dilatation is so unsuccessful when applied to strictures of the penile portion, as compared with those of the deep urethra, is probably explicable by anatomical differences in the location of the stricture. In some cases of stricture of the penile portion of the canal the thickening and induration occur principally in the structure of the mucous membrane proper, and just beneath it, rather than in the erectile tissue, and, moreover, the process occurs at a point of normal inelasticity of the canal—*i. e.* at a point which cannot be effectually dilated. The infiltration that occurs in deep strictures is more extensive, and is located principally in the corpus spongiosum, beneath the mucous membrane, at a point where the urethral walls are thick. It is located, moreover, upon each side of the bulbo-membranous junction, and chiefly anterior to it rather than at a point that exactly corresponds to it. The pressure of the sound produces absorption at this point on account of the thickness and succulency of the tissues and the abundance of absorbents. Stricture of the deep urethra is not so apt to be produced by strong injections as in the penile portion. Virulent inflammation is not so severe in the deep urethra, as a rule, as in the anterior portion.

When the urethral mucous membrane is severely abraded the consequent stricture is invariably tougher and more inelastic than under ordinary circumstances. Stricture of the penile urethra is very much like traumatic stricture in this respect; it will be found to be precisely like the latter, or nearly so, in respect to its amenability to treatment by dilatation.

Another point not generally recognized is the relative unrest of a stricture in the penile urethra incidental to varying conditions of blood-supply incidental to erection.

The treatment of strictures of the penile urethra may be briefly summed up as follows:

1. Those located within $2\frac{1}{2}$ inches from the meatus cannot, as a rule, be cured by dilatation, and must be cut.

2. Pronounced cases in any portion of the penile urethra must be cut, either immediately or after preliminary dilatation, in by far the majority of cases.

3. The treatment of marked cases—*i. e.* those of small caliber—may be begun by continuous or gradual dilatation with soft instruments up to the size of 15 or 16 French, or even larger, and in some cases it may be advisable to continue the dilatation with soft instruments beyond this point, until the stricture shows irritability.

4. Strictures of large caliber, strictures of recent formation, and those consisting of points of normal inelasticity that are perpetuating gleet may be

treated by dilatation, the patient being forewarned that the treatment is apt to prove unsuccessful, and that urethrotomy will probably be required, either within a short time or later on, on account of a recurrence of urethritis. In other words, the patient should be informed that the treatment by dilatation, although it may prove efficacious in temporarily relieving the gleet and other symptoms of stricture, may at the same time fail to produce a satisfactory result, and that he will constantly be predisposed to attacks of inflammation from the slightest indiscretion. Should the patient be satisfied with treatment of this kind, it is hardly wise for the surgeon to insist upon an operation.

By the term "internal urethrotomy" in connection with strictures of the pendulous urethra the author means the combined operation of dilating urethrotomy according to the Otis method.

Stricture of the Deep Urethra.—Stricture of the deep urethra implies those contractions that involve "*the bulbo-membranous region.*" Strictures in this location are much more important with reference to serious secondary and complicating conditions that are directly dangerous to life than are those occurring in the anterior portion of the canal. It may be accepted as an invariable rule that the gravity of stricture is proportionate to its distance from the meatus. The structures surrounding strictures of the deep urethra are thick and vascular, and operations for their cure are a much more serious matter than in other portions of the canal. The various complicating conditions of stricture are not only most likely to arise in these cases, but they involve such important structures that the most disastrous results are occasionally produced by them. The selection of the method of treatment becomes, therefore, a question of vital importance, and in a general way it may be said that the more cautious and conservative the surgeon and the more delicate his manipulations, the more likely he is to obtain a successful result. A careful study of the case is necessary to determine the probable existence of serious vesical, and more particularly of renal, complications prior to surgical interference. The duration, condition, and caliber of the stricture and the habits and general condition of the patient must receive most careful attention, as they serve as criteria for the selection of the method of treatment.

In strictures of small caliber that have existed for a considerable time, particularly in intemperate and cachectic patients, serious disturbance of the structure and function of the kidneys is to be inferred, independently of the results of urinalysis. Even in cases of deep stricture of comparatively large caliber care should be exercised if the patient be broken down in health, is intemperate, or if the stricture is of long standing. Although in the majority of cases the danger of secondary and complicating conditions is proportionate to the degree of contraction, it must be remembered that the fibrous deposit of stricture forms and contracts more readily in some patients than in others, so that in some cases a stricture of short duration may be of very small caliber, while in others that have lasted for a much longer time there may be little contraction. Other things being equal, however, the tighter the stricture the greater the danger of renal complications; yet in cases of slow-forming stricture of large caliber the bladder and kidneys may be in a much more serious condition than in other cases of smaller caliber in which the contraction has occurred quite rapidly.

In selecting the method of treatment the surgeon should remember that no method of management of deep strictures has yet been generally accepted as yielding a permanent cure. Inasmuch as radical operations do not promise

enough to counterbalance their danger, we should lean toward conservatism. If an approximately successful result can be obtained by simple and conservative measures, it is certainly unfair to subject the patient to the dangers of a radical operation.

Simple uncomplicated stricture of the deep urethra should be treated by dilatation. If the stricture be of small caliber, it may be necessary to begin treatment by continuous dilatation with soft instruments, one instrument after another being introduced in increasing sizes until the stricture is dilated as far as possible without the use of force. If a soft instrument is allowed to remain in the urethra for a few minutes, it will be found that the next larger size can, as a rule, be quite easily introduced. In cases in which a small instrument is introduced with difficulty it may be left in the canal for from six to twenty-four hours, at the end of which time sufficient absorption of the stricture will usually have occurred to permit of the introduction of a larger instrument and to permit of the passage of the urine beside the instrument while *in situ*. This is a desirable method for the treatment of some cases of tight stricture in which there are considerable congestion and a tendency to spasm, it being oftentimes rather hazardous to introduce and immediately to remove an instrument, because of the danger of spasmodic or congestive retention coming on within a few hours as a consequence of reaction. After the stricture has been dilated to a certain extent this is not so likely to occur. Gradual dilatation performed in a conservative manner, with due regard to general and local measures for the correction of general nervous sensitiveness of the patient and irritability or congestion of the lesion, will generally bring about what is practically a cure in by far the larger proportion of strictures of the deep urethra.

Anesthetics are sometimes necessary for the purpose of facilitating dilatation. In very many persons, as a consequence of nervous excitement and fear, the passage of the instrument produces so much reflex spasm that a comparatively small bougie will produce considerable bruising and inflammation at the site of the stricture. In such patients anesthetics may be required; the preliminary administration of morphine is, however, often successful. It is certainly exceptional that radical operations become absolutely necessary, for, given a patient who is able and willing to visit the surgeon or be visited by him as frequently as may be required, and an operator who has an abundance of patience as well as expertness in urethral manipulations, gradual dilatation is generally successful. The surgeon who regards the urethra as an insensate tube that is susceptible of the various operations of division, cutting, and forcible dilatation without resentment is the one who is able to report the largest number of cases of radical operations for deep stricture. In direct proportion to the degree of gentleness and patience that is exhibited in the management of strictures of the deep urethra will be the success achieved in their treatment.

With all the patience, perseverance, and gentleness that can possibly be brought to bear, however, cases occasionally occur that are not susceptible to treatment by simple dilatation. In some cases the tissue of the stricture is highly contractile and elastic, and resents dilatation beyond a moderate degree, all attempts at further stretching and absorption being followed by chill, exacerbation of urethritis, or painful vesical symptoms. It may apparently dilate quite readily, and yet immediately recontract as soon as the dilatation is suspended for a time. In some patients so much pain and irritation is produced by instrumentation that it is impossible to carry out the treatment by dilatation successfully. This state of affairs rarely exists in

simple strictures, but is frequently observed in those which are complicated.

The conditions requiring radical measures are—

1. *Irritable Stricture.*—In this form the patient is usually nervous and irritable and the urethra hyperæsthetic. Every dilatation is attended by pain and spasm, sometimes with general convulsive manifestations, and followed by chill and perhaps fever. Such strictures are also resilient, and liable to congestion and inflammation, so that attempts at dilatation are not only unsuccessful, but it will be found impossible to pass instruments that were previously admitted with only moderate difficulty. Such strictures are usually of small caliber.

2. *Resilient and Elastic Stricture.*—Although often irritable, this form may be dilated quite readily until the urethra is apparently dilated to its fullest capacity. The symptoms, however, are not completely relieved, and on exploration with the bulbous bougie it is found that although a large-sized sound has readily passed, the stricture is still present. This condition is exceptional in the deep urethra, being more frequent in the penile portion; still, it is occasionally met with deeper.

3. *Recurrent Stricture.*—This form is really a variety of resilient stricture in which resiliency or elasticity does not immediately manifest itself. Such strictures recontract within a short time after cessation of treatment, either spontaneously or from some slight cause. As a rule, resilient, elastic, and recurrent strictures do not exhibit their evil propensities until they have been well dilated, when they become exceedingly stubborn. Very often they are of comparatively large caliber. Other things being equal, such behavior is more likely in stricture of large caliber than in one of smaller size. Like the preceding form, recurrent stricture is more frequently seen in the penile portion of the canal, although occasionally seen in the deeper urethra.

Recurrence of stricture is most rapid and certain in gouty or rheumatic subjects. The habits of the patient have a very important bearing upon this form of stricture.

4. *Very Hard Stricture of Cartilaginous Consistency and Long Duration.*—Strictures of this kind, although often traumatic, may arise from the ordinary cause—*i. e.* virulent urethritis. They are usually tortuous, and instruments are passed with difficulty. Dilatation cannot be carried beyond a moderate degree, owing to the density of the quasi-cicatricial tissue of which they are composed. Strictures of this kind will not dilate—or at least, if they do so at all, they immediately recontract—nor can absorption be induced in them by pressure. Stricture in the deep urethra involving one-half or three-quarters of an inch or more of the canal is apt to present these characteristics.

5. *Hard, Tortuous Complicated Stricture.*—Strictures of this kind are apt to be complicated by serious retention, urethral rupture, and urinary infiltration or fistulæ. There may be considerable infiltration of plastic material, not only in the urethra, but in the cellular tissue of the perineum about it. There is invariably a formation of dense fibro-connective tissue about the parts if fistulæ have developed.

6. *Cases in which Economy of Time is Necessary or the Condition of the Patient urgently Demands Relief.*—Non-resident patients who cannot afford the necessary time and expense involved in gradual dilatation must be included under this head.

Irritable, resilient, and recurrent strictures of large caliber in the deep urethra are best treated by external section, although the combined method

of urethrotomy and divulsion—a relatively small nick being made in the strictured tissue, just sufficient to facilitate rupture—sometimes gives good results. American surgeons, however, are wisely giving up all cutting operations in the deep urethra with the exception of external section. When strictures of this kind are of only moderately large caliber, the tissues being relatively dense and cartilaginous, perineal section is to be preferred, although simple divulsion is often successful.

It will be found in cases of irritable stricture that the more radical operations are, on the average, productive of less constitutional disturbance than repeated attempts at dilatation. The contracted and resilient stricture-tissue is so hyperesthetic that the slightest attempt to stretch it may produce serious results; whereas division by incision or rupture relieves the hyperesthesia at once, and produces comparatively little irritation, the danger from operation being of a direct character and incidental to the possible occurrence of sepsis rather than due to any remote impression produced through the medium of reflex nervous disturbance.

The difference in the results obtained by stretching a contracted and highly sensitive fibrous structure and completely dividing it is well illustrated in certain cases of talipes, torticollis, and other conditions in which fibrous, tendinous, and muscular structures are shortened, and perhaps thickened, by interstitial connective tissue or fibrous deposit. When we find that attempts at dilatation produce severe pain and reflex spasm, with perhaps constitutional manifestations of an alarming character, further attempts at dilatation are contraindicated, and more radical measures, involving division by rupture or incision, are demanded. Complete rest for a time occasionally removes irritability, with subsequent facility of cure by dilatation.

Very hard and cartilaginous deep strictures of long standing, whether complicated or not, require external perineal section. Especially is this true of cases with serious bladder complications. The simpler varieties of complicated stricture do not necessarily call for such radical measures. In these pronounced forms of stricture divulsion and internal urethrotomy are very dangerous as well as unreliable operations. There is great danger of hemorrhage, the control of which is difficult on account of the depth of the operative lesion and the induration of the bleeding tissue, and also the special dangers of septic infection, infiltration of urine, abscess, and fistulæ, due to the tearing of the stricture and surrounding parts, these complications being favored by the heat of the tissues and the impossibility of maintaining a perfectly aseptic condition of the wound.

Internal incision of dense strictures of the deep urethra fails because it is impossible to introduce a cutting blade of sufficient size thoroughly to divide them. Indeed, in order to accomplish complete division the incision in some cases must necessarily cut entirely through the urethra. The relation of urethrotomy to deep strictures is different from that which it bears to strictures in the penile portion of the canal. In the latter the blade of the urethrotome, when properly used, nearly or quite divides the strictured tissue, which involves in many instances—and invariably in strictures of large caliber—only the mucous membrane and a more or less superficial layer of the tissues beneath it. It is of course admitted that there are many cases of penile stricture which are extensively indurated, but these are exceptions to the rule. Dittel has shown some striking cases of this kind. In the dense varieties of stricture of the deeper portion of the canal the blade of the instrument merely makes a comparatively superficial incision in the strictured tissue, and does not completely divide it. It is obvious that complete rup-

ture of strictures of this kind cannot be accomplished without considerable injury to the structure of the corpus spongiosum. Taking these things into consideration, external perineal section is to be recommended from the considerations that—(1) complete division of the stricture is accomplished; (2) complete relief of retention is secured; (3) perfect drainage and a comparatively aseptic condition of the wound are provided for; (4) hemorrhage can be easily gotten at and subdued; (5) it is an indubitable fact that the result obtained by the operation is better and much more easily maintained permanently by occasional dilatation of the urethra than where internal operations are performed.

The author believes there is less danger, even in the comparatively slight forms of stricture in the deeper portions of the urethra, in the performance of external perineal section than in either internal urethrotomy or divulsion.

Cases demanding immediate interference on account of retention are best treated by external perineal section. If, however, the patient can be under the control of the surgeon and there is a fair prospect of a favorable result from conservative measures, the case should be temporized with in the manner that will be shortly outlined until such time as it is practicable to begin treatment by dilatation. Non-resident patients with strictures of large caliber should be operated upon by dilating urethrotomy. In certain selected and exceptional cases divulsion may be judicious. If the stricture be of small caliber, external perineal section should be performed. In some cases of deep stricture, especially when complicated by retention, electrolysis—*i. e.* galvanism—is successful as a temporary measure—*i. e.* as a preliminary to other treatment.

THE SYSTEMATIC TREATMENT OF STRICTURE BY DILATATION.

Instruments.—The instruments used for dilatation of stricture are of three varieties: (*a*) soft and flexible bougies; (*b*) fine, stiff, hair-like bougies known as filiforms; and (*c*) metallic sounds. The soft bougies are made in various patterns, the French and English varieties being most generally used. They are made in two forms—*viz.* (*a*) with a plain conical point, and (*b*) with an olivary tip. Their flexibility varies according to their composition. The best (or French) bougies are composed of a web of woven material covered with rubber. The plain conical form is the most serviceable. The olive-pointed variety is designed chiefly to avoid passing the instrument into any of the crypts or enlarged follicles that so frequently exist in chronic urethral disease.

In selecting French bougies it is best to choose those that are least flexible, as they are apt to be more durable and serviceable than the very flexible forms, which are so limp that they bend upon themselves when they come in contact with the slightest obstruction. The French bougies are unquestionably preferable to the English, but, unfortunately, they are not very durable. The latter variety is less flexible, but much more durable. Filiform bougies—so called because of their thread-like fineness—are composed of rubber, catgut, or whalebone. The whalebone variety is the best. The rubber variety is of the same composition and construction as the ordinary French or English bougies. Some forms of soft bougies are made with a small cap with a thread upon it, that may be fastened to a urethrotome or divulsor, the bougie acting as a guide or conductor for the larger instrument. Soft bougies of considerable length may be procured when necessary to use them as guides for cutting or divulsing instruments. The whalebone variety is stiffer and more durable than those composed of rubber, and if dipped in hot

water the point may be moulded into any form that may be deemed useful for the purpose of avoiding diverticula in the urethra and to prevent the engagement of the bougie in the orifice of the stricture. When used as a guide a tunneled instrument may be passed over them. The late Professor W. H. Van Buren was the inventor of the first tunneled instruments ever used, and should have due credit for them. Some care is necessary in the selection and preservation of filiform guides. It is well to have them at least 18 inches in length. They should be smooth and perfectly straight, excepting when it is necessary to bend them for adaptation to tortuous strictures. A partial fracture of a filiform bougie is a warning to condemn the instrument. Any irregularities, inequalities, or roughness of the filiform guide are likely to catch the loop of tunneled instruments, thus obstructing their passage, and oftentimes a filiform guide is cut through.

Soft bougies and catheters are not so easily managed as stiff metallic instruments, as their flexibility permits them to bend upon themselves when they come in contact with a tight stricture. It is difficult, however, to produce injury with them, and, inasmuch as instruments should be coaxed rather than forced through a stricture, their function in the treatment of strictures of small caliber is of great importance.

During warm weather gum instruments are apt to become soft and sticky; this may be prevented by dusting them with soapstone. Care should be taken to have them perfectly free from oil before putting them away, else they will become soft and worthless. They tend to grow brittle with age, and it is not a difficult matter to break them. Measures should consequently be taken to guard against the use of superannuated instruments. In cleansing soft instruments strong solutions of carbolic acid should be avoided, for if allowed to remain in such a solution for a few minutes the polish is removed from them, and they become rough, their facility of introduction being consequently impaired.

Soft instruments may be introduced with the patient in either the recumbent or standing posture, the latter being sometimes preferable. In practising dilatation soft instruments should be used whenever a smaller size than 16 French is required. In cases of tight stricture in which instrumentation produces considerable pain and spasm the use of soft instruments is absolutely essential until the urethra has been dilated to a moderate size, after which steel instruments may perhaps be substituted.

Sounds are usually composed of inflexible metal, the steel instrument being the most popular. There is an old-fashioned variety composed of soft metal capable of being bent in any form, the use of which is very limited. There are three principal varieties of sounds. The French variety or Beniqué sound has a double curve, whose usefulness is not at all obvious.

The most important features of the steel sound are the shape and length of its point. The English (or Thompson) sound has a point the diameter of which is but slightly less than that of the rest of the instrument, it being comparatively blunt. The curve is rather long, and the point is at right angles with the shaft. Van Buren devised a modification of the English instrument that is very popular among American surgeons. Its point is smaller, more conical, and the curve shorter than that of the English instrument. The Van Buren sound is advantageous on account of its short curve, the form being such as to make the instrument easily controlled by the hand (Fig. 52). There is a disadvantage in the fact that the point is so small and conical that injury at the hands of a careless operator might be produced by it more readily than by the English instrument. As the sound acts some-

what on the principle of a wedge, it is obvious that stretching the stricture is more likely to be forced by the American than by the English instrument.

Care should be taken that the sounds are perfectly clean—*i. e.* aseptic—before their introduction into the canal. Should they become rough, they should be thrown aside or polished anew.

It is desirable for the surgeon to have a second set of sounds with a very short curve and conical point for use in the pendulous urethra. In the majority of cases of stricture it is not necessary to pass an instrument completely into the bladder in order to secure the maximum of beneficial effects from dilatation. Prostatic and vesical irritation is very often caused by the mechanical injury produced by sounds introduced into the urethra for the purpose of treatment of a stricture located several inches anterior to the neck of the bladder. There are in the market several varieties of sounds with a very short curve. After a number of years of careful study of urethral sounds the author has had an instrument constructed which he thinks is far superior to any other he has seen. The shaft of this instrument is much shorter and its point much blunter than those of the sounds in common use.

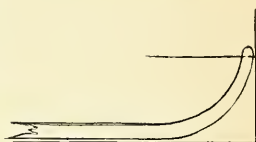


FIG. 53.—Proper curve.

The proper curve for metallic instruments, as already stated, is that known as the Thompson. This corresponds to a circle $3\frac{1}{4}$ inches in diameter. The proper length of arc of such a circle for the beak of sounds is that subtended by a chord $2\frac{3}{4}$ inches long. A shorter curve, however, enables the operator to keep the instrument under better control.

Continuous dilatation is of service in certain cases of tight stricture in which instrumentation is difficult. In cases of this kind considerable nicety of judgment is required as to the advisability of withdrawing an instrument once it has entered the bladder. The practice of continuous dilatation is certainly tempting under such circumstances, and the surgeon is excusable for hesitancy in deciding to remove an instrument that perhaps required the utmost patience and perseverance for its introduction, providing there exists any possibility of benefit if it be allowed to remain. It is usually safe to permit a small soft or filiform bougie to remain in the urethra after it has passed a stricture, and, as a rule, the effect is beneficial, for in a short time it will be found that more or less absorption has occurred, and the bougie that was previously tightly grasped has become loosened, after which it may be removed and an instrument of a larger size introduced.

The first instrument passed should be tied in the bladder and allowed to remain *in situ* for from twelve to twenty-four hours, during which time the urine may escape beside it; it certainly will do so at the end of that time. When the first instrument is removed the next larger size should be immediately introduced, as a certain degree of recontraction may occur in a few minutes and prevent the introduction of another instrument. A certain amount of urethritis is caused by the presence of the bougie, but this is rarely severe, and will subside very soon after gradual dilatation has been substituted for the continuous method. Continuous dilatation should be practised until a No. 10 or 12 French can be introduced, after which gradual dilatation should be instituted. Where it is practicable to do so a very small catheter may be passed instead of a bougie to facilitate evacuation of the bladder in case retention should occur. At the second passage of instruments, as a rule,

a small catheter or bougie may be introduced, even though at the first operation it may have been difficult to pass even a filiform bougie.

The principal objection to the use of the method of continuous dilatation is the danger of cystitis. This may be obviated by daily irrigations of the viscus with a mild, warm antiseptic solution. Sloughing of the urethral mucous membrane with perineal abscess and fistula has been known to occur as a result of this method of treatment. Erichsen records a case of this kind. Such an accident could only occur as a result of extreme distention by forcibly introducing an instrument larger than necessary.

Gradual dilatation is generally the most practicable method of treatment of stricture. It should be begun on about the third day after a preliminary exploration has determined the precise location of the obstruction and the various qualities of the lesion to which allusion has already been made. It may be necessary to vary the interval following the preliminary exploration according to the amount of reaction from the latter. Much depends upon the tolerance of the urethra and the nervous susceptibility of the patient. If a preliminary meatotomy has been performed, it is often well to wait until the meatus has completely healed before going on with the treatment of the deeper portions of the canal, unless the necessity for dilatation is urgent, as in very tight strictures in which retention may occur at any time. The irritation of the raw cut surface produced by the passage of the sound over it invariably gives rise to a certain amount of reflex spasm of the deeper parts of the urethra. As a consequence irritation and inflammation of the stricture may be produced by even a small instrument.

If treatment by gradual dilatation be decided on, it should begin with the insertion of a small sound at the next sitting following the preliminary exploration, or as soon as the meatus has healed, as the case may be. The first instrument passed should be small enough to be introduced without any difficulty. In this way the sensibility of the stricture may be blunted to a certain degree, and the canal opened up, facilitating the passage of an instrument of sufficient size to distend the stricture. After the withdrawal of the small instrument a second should be inserted that is large enough to distend the stricture, but at the same time does not require force for its introduction. If pain and spasm are excited, the sound should be immediately withdrawn. If, however, the urethra tolerates its presence, it should be allowed to remain for a minute or two to secure the full effects of the distention. It should now be removed and the next larger size introduced in the same manner. It is rarely advisable to use more than two, or at most three, sounds at a single operation, a single instrument being best if the stricture be very irritable. If the surgeon undertakes to hurry the matter, he may produce severe urethritis, prostatitis, cystitis, epididymitis, or urethral fever, or cause a perfectly tractable stricture to become irritable and resilient. Any of the accidents that have been mentioned may prove a serious complication, and in addition will inevitably delay the treatment. It is the author's opinion that the surgeon is often responsible for congestion and inflammation, irritability, and resiliency of stricture occurring in the course of treatment by dilatation. One of the cardinal principles that should guide the operator is the avoidance of force, conjoined with efforts to "coax" the stricture to a cure. Nothing is gained by torturing the sensitive tissues by the introduction of too large and too many instruments.

The preliminary administration of anodynes, the continuous use of nervous sedatives and antispasmodics, and, if necessary, anesthetics, are frequently useful adjuncts to treatment by dilatation.

The sudden acquirement of a spasmodic element in a stricture under treatment may indicate renal complication. In one of the author's own cases the formation of a perinephritic abscess was heralded by severe spasm of a stricture then under treatment by dilatation.

At the next sitting dilatation should be begun with an instrument a size smaller than the largest introduced at the previous operation. Should the urethra be very irritable, it may be necessary to pass again as a preliminary measure a very small instrument for the purpose of blunting sensibility. Two sizes should be introduced as before.

The frequency of operations of dilatation should vary according to the exigencies of each particular case. Many surgeons in their enthusiasm for a speedy cure of stricture neglect to study the case carefully, and consequently introduce instruments too frequently. It is not an unusual experience to meet with cases that have been tortured into irritability and resiliency by the daily introduction of sounds at the hands of over-enthusiastic operators. While it is permissible in very tight strictures to introduce soft instruments every day, it is rarely beneficial, and usually injurious, to pass steel instruments oftener than once in three days. In many cases once in four or five days, or even longer, is sufficiently often.

Some patients will complain greatly of pain, severe spasm, and perhaps urethral chill and fever, if the sound be introduced oftener than once a week. Prolonged intervals of rest are essential in some cases.

It is necessary in all cases of tight stricture to begin treatment with soft instruments—perhaps by the method of continuous dilatation. After the stricture has been dilated to a caliber of about 15 French, steel instruments may be substituted. With steel instruments of small size there is great danger of producing injury. Such instruments do not pass of their own weight, but require a little force. The degree of pressure exerted requires some nicety of judgment, as it takes but little force to drive the point of a metallic instrument through the urethra, thus causing a false passage. In some instances it may be necessary to use soft instruments up to a considerable size before substituting sounds.

Dilatation acts in two ways: in the first instance the sound produces stretching of the stricture and temporarily increases its caliber. The next effect is absorption of the adventitious tissue. In order that this may occur it is necessary that a certain amount of reaction should follow the introduction of the sound. It is upon the increase of the nutrition of the part incidental to the slight hyperemia resulting from the mechanical stretching of the stricture that the cure depends. This reaction must be kept within bounds, for when it approximates marked inflammation the condition can only be aggravated by sounding. A slight increase in discharge following the use of the sound is usual; a marked increase is an indication that undue inflammation has been excited, and should serve as a caution against further attempts at dilatation until the parts have had time to recover.

For a short time after the introduction of the sound the flow of urine is facilitated on account of the mere mechanical stretching that the instrument has produced. This enlargement of the caliber of the stricture persists for from twenty-four to thirty-six hours, at the end of which time reaction occurs, with coincident hyperemia of the diseased tissues and an increased activity of nutrition. A moderate amount of swelling results that serves to diminish the caliber of the stricture. Within a day or two, however, absorption begins and continues for several days, at the end of which time recontraction com-

mences. If a sound be introduced during the time the reaction is at its height, inflammation results.

As the reaction produced by the sound diminishes, the benefits of the absorption are apparent in the increased size of the stream. If the operation has been successful, the stream of urine will be larger than before. The rapidity with which reaction comes on, its degree, and the amount and duration of absorption vary greatly in different cases. A careful study of each case teaches the surgeon when another operation is desirable. If the canal be dilated in a routine manner and increasing degree every three or four days, more or less, many disappointments will be experienced. Each case is a law unto itself and should be treated upon its own merits. In some cases the urethra will not tolerate any increase in the size of the instrument for several successive operations, it being necessary to introduce the same instrument several times.

The introduction of the sound usually occasions more or less smarting and a variable degree of pain, that is most marked as the point of the instrument approaches the neck of the bladder. As it passes over this highly sensitive part more or less nausea and faintness may be produced; actual syncope not infrequently results. As already asserted, the patient should never be operated upon for the first few times in a standing posture, although it may be found to be more advantageous later on than the recumbent posture. A semi-recumbent position is perhaps most universally applicable.

Care should be taken that the instrument is well warmed and lubricated before its introduction, else pain and spasm will be greatly enhanced. The best lubricant is albolene, with the bichloride of mercury, 1 in 10,000, in combination with five to ten grains of cocaine to the ounce. Should medicated applications to the canal be required after removal of the sound for the purpose of curing a refractory gleet, glycerin should be used for the purpose of lubricating instruments. Oils coat the surface of the mucous membrane and prevent the proper action of astringent remedies applied by the endoscope or long urethral syringe.

Untoward Effects of Dilatation.—Urethral Fever.—Urethral or urinary fever is an omnibus term applied to certain morbid phenomena that occasionally follow operations upon the genito-urinary tract. These phenomena frequently follow simple dilatation; indeed, a slight operation is often productive of serious results in cases in which severe operations are well borne.

The greatest discrepancy exists in the statements of various authorities regarding the pathology of the polymorphous disturbances known by the various terms of urethral, urinary, and urine fever. This the author believes to be due to the fact that these terms are applied in a haphazard manner to several distinct types of disease consequent upon diseases of, and operations upon, the genito-urinary apparatus; and he is positive that a careful survey of the clinical evidence upon the subject will substantiate this opinion. Urethral fever, as the term is ordinarily used, is a "blanket" term, as broad as the mantle of charity, that comprises a series of widely-varying phenomena following chronic disease or trauma of the genito-urinary tract. Fallacious as the nomenclature of these phenomena may seem to be, we are compelled to select some comprehensive term by which they may be recognized. The term urinary fever is perhaps the most accurate. Unfortunately, however, even this term is suggestive of only one element that may act as a causal factor in the production of the morbid phenomena. Harrison has adopted this term because of his opinion that the so-called urethral fever is invariably

due to morbid changes in the urine at the site of injury, these morbid changes giving rise to the development of toxic materials, which, when absorbed into the circulation, are always inimical to health and often productive of a fatal result.

It is apparent that the term "urethral fever" has been made to include conditions which bear no relation to each other, save in the fact that they have the same point of departure—viz. disease or injury of the genito-urinary tract. It is obvious that nothing else justifies the prevalent nomenclature of the various phenomena resulting from operations in this region. Surgical shock, uremia, nervous symptoms, and sepsis following operations on the urethra and bladder are entirely different conditions. It is true that these different conditions may exist in varying combinations; this does not, however, justify an omnibus nomenclature. How widely different are those cases in which death results shortly after the introduction of a sound, and cases of classical septicemia following genito-urinary operations! yet these distinctive types of disease are included under the head of urethral fever. Much of our recent knowledge of the subject is due to bacteriological studies which prove conclusively that many of the cases hitherto described as classical urethral fever are due to germ-infection or the absorption of germ-products, and should be so designated.

From an etiological standpoint the author believes we are warranted in dividing so-called urethral fever into six forms of morbid phenomena, these varieties, however, being capable of demonstration only in typical cases in each instance. They may merge one into the other, and are all secondary to genito-urinary operations, chronic disease, or injury.

1. The first form, which is by far the simplest, consists of a nervous rigor not succeeded by fever, that follows shortly after operations or injury. This nervous disturbance is, in all probability, due to slight surgical shock, with a resultant vaso-motor disturbance of the peripheral circulation.

2. Traumatic or surgical fever (ferment-fever), due to the same causes and dependent upon excessive reaction from surgical shock—perverted metabolism—in combination with decomposition of fibrin-ferments. This form of fever is quite apt to be modified by a varying degree of septic infection.

3. Toxemia following severe shock, with a resultant perverted elaboration of the urinary secretion and the formation of organic poisons similar to the vegetable alkaloids. Associated with this we have reflex inhibition of the function of the kidney with its attendant uremia, and a perversion of general tissue-metabolism. This we may term the typical form of urethral fever. It is sometimes complicated by convulsions.

4. Classical septicemia, which may prove fatal within a short time or may merge into so-called pyemia, with its characteristic circumscribed and diffuse suppurations in the various organs and tissues of the body. The latter may supervene without the characteristic phenomena of ordinary sepsis.

5. Chronic urinary fever attendant upon obstructive diseases of the urinary organs.

6. Cases of mixed type that combine in varying degrees elements of the first four forms of the disease.

If the above classification be scientifically correct, it is not surprising that the opinions of various authorities in regard to the pathology of urethral fever vary so widely. There must be some explanation for the fact that one authority claims that these varying phenomena are invariably septic; another, that they are due to ammoniacal decomposition of urine and subsequent absorption

of the products; another, that they are due to simple uremia; and last, but not least, that they are due to obscure changes in the urinary secretion and the formation of new and as yet unisolated toxic compounds. It is evident to every practical surgeon that none of these causes are sufficient to explain all of the cases of so-called urethral fever. Simple absorption of healthy urine certainly will not cause the disease, nor will it even produce simple suppuration when introduced into the cellular tissue by hypodermic injection. We do know, however, that urine in a state of decomposition is possessed of most powerful propensities for evil; in fact, there is hardly any organic substance that is so destructive to the vitality of cellular tissue. There is a close resemblance between the effects of extravasation of decomposing urine and those of the poisons of erysipelas, of dissecting wounds, or even the bite of venomous reptiles, so far as their effects upon the vitality of connective tissue are concerned. It is obvious that there must necessarily be pronounced danger of septic infection in all cases of injury or operations upon the urinary organs. The injury or the site of injury is usually such that free drainage is impossible; decomposing urine is usually present, and is productive of more or less widespread death of connective and cellular tissue, and the conditions of heat and moisture are always present. Such an environment, as every biologist is aware, is peculiarly favorable to the development of those minute organisms upon which septicemia and its congeners unquestionably depend.

None of the explanations that have been given will, when taken alone, explain the fatal result which has been known to occur from the simple introduction of a smooth staff into the urethra.

There is also food for reflection in the fact that a simple straight cut in the urethra—such, for instance, as that produced in internal urethrotomy—is productive of less shock in many cases than repeated stretching of the sensitive structures of the stricture by a sound or bougie.

The cure of stricture by gradual dilatation is dependent upon (1) mere mechanical distention; (2) reactionary hyperemia, with increased tissue-change at the site of the organic deposit. The functions of the lymphatics and veins are increased in activity, and absorption takes place very rapidly. It would appear, then, that if the tissue be extraordinarily sensitive, as is frequently the case in organic stricture, and if there be present toxic principles from decomposing urine or ordinary septic materials at the site of the stricture or behind it, the operation of dilatation must necessarily be followed by a degree of nervous shock dependent upon the susceptibility of the individual and the degree of roughness of manipulation, and by a varying degree of absorption of infectious materials. The lymphatics and veins, unfortunately, have not the power of discriminating between those organic substances that are inimical to the welfare of the individual and those which can be disposed of in a physiological manner without injury to the blood or tissues, and they therefore take up the poisonous materials simultaneously with the products of retrograde tissue-change.

The urethra of organic and functional disturbance of the kidneys to so-called urethral fever is a most intimate one. There is probably no case of long-standing obstructive disease of the genito-urinary tract that is unaccompanied by functional aberration of the kidneys, and in a large proportion of cases there occurs later on actual organic change in the renal tissues. This condition of affairs is to be anticipated, and should be given serious consideration in every case of chronic urinary disease. The immediate effects of the kidney difficulty may not be marked because of the activity of vicarious

elimination by the skin and bowels, this vicarious action constituting the means by which the system accommodates itself to the imperfect elimination of the constituents of urine. There are very few persons, even among those who term themselves healthy, in whom the bodily sewage is perfect, and it is obvious that when the kidneys perform their functions imperfectly this condition becomes one of vital importance. When, as a consequence of operations upon the genito-urinary organs, surgical shock is produced, reflex hyperemia of the kidneys is quite apt to result. This causes a strain upon the renal circulation, which in its impaired condition it is unable to withstand, and as a consequence its functions are completely inhibited, with resultant uremia.

To those familiar with the physiology of the nervous system in its more intimate relations to visceral functions the association of renal aberration and reflex irritation will be readily understood. Many interesting examples of urinary suppression from reflex inhibition of renal function have been observed.

Peyrani has shown that the sympathetic nerves have a remarkable influence over the secretion of urine, galvanization of these nerves increasing the amount of urine and urea, while section causes both urine and urea to sink to a minimum.

The subject of autogenesis in its relations to the development of certain constitutional diseases demands more attention than is usually accorded it, and it is probable that physio-chemical researches in this direction will in future shed light upon many diseases the etiology of which is now obscure. It is probable that perverted tissue-metabolism bears a causal relation to the typical cases of urethral fever. Perverted physio-chemism may quite readily be brought about by surgical shock, this being especially marked in the glandular tissues. We know quite well that mental emotions of various kinds and those impressions upon the nervous system that result in the condition which we term "shock" may produce marked changes in the physiological secretions of the body, these changes consisting either in an increased or diminished flow or obscure chemical changes of composition; thus we may have, through various nervous impressions, an increase or decrease in the quantity of the saliva, the lacteal secretion, the gastro-intestinal secretions, the urine, and the menstrual flow.

A familiar illustration of the effect of various emotions upon physiological secretions is the change in the quality of the lacteal secretion induced by fright, anger, or grief. This change, although occult and incapable of demonstration by microscopical or chemical research, is most pronounced in its morbid effects upon the child, cholera infantum of a most fatal character being a frequent sequel to the emotion of anger in the mother. Precisely what this change in chemical composition may be is an open question, but it is possibly a species of decomposition that results in the formation of a poison analogous to the "tyrotoxin" discovered by Professor Vaughan in impure cow's milk. It is well known, too, that sexual excitement in the cow is productive of marked changes in the milk and renders it unfit for human food.

If the changes above indicated occur in one secretion, it is highly probable that all of the physiological secretions are susceptible to them. It is possible in the case of the saliva that the emotion of anger causes the development of toxic principles in that secretion.

The difficulty of proving this theory in the present state of our knowledge of physiological chemistry is obvious. In the case of the urine the influence

of surgical shock may possibly consist of the development of organic poisons in that secretion. These may be considered to be hypothetically analogous to ptomaines and leucomaines.

In some cases the development of uremia or toxemia is very gradual, and results from successive operations upon the urethra. The poisonous materials may accumulate in the system for some time, and their presence fail to manifest itself until the system is ready for the "explosion," when a previously well-tolerated and comparatively slight irritation of the genito-urinary apparatus will be sufficient to develop a serious result.

The danger of the development of urethral fever is directly proportionate to the depth of traumatic and surgical injuries of the urethra—*i. e.* their distance from the meatus. Those situated in the pendulous portion of the urethra are not, as a rule, very dangerous. The explanation of this is simple, the nerve-supply of the deep urethra being much more abundant and sensitive, the cellular tissue more abundant, and the opportunities for drainage much less favorable than in the pendulous urethra.

The relation of germ-infection, or the absorption of the products of germ-evolution, to the septic varieties of urethral fever is a most important one.

The clinical features of the various morbid phenomena included under the head of urethral fever require some special consideration :

The nervous form of the disease usually appears in patients of an impressionable constitution, or who, in other words, present a decided tendency toward neurotic disturbances. Oftentimes its occurrence may be anticipated by the behavior of the patient while he is under instrumentation. He is quite apt to have nausea, perhaps vomiting, slight rigors, partial or complete orgasm, or more or less syncope during the passage of instruments into the deep urethra. Such patients are apt to develop a sharp chill within twenty-four hours after urethral operations or injuries. This lasts for a variable time, being rarely prolonged, and then disappears, leaving the patient as well as before, with the exception perhaps of more or less mental depression. There may be a slight amount of fever or sweating. The chill may come on within a few moments after the operation.

The traumatic form is the most common : it manifests itself by a sharp chill, usually within twenty-four hours after operations or injuries of the genito-urinary tract, and is followed by pronounced fever and sweating. The disturbance either passes off after a single paroxysm or is followed by a period of general malaise, with perhaps a recurrence of the paroxysms for several days. In these latter cases a slight septic element is in all probability present.

The third form—the typical urinary fever—may or may not be attended by a violent chill coming on within twelve to thirty-six hours. There are marked prostration, violent vomiting and diarrhea, coldness of the surface of the skin at first, succeeded by more or less febrile movement if the patient survives, with suppression of urine, merging in a very short time in fatal cases into coma of an apparently uremic type. The author says "apparently uremic type," because, according to the theory already advanced regarding the action of shock upon the urine, there is probably in many cases a toxic element independent of uremia. Cases of this kind may come on gradually and manifest themselves by a sudden explosion in the form of convulsions.

The fourth or septic form of urethral fever manifests itself usually by a slight (but sometimes by a very severe) chill : this is followed by fever of varying degree of severity. The patient may sink into a typhoid condition or become comatose, and die within two to ten days from acute septicemia, or

the condition may be subacute and merge into the pyogenic form of infection, known more familiarly as pyemia, in which event the patient finally succumbs to the slow development of circumscribed or diffuse purulent deposits in the joints, viscera, and other structures of the body, dependent upon infection by pyogenic microbes and their products.

The fifth or chronic form of urinary fever may be described as a chronic condition of toxemia and nervous irritation produced by long-continued obstructive and inflammatory affections of the genito-urinary tract. This condition of toxemia and general nervous irritation is one that is not generally recognized, but is very important in its relations to chronic genito-urinary disease. It exists in the majority of cases of organic stricture of long standing, in old men suffering with prostatic hypertrophy, in tumors of the bladder, in chronic cystitis from whatever cause, and in pyelitis, particularly the form due to the presence of nephritic calculus. In patients suffering with these affections there is a marked tendency to a mild form of hectic fever; flushing of the face with slight elevation of temperature, and perhaps followed by a certain degree of perspiration, is quite common; nervous irritability is especially marked. Indeed, there are few conditions that are productive of so much mental depression and irritability of temper as chronic diseases of the genito-urinary tract. In all of these cases there is apt to be more or less obscure rheumatic or neuralgic pain in various situations. After prolonged retention of urine from any cause it will be found that the majority of patients will present for a few days or weeks more or less elevation of temperature.

The different general conditions that have been outlined are due, in the author's opinion, to a toxemia dependent upon (a) imperfect elimination of the products of retrograde tissue-metamorphosis; (b) to a greater or less degree of absorption of morbid materials produced by inflammation and the decomposition of residual urine behind the site of obstruction—*i. e.* to pseudo-alkaloidal germ-products. It will be observed that many patients suffering from chronic genito-urinary disease of an obstructive or chronic character fail to realize how sick they are until the diseased condition has been removed or at least improved; they then find that slight disturbances to which they had paid comparatively little attention, and which they had never thought of attributing to their urinary trouble, have disappeared. This is due in great measure to the fact that reflex nervous irritation has been relieved, but, more than this, to the fact that absorption of poisonous materials no longer occurs.

It is obvious that the range of cases which may properly be classified as urethral or urinary fever is rather limited. Those cases resulting from septicemia and surgical shock are certainly improperly so classified.

It has been the author's experience that patients suffering from paludal poisoning are especially apt to develop chill and fever after genito-urinary manipulations.

Treatment of the Conditions usually termed Urethral Fever.—The principal measures of treatment are of a prophylactic character, for, unfortunately for the patient, the marked forms of the disease—*i. e.* the septic and uremic varieties—are seldom recovered from. The principal feature of prophylaxis should consist of strict attention to the principles of genito-urinary hygiene. If the functions of the kidney are stimulated by alkaline diuretics and the skin and bowels kept in an active condition, thus affording vicarious relief to the kidney, the patient is placed in the best possible condition to avoid those complications that have been described. In addition to these measures moderate doses of antiseptic drugs may be given internally. The best uri-

nary antiseptic in the author's experience is the oil of eucalyptus, administered in doses of ten minims every three hours. This may be advantageously combined with salol in ten-grain doses.

Local antiseptics in cases of chronic bladder and prostatic disease is of course essential, and can be accomplished by irrigation with mild antiseptic lotions, such as carbolic acid, borate of soda or boric acid, potassium permanganate, and the bichloride of mercury. The surgeon should, if possible, avoid operation in cases complicated by structural renal disease; if operation be unavoidable, he must be very careful in his manipulations and guarded as to prognosis. Prior to operation attention should be paid to the urine and local antiseptics. The patient should be put to bed and given a milk diet and moderate doses of quinine—two to five grains three times daily—for a week or ten days.

Various drugs have been recommended for administration just before or at the time of urinary manipulations or operations. Quinine and morphine are the most popular remedies, and unquestionably increase the resisting power of the nervous system, thus lessening the liability to shock. Jaborandi is also recommended for the same purpose, and, inasmuch as its physiological action is such that it must necessarily relieve any strain upon the kidney, this drug seems to the author to be one of our most philosophical remedies. Hypodermic injections of the muriate of pilocarpine may be given instead of the fluid extract of jaborandi. In case uremia supervenes, this method of administration is absolutely essential.

The milder cases (the nervous and traumatic forms) are rarely fatal, but may possibly lead to the severer forms of the disease. The administration of opium and jaborandi, with perhaps (in the traumatic form of the disease) aconite or veratrum viride, constitutes the best treatment at our command. If uremia occurs, our attention should first be directed to the vicarious elimination of urea: valuable time may be lost in attempting to restore the functions of the kidney within the first few hours after the supervention of uremia, particularly if coma has occurred. Pilocarpine acts upon the skin even when the patient is comatose, and should be given freely. The bowels should be moved by croton oil, two or three drops of which, in combination with five or six drops of olive oil, may be placed upon the back of the tongue. If the patient is able to swallow, elaterium in doses of from one-eighth to one-third of a grain is preferable to all other hydragogues. Hot baths should be given and dry or wet cups applied over the region of the kidneys. Digitalis may be given internally as a diuretic after the emergency is over, but it is bad practice to attempt to accomplish anything by diuretics before vicarious elimination of urea has been attended to.

Urethral irrigations with solutions of bichloride 1 in 20,000 before and after manipulations of the canal will, in the majority of instances, prevent septic infection.

Measures to ensure a perfectly aseptic condition of the instruments used for exploration and dilatation of the urethra constitute an important means of prophylaxis of sepsis. Sounds when introduced should be carefully warmed and lubricated with some antiseptic ointment, and care should be taken that they are perfectly smooth.

When septicemia or pus-infection develops in spite of all precautions, little can be done in the majority of cases beyond supporting by free stimulation, a fatal result being almost inevitable. It is, however, the duty of the surgeon to attempt to avert a fatal result by incision and drainage where possible, and, if the case is clearly septic, a free incision if the stricture be

perineal, or a perineal or suprapubic cystotomy in cases of bladder and prostatic trouble, is indicated.

The management of cases of chronic urinary toxemia consists in local antiseptics by irrigation and the prompt removal of the organic conditions upon which the gradual and constant septic infection depends.

Nervous manifestations due to the introduction of sounds and bearing a certain relation to so-called urethral fever are so frequently seen that they are worthy of special consideration, even at the risk of repetition of some points embraced in the preceding general discussion.

There exists in some individuals of a nervous temperament extreme hyperesthesia of the urethral mucous membrane, particularly in the prostatic portion of the canal. The nerves of sexual sensibility are apparently involved in the hyperesthesia and enter into the causation of the direct and reflex nervous results of instrumentation. Shivering, a sense of faintness, cold perspiration, and perhaps nausea are not infrequently noted during the passage of instruments into the bladder. These symptoms usually begin as soon as the instrument enters the membranous urethra, and increase as the neck of the bladder is approached. They usually pass off immediately, but may recur and constitute the nervous form of so-called urethral fever already described.

The precise cause of these nervous manifestations is difficult to determine. They are probably due in the first instance to an impressionable nervous system and timidity. They may, however, occur in individuals of strong constitution and of undoubted physical and moral courage. There is, nevertheless, no question but that a dread of the operation of dilatation has much to do with the etiology of the nervous phenomena described.

In this connection it is well to remember the intimate association of the nervous supply of the genito-urinary tract—and particularly the parts about the neck of the bladder and prostate—with the sympathetic ganglia. It is certainly true that in some individuals relatively slight disturbances of these parts produce a most profound and depressing effect upon the sympathetic nervous system, and incidentally upon all the vital functions. The modus operandi of such disturbances is probably through a reflex impression made upon the sympathetic ganglia through irritation of the nerves of sexual and general sensibility supplied to the parts involved. Conversely, it will be found that stimulation of this region within certain limits has a decidedly stimulating and even tonic effect that is beneficial to the general system. There are many disturbances of a nervous character that are purely reflex and referable to irritations of the sexual apparatus, independently of the previous existence of actual inflammation in these parts. As a matter of common experience it is noted that inflammations about the neck of the bladder and prostate are attended by relatively greater constitutional depression than similar morbid conditions of apparently much greater importance located in other situations. This is only explicable upon the theory of a reflex impression produced upon the sympathetic nervous system.

Urinary fever, and even minor disturbances, very rarely occur in women, in whom the urethra is relatively much more sensitive than in the male. Then, too, the seat of sexual sensibility is not located in this portion of the female anatomy. Erichsen states that he has only once seen symptoms of urethral chill in the female.

The liability to nervous and febrile disturbances following instrumentation of the urethra is modified to a great extent by the location of the morbid condition that is being treated. Dilatation of stricture in any part of the

urethra may produce such phenomena, but they are most likely to occur after operation upon strictures in the deeper portion of the canal, not because—as has been erroneously stated by some—the deeper portions of the canal are more commonly strictured, but because these parts are more closely associated with the nerves of sexual sensibility and the filaments supplied by the sympathetic system.

Erichsen speaks of one case in which a fatal chill followed incision and dilatation of the orifice of the urethra. A case of this kind might occur as a result of reflex inhibition of the function of the kidneys produced by nervous shock. It is well known that strictures at the meatus often produce serious nervous disturbance, reflex spasm, and vesical troubles, and it is conceivable that an operation upon this sensitive part might have a very profound effect upon the nervous system in some cases. Such an effect, no doubt, might result in reflex hyperemia of the kidneys, with complete inhibition of their functions and the supervention of uremia following the purely nervous manifestations induced by the operation.

Urethral chill and fever are not very often met with unless some actual lesion of the mucous membrane exists, showing that a large proportion of these cases are due to the absorption of some toxic material.

It is well to remember that, independently of all theoretical reasoning as to the precise causation of the various forms of urinary fever, there are certainly three elements to be considered—viz. (1) An impression of a purely nervous character; (2) a condition of toxemia due to the absorption of septic materials from the affected mucous membrane; and (3) a toxic condition of the blood incidental to the retention in it of the products of retrograde tissue-metamorphosis incidental to inhibition of the function of the kidneys, and which in lieu of a better term we call uremia. These three elements may exist singly or combined.

It has been noticed that metallic instruments are more liable to produce chill and urinary fever than are the soft varieties. The only reason for this that the author can suggest is that soft instruments are used in comparatively small sizes, and their introduction is so easy that it would be a bungling operator indeed who could succeed in producing injury; whereas even in skilful hands the use of the steel sound or metallic catheter is likely to produce a relatively marked disturbance of the normal mucous membrane and of the lesion. The majority of practitioners who are called upon to introduce instruments into the urethra are by no means expert in the necessary manipulations, and are therefore more likely to produce injury with a stiff and inflexible instrument than with one that is comparatively harmless like the soft bougie.

It is to be remembered that, as already suggested, a condition of chronic uremia underlies many of the cases of rigor and fever following instrumentation of the urethra. The nervous system under such circumstances is in a perpetual state of irritability, and it is only necessary for some slight shock to occur to precipitate a nervous crisis. This shock is afforded in some instances by even the most delicate manipulations of the canal.

The occurrence of the various symptoms described may be prevented in a large proportion of cases by gentleness in manipulation and a careful study of the condition of the case at the time of each instrumentation.

The administration of anodynes, the use of hot baths, diaphoretics, and other derivative and eliminative measures of treatment, with the careful use of cocaine in mild solution and moderate quantity at the time of the operation, are very useful in the prevention of disagreeable nervous results.

The administration of morphia just before the operation in very sensitive patients, or just after it as a matter of routine until the tolerance of the patient for instrumentation has been established, is a very useful measure. Quinine, morphia, jaborandi, and perhaps diuretin, are the only remedies that are generally recognized as valuable in the prevention of urethral chill, and it is noteworthy that they are all remedies which act selectively, so to speak, upon the nervous mechanism. Eucalyptus, however, the author holds to be of great value, especially where the malarial cachexia exists. The use of hot antiseptic irrigations of the canal before and after operation in cases in which urinary fever is apprehended is a very rational procedure, as has already been suggested.

When it is found that serious nervous disturbance or urethral fever follows each operation of dilatation, more radical measures of treatment must be substituted for it. Urethrotomy in such cases is far safer than dilatation and constitutes the only feasible method of cure.

Extra sensibility of the urethra, and incidentally of the nervous system, is very frequently observed in cases in which the urethra is being operated upon for the first few times. This local and general hyperesthesia, however, becomes blunted within a comparatively short time, and after a few *séances* it will be found that the operation will be well tolerated. In some exceptional cases, however, the urethra remains permanently intolerant of instruments, and, no matter for how long a period the treatment may be continued, severe spasm, nervous shock, and perhaps rigors, will be produced by instrumentation.

Hemorrhage and False Passages.—Hemorrhage is a frequent result of the introduction of urethral instruments. As a rule, the author believes that its occurrence is an indication that undue force has been used. In most cases when the operation of dilatation is productive of hemorrhage the instrument used is too large or has been forcibly introduced. An instrument that will enter the bladder by its own weight will rarely produce bleeding, as the stretching of the stricture-tissue is accomplished in a gentle manner. In very tight strictures, and in those in which there is considerable congestion and spasm, the introduction of any instrument, however small, is liable to produce hemorrhage. When, therefore, the surgeon finds that the introduction of an instrument that will enter the bladder without the employment of force is followed by bleeding, he may infer that there exists considerable congestion at the site of the stricture. The hemorrhage, *per se*, is not injurious, but, on the contrary, is very beneficial by producing local depletion. If, however, it results from forcible catheterization, the reaction following the traumatism produced by the instrument more than counterbalances any possible benefit that might be derived from the abstraction of blood.

Some cases in which congestion exists as a predominating condition will bleed occasionally after the act of urination, and particularly if the patient has recently indulged in intercourse or has become sexually excited. Strictures of this sort are particularly apt to occur in intemperate individuals or those who have suffered from syphilis. Under such circumstances the utmost gentleness in the introduction of instruments will not prevent the occurrence of more or less hemorrhage. It is rarely necessary to treat the hemorrhage; in fact, it should be allowed to continue within reasonable limits. Should it, however, become excessive, the application of the cold-water coil or ice-bag will usually check it.

False passages more frequently result from the introduction of sounds and bougies than is generally believed. They are produced by the passage of the

instrument through the urethral walls into the surrounding tissues. The mucous membrane only may be torn up, in which case the passage rarely extends for a great distance, or the corpus spongiosum may be entirely penetrated and the tissues of the perineum entered. The danger is greatest with small metallic instruments, it being rather difficult to produce injury with flexible bougies or catheters. The common English catheter with the stylet is, however, nearly as dangerous as metallic instruments.

In pack-thread or bridle strictures numerous pockets are apt to exist in the canal, or there may be a sort of membranous diaphragm thrown obliquely across the urethra in such fashion that the instrument impinges upon it just at its junction with the urethral walls, instead of entering the orifice of the stricture. Under such circumstances the conditions necessary to the production of a false passage are very favorable, and it takes but little force to perforate the urethra.

Symptoms.—The occurrence of this accident is usually quite evident at the time of operation. The surgeon is usually conscious of having used considerable force or of carelessness in respect to conforming the instrument to the natural direction of the urethra. The obstruction suddenly yields to the pressure, and the direction of the handle of the instrument demonstrates that the point is thrown out of the proper line. If the handle of the instrument be rotated between the thumb and fingers, it will be found that the point is fixed, thus showing conclusively that it cannot have entered the bladder. When the bladder is entered the point of the instrument is usually freely movable within the cavity of the organ, and there is no sense of resistance imparted to the handle when rotated.

Under exceptional circumstances the instrument may not only be forced through the urethral walls into the tissues outside it, but passed completely on until the bladder is perforated. Coincidentally with the alteration in the direction of the instrument the patient complains of severe pain and perhaps a sense of impending syncope, and is apt to assert that something has been torn. Free bleeding almost invariably results. If a rectal examination be made, the beak of the instrument may be detected in the connective tissue between the vesical and rectal walls.

False passages are usually formed in the deep urethra, as it is here that the lever action of the sound can be exerted to the best advantage, and, moreover, it is here that strictures so tight as to demand the use of small instruments are usually found. It is not so easy to produce false passages in the pendulous urethra, as the point of the instrument is continually under the control of the fingers and its proper direction is easily maintained.

The danger of false passages is directly proportionate to their distance from the meatus. Their direction is usually to one side of the canal. They may, however, perforate beneath it or above it. When they occur above it, they are not likely to penetrate for a great distance on account of the firmness of the tissues. The corpus spongiosum, or even the prostate, may be completely perforated when the false passage occurs below.

The character of perforation has also much to do with the degree of danger. If the false passage enters the corpus spongiosum and runs along the urethra, perhaps to open again into the canal, or if the bladder be entered after a lateral lobe of the prostate has been perforated, the danger to life is comparatively slight. When, however, it passes clear outside the corpus spongiosum into the vesico-rectal areolar tissue, serious extravasation of urine may result, with consequent inflammation, suppuration, or perhaps gangrene of the surrounding tissues.

Old false passages are occasionally very annoying, and frequently interfere not only with treatment, but prevent a complete relief of symptoms, even though the caliber of the canal be restored. As a rule, the history justifies a suspicion of the formation of a false passage or passages at some previous instrumentation. The abnormal direction of the sound, failure to enter the bladder, and the peculiar gristly sensation imparted to the instrument are often sufficient to indicate its existence. Oftentimes the patient is aware of the presence of the false passage. Occasionally he will know that the abnormal channel has been penetrated by the instrument when its course is not evident to the surgeon. In some instances only the most careful study of the symptoms and course of the case will enable us to determine the true condition.

Acute inflammation of the urethra, prostate, bladder, and epididymis is a by no means infrequent complication of stricture arising as a direct consequence of instrumentation. Following dilatation of stricture there is always a moderate amount of inflammation. This reaction, however, may be limited to the stricture itself. There may occur, on the other hand, a sharp attack of urethritis. Much depends on the condition of the urethra at the time of dilatation; of more importance, however, is the degree of cleanliness and gentleness displayed in its introduction.

Inflammation of the prostate, incidental to the rough introduction of instruments, is an occasional result of dilatation. It should be remembered that the prostate is invariably congested and irritable as a consequence of the bruising to which the organ is subjected during frequent and spasmodic efforts at urination. In this condition of affairs comparatively slight traumatism may cause prostatitis. This may appear in an acute form as a consequence of a single act of violence, or it may appear in a subacute or chronic form as a result of repeated bruising and irritation. Abscess may occur, especially if trauma and infection be produced by a septic sound.

Cystitis in the course of stricture arises in several ways:

(1) It may be due to actual violence done the neck of the bladder by large instruments.

(2) It may result from the prolonged contact of instruments with the neck of the bladder in continuous dilatation. Ulceration of the bladder-walls may result from pressure produced by the point of the sound.

(3) Pre-existing chronic cystitis of the vesical neck, due to direct extension of inflammation from stricture, may be so enhanced by the irritation produced by the introduction of instruments that acute generalized cystitis and perhaps pericystitis result.

(4) A small quantity of poisonous material, formed by bacterial evolution posterior to the stricture, is carried by the point of the instrument to the deep urethra and sets up acute inflammation which extends to the bladder.

The relation of bacterial organisms—not necessarily “specific”—to the morbid processes at the site of stricture and to cystitis is a very important one.

(5) Poisonous materials—*i. e.* bacterial organisms or their products—may be conveyed to the bladder through the medium of unclean instruments.

Epididymitis is one of the most frequent complications of stricture. It may be produced in two ways: (*a*) by the production of acute inflammation at the site of the stricture, which extends down to the mouths of the ejaculatory ducts and thence to the epididymis; (*b*) by the conveyance of organic poisons to the mouths of the ejaculatory ducts *via* the sound or catheter.

It is desirable for patients under treatment for stricture to wear a suspensory bandage if the testes are sensitive.

These various complications of stricture may be avoided in most instances if the patient keeps quiet, is temperate, and follows directions implicitly, and, more important still, if the surgeon is gentle in his manipulations and absolutely cleanly as regards his instruments.

OPERATIVE TREATMENT OF STRICTURE.

Divulsion.—Divulsion of stricture consists of its rapid and forcible dilatation with the object of rupturing the morbid tissues. It originated, in all probability, in England, where it is still a very popular operation.

Various instruments have been devised for the operation of divulsion. Some of these consist of sliding tubes of varying caliber which are forcibly introduced over a central guide. Another variety splits the stricture after the fashion of a wedge. Still another, and the most popular variety, consists of several parallel blades separable by means of a powerful screw.

Divulsing tubes were first used by Desault about one hundred years ago. They are used in the following manner: A small bougie is introduced into the bladder as a guide; over this an open-ended catheter is passed, and over this another catheter or tube a trifle larger, as much force as is necessary being used. A succession of tubes of increasing size are passed until the urethra is dilated to its fullest capacity.

Divulsion upon the wedge principle was first recommended by Reybaud, and has been modified to a certain extent by Mr. Holt of England. Holt's instrument consists of two grooved blades of strong metal joined at their points. Between the two points and fastened to them at their point of junction is a wire that acts as a guide; over this wire a tube of considerable size is forcibly passed. This separates the blades and splits the stricture. It is claimed by Holt that the rupture produced by the instrument does not extend beyond the morbid tissue, the healthy urethra not being injured. The accuracy of this statement is certainly questionable. The author does not believe it possible for a stricture of any extent to be ruptured without injury to the urethra.

Divulsors with separable blades are the most popular instruments for the rupture of strictures.

Various patterns of the screw divulsor have been devised; they have been made with two, three, and four blades. The best divulsor is probably that of Sir Henry Thompson, which has two strong, separable parallel blades. This instrument may be used for the purpose of rapid dilatation by slowly separating the blades with successive turns of the screw, or it may be used to rupture a stricture by separating the blades as rapidly as possible. When the operation has been slowly done there is very little bleeding, and probably little or no laceration of the wall of the urethra.

Divulsion is not very popular at the present time among the leading surgeons in America. It still, however, has many advocates in England and on the Continent, where urethral surgery is far behind that of this country. The operation appears to the author to be a very unsurgical one. Unless considerable damage is done at the site of the lesion it is apt to fail of its object. Rapid stretching, unless attended by complete rupture of the stricture, will usually serve only to inflame and irritate the stricture tissue and cause it to become resilient and irritable. It is, perhaps, a safer operation than internal urethrotomy in the deep urethra, but external perineal section is safer by far than either of these operations in cases of pronounced stricture.

Resilient, elastic, and recurrent stricture of large caliber in the deep urethra may sometimes be divulsed with advantage. In these strictures gradual dilatation is usually carried on until the morbid tissue is very slight in amount and involves but a superficial extent of the urethra and the sub-lying connective tissue. Under such circumstances urethrotomy may be objected to on account of the danger of hemorrhage, and external perineal section for such slight lesions is likely to be considered severe. Divulsion under these circumstances is a useful operation. Dilating urethrotomy carefully performed may be justifiable in such cases.

The operation should be followed by gradual dilatation. A steel sound of moderate size is to be introduced four or five days after the operation, the time varying with the amount of inflammation resulting from the rupture of the stricture. An instrument should be passed at first every third day, the intervals being subsequently lengthened.

Internal Urethrotomy.—Internal urethrotomy consists in division of the stricture by cutting instruments. These are practically of three kinds—viz. (1) those which cut the stricture from before backward; (2) those which cut from behind forward; (3) those which, in addition to a cutting blade passed through a hollow central guide, have two separable blades, the object of which is to complete the operation by divulsing or tearing any of the fibers of the stricture that may still remain after the incision. The only reliable instruments for internal urethrotomy are those of Maisonneuve and Otis and their modifications. The most satisfactory instrument is the Otis dilating urethrotome.

Maisonneuve's instrument cuts from before backward, and is especially serviceable for the division of strictures of the deep urethra. It consists of a hollow tube with a slit on the side corresponding to the roof of the urethra. Triangular knives of different sizes fastened to a wire shaft are passed along this central tube after its introduction into the bladder until the stricture is divided. This urethrotome is supplied with a screw tip to which a filiform bougie may be attached. The principal objection to the use of this instrument is that it never divides the stricture completely unless a very large blade is used, in which event much more cutting is done than is absolutely necessary, and serious hemorrhage is apt to result.

The latest pattern consists of a straight tunnelled shaft with a secondary blade, the two being separated by means of a powerful screw. The cutting

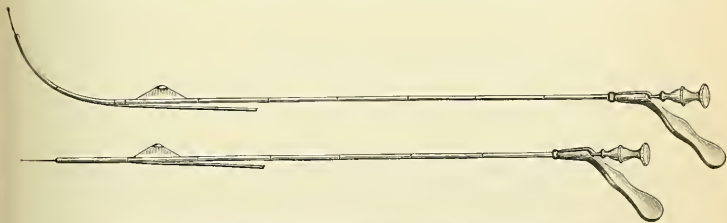


FIG. 53.—Dr. F. Tilden Brown's modification of Maisonneuve's urethrotome.

blade is slipped along in a groove upon the central shaft. Attached to the handle near the screw is a dial-plate. By this instrument the urethra may be cut, or dilated and cut, to a caliber of 45 French. Another modification is that of Dr. F. Tilden Brown, which consists in the adaptation of a slender

tunnel at the distal end, and of a handle set at an angle at the proximal end, of the instrument (Fig. 53).

General anesthesia is only occasionally necessary in the performance of internal urethrotomy. In very nervous patients it is perhaps essential. It must be remembered, however, that when a general anesthetic can be avoided, especially in chronic genito-urinary cases, it is well to do so on account of the possible evil effects of the anesthetic upon the kidneys. The author recognizes the fact that cocaine has something of an unsavory reputation in certain quarters, especially in urethral surgery. He believes, however, that if used in relatively weak solutions it is perfectly safe. Internal urethrotomy may ordinarily be performed with a 1 per cent. solution of cocaine in a 1 per cent. solution of carbolic acid; 4 per cent. should rarely be exceeded in the urethra. Before any surgical operation upon the urethra the canal should be flushed by solution of bichloride of mercury in a strength of 1 in 20,000 to 1 in 10,000.

Operation.—The number of strictures and the distance from the meatus having been estimated as accurately as possible, the dilating urethrotome



FIG. 54.—Otis's dilating urethrotome.

(Fig. 54) is passed down until the point upon the shaft at which the blade will first appear when withdrawn is about half an inch behind the stricture. The blades are now separated by turning the screw until tension of the stricture is evident; the cutting blade is then to be steadily and with moderate rapidity withdrawn. The dilating blades are now separated to the required extent. They are then screwed together again and the instrument withdrawn, care being taken not to catch the mucous membrane between the blades during withdrawal. Exploration with a full-size bulbous bougie should now be made to determine whether the strictures have been completely divided. If the urethra is not perfectly free, the urethrotome should again be inserted and used in the same manner as before. The operation is to be completed by the passage of a full-size steel sound. After the operation the urethra should be irrigated with a hot saturated solution of boric acid or bichloride-of-mercury solution, 1 : 20,000. The patient should be put to bed, and if there be much hemorrhage, an ice-bag or the cold-water coil applied to the parts.

The determination of the size to which the urethra should be enlarged involves some nicety of judgment. The only fixed standard that has ever been advanced is that of Dr. Otis, already described. It would seem essential to repeat its essential points at this juncture. According to Otis, the average size of the urethra, as determined by numerous measurements with the urethrometer, is as follows: When the circumferential measurement of the penis is three inches the urethra should admit a sound No. 30 French. With each eighth of an inch increase in the circumference of the penis the urethra is supposed to increase one-third of a millimeter in diameter; that is, it should admit one size larger upon the French scale. Thus the circumference of the penis being $3\frac{1}{8}$ inches, the urethra should take 31; with a circumference of $3\frac{1}{4}$ inches, 32, and so on. A circumference of $4\frac{1}{4}$ inches is rarely exceeded. In such cases the urethra should admit at least 40 French. Dr.

Keyes's remarks upon this point will doubtless be endorsed by the majority of surgeons. He speaks as follows: "If the surgeon desires to enlarge the patient's stricture as widely as he can in safety, and desires a test as to the limit in size of the sound which he shall use, I know of no better ultimate limit than the scale proposed by Otis, giving it as my personal opinion that while his limit may be safely aspired to and reached, it is wiser to fall short of the standard by a few sizes, in which case all the advantages claimed by Otis will be ordinarily secured, and some of the disadvantages of a urethra unnaturally wide will be avoided."

One of the principal objections to Dr. Otis's measurements is that they are liable apparently to demonstrate the existence of stricture of large caliber at points of normal relative inelasticity of the canal. As a rule, however, there is no danger, and no disagreeable results are to be apprehended from dilating the urethra after preliminary incision to as great a caliber as is possible with the Otis instrument. Occasional cases may arise in which damage might be done.

The author believes that it is generally practicable, and, as a rule, advantageous, to enlarge the urethra as recommended by Otis where urethrotomy is necessary, but is by no means convinced that the size attained at the time of operation should be maintained by subsequent dilatation with sounds. In fact, it will often be found impracticable to maintain a caliber of more than 32 to 35 French even where the urethra has been incised and stretched to the fullest capacity attainable by the Otis dilating urethrotome (45 French). The enlargement of the urethra secured by the operation, even when the cutting is thoroughly done, is to a certain degree temporary in character, being dependent upon overstretching of the muscular fibers of the urethral walls. This overstretching makes the urethra flaccid, and for a few days a large-sized sound will be admitted; but after a time the tonicity of the urethra is restored, and as a consequence an instrument of the size which it was practicable to introduce immediately after the operation can no longer be passed without undue force. In fact, the permanent caliber of the urethra which it is practicable to secure by the operation is usually some sizes smaller than that primarily secured.

In the performance of urethrotomy the rule should be, (*a*) to make the incision downward at the meatus and a short distance within it; (*b*) to cut upon the roof of the canal in the penile urethra; (*c*) to cut downward in the balance of the canal, if at all, unless the curved Otis dilating urethrotome be used, in which event the direction of the cut must be upward.

Untoward Effects of Internal Urethrotomy.—There is sometimes considerable inflammation following dilating urethrotomy. This may give rise to chordee that may last for some little time, perhaps leaving a curvature which persists for some weeks or even months after the operation-wound has entirely healed.

There is no question that cases occasionally arise in which a greater or less degree of deformity (usually slight) results after internal urethrotomy. This has been the principal reason for the terrific howl that has been set up against internal urethrotomy by the anti-operation faction of the profession. Failure to cure a chronic gleet is frequently offered as an objection to the operation. The author is not aware of any other operation in which infallibility and absolute freedom from disagreeable results in every case operated on are demanded. Such a demand in the case of internal urethrotomy is, to say the least, decidedly unfair. A discussion at this point of the various arguments pro and con, in relation to internal urethrotomy would hardly be in

good taste. The author will simply say that in seventeen years' experience with internal urethrotomy he has not only had no occasion to alter his views upon the subject, but, on the contrary, has become more firmly convinced of the solidity of the foundation upon which the doctrines enunciated by Otis were constructed.

The author has observed imperfect erection in several cases which lasted a year or more after urethrotomy. The complaint usually made is, that, while the rest of the organ becomes normally erect, the glans remains soft and flabby. This is only explicable on the ground of cicatricial interference with the circulation of the organ.

After-treatment in Dilating Urethrotomy.—The author finds that the prevailing tendency is to regard the operation of urethrotomy as a trivial matter requiring little attention to details. It is customary, for example, for the surgeon to operate at his office and allow the patient to go about as much as he pleases. This conduct the author holds to be wrong. Where possible the patient should, as a rule, be put to bed for at least a week. As an illustration of the unfairness with which the operation of urethrotomy is sometimes condemned the following is a very pertinent case: A prominent practitioner in one of our Western cities asked the author if he advocated the operation of urethrotomy. On replying in the affirmative, the practitioner informed him that he had had bad results with it, the patient dying in one instance. On inquiry the author found that the doctor was in the habit of operating at his office, and that in the fatal case the patient rode some miles on horseback to his home after the operation, and lost so much blood on the way that he died shortly after reaching his destination. It is hardly necessary to state that it was not the operation that killed this patient. Personally, while occasionally compelled to operate at his office, the author is always uneasy regarding the subsequent course of the case.

Cases occasionally occur in which there is little bleeding at the time of operation, but very free hemorrhage comes on during the night as a consequence of erection. This makes the application of cold a necessity. In one of the author's cases a very severe hemorrhage followed an erection two weeks after operation. In addition to the application of cold, anaphrodisiacs may be given after the operation. Ergot, bromide of potassium, and gelseminum meet the indications admirably. A suppository of hyoscyamus, morphia, and monobromide of camphor is of great service.

It is the author's custom to give oil of eucalyptus in ten-minim doses three or four times daily after a urethrotomy. This drug keeps the urine bland and aseptic. Boric acid, benzoate of soda, gaultheria, and salol are also of service.

It is the author's conviction that sounding is usually too vigorously carried on after urethrotomy. The danger of hemorrhage, urethritis, and curvature of the penis is directly proportionate to the frequency of dilatation after operation. The best results follow infrequent dilatation beginning on the second or third day, or even later if bleeding be profuse, and repeating the dilatation every third day for a week, and then every fourth or fifth day thereafter. There is no danger, as a rule, in allowing a stricture that has once been thoroughly cut to go for an entire week without dilatation. The cut ends of the circular muscular fibers of the urethra probably retract, serving to keep the incision sufficiently open for all practical purposes. The intermittent dilatation of the canal by the urinary outflow also plays an important rôle in maintaining the patency of the urethra.

Permanency of Result.—The claims of dilating urethrotomy as advanced

by Otis and his adherents have been chiefly based upon permanency of result. The only reliable test in any particular case is a re-examination with the bulbs a considerable time after the operation. It is safe to say that in most cases of stricture appreciable recontraction will occur in a very short time—a few months perhaps—after treatment, if it occur at all. This may be disputed by those surgeons with whom the passage of an ordinary sound is a crucial test for stricture, but it will hardly be disputed by the andrologist who relies upon bulbs for his explorations. Recurrence is of course not likely to occur if systematic sounding be persisted in at regular intervals; hence old-time cases of urethrotomy in which the sound has been used from time to time will not answer our purpose in testing the permanency of the result in dilating urethrotomy. Otis, Mastin, and many others have made careful re-examinations of cases at variable periods after operation, and have found the majority of cases to be still free from stricture. As Mastin tersely remarks, it is not the number of cases, but the permanency of results, that counts for the operation. A large number of cases operated within a few months are not nearly so valuable as a few cases several years after operation.

The author has personally examined a number of cases at periods varying from one to ten years after internal urethrotomy, and has become thoroughly convinced that in by far the larger proportion of cases the operation is followed by permanent cure.

External Urethrotomy.—External urethrotomy, or perineal section, may be divided for description into two varieties of operation, which, although involving the same structures, differ as regards prognosis and facility of performance. They are termed perineal section with, and perineal section without, a guide.

Perineal section with a guide is the simpler and safer of these operations, but is adapted only to strictures permeable to instruments. The best procedure is Syme's operation. The instruments necessary for operation are a staff with a central groove (Fig. 55), a silver catheter of a caliber of 7 or 8

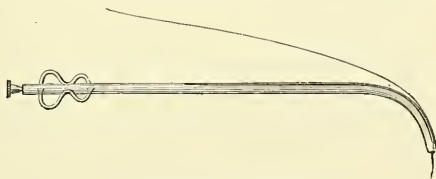


Fig. 55.—Gouley's catheter-staff.

English, a sharp-pointed scalpel of moderate size, and a strong, broad-grooved director. The required size of the guide or staff necessarily varies according to the caliber of the stricture. It may be grooved along its entire length or only along its convexity. Syme's staff has a shoulder which impinges upon the anterior surface of the stricture, the groove in the convexity of the instrument beginning just at this point. If false passages exist, a grooved hollow staff may be used, the successful passage of the instrument into the bladder being indicated by a flow of urine.

Operation.—The patient, having been anesthetized, is put in the lithotomy position, with feet and hands fastened together with lithotomy anklets or ordinary roller bandages or held by assistants, and the staff or guide is passed through the stricture into the bladder. The perineum should be scrubbed

thoroughly and bathed with alcohol or bichloride solution 1:1000. The operator, seated in front of the patient, now enters his scalpel, with the cutting edge of the blade upward, into the raphe of the perineum one-half to three-fourths of an inch in front of the anus; an upward dissection of about an inch and a half is now made until the urethra is exposed, when the knife is made to enter the groove of the staff behind the stricture, after which the latter is thoroughly divided from behind forward. The staff is now withdrawn, and a good-sized sound is passed into the bladder to demonstrate that the canal is perfectly free. A soft catheter or the silver catheter before mentioned should now be passed into the bladder and tied in for twenty-four hours. There are several varieties of drainage-tubes that are excellent substitutes for the catheter. At the end of from four or five days to a week gradual dilatation must be commenced, sounds being introduced every third day at first, later at less frequent intervals. The urine escapes by the perineal wound for some little time, but healing gradually occurs and the urine flows through its normal channel. Fistula is a rare result; sooner or later the track of the wound closes spontaneously. Incurable fistula is rare.

The rules for the operation as outlined by Syme are essentially as follows:

1. Be positive that the staff or guide has really penetrated the stricture and entered the bladder, this caution being especially necessary if false passages exist.

2. Take care not to deviate the incision from the median line. In this location a sort of septum exists even in the deep perineal tissues. As long as the incision does not deviate from this line there is little or no danger of injuring any vessel of considerable size. The principal vessel that is in danger is the artery of the bulb, but this need not be cut, as a rule, if the incision is carefully made in the raphe.

3. Keep the edge of the knife mainly upward to avoid opening the posterior layer of the deep fascia of the perineum, with consequent danger of infiltration of urine into the pelvis, with serious inflammation and perhaps gangrene of cellular tissue.

4. Insert the point of the knife posterior to the stricture, and incise it by cutting from behind forward in the groove of the guide. (This is not always practicable.)

5. There is sometimes considerable trouble in passing an instrument into the bladder after the stricture has been cut. This may be obviated by inserting a director with a broad groove into the posterior portion of the urethra after the stricture has been divided and before the withdrawal of the staff. The grooved director is turned upward in such a manner that as the sound



FIG. 56.—Filiform whalebone bougies.

or catheter is passed through the canal its point is directed past the incision into the bladder.

In cases in which it is difficult to insert the ordinary grooved staff a filiform bougie (Fig. 56) may be passed into the bladder and Thompson's dilator threaded upon it. With this instrument the stricture is expanded until it will readily admit the staff. A tunnelled staff (Fig. 57) may, however, be used, being forced into the bladder over the bougie as a guide.

Perineal section without a guide is one of the most troublesome and formidable operations in surgical practice. Some of the most skilful surgeons who have attempted the operation have failed in its accomplishment. Others have succeeded only after a bunglesome, tedious, and prolonged search for the urethra. It is a very fortunate circumstance that such operations are at the present time very rarely necessary of performance, for the reason that if the surgeon be patient and administers an anesthetic he will usually succeed sooner or later in passing an instrument through the stricture and into the bladder beyond it. No matter how small the instrument may be, it is

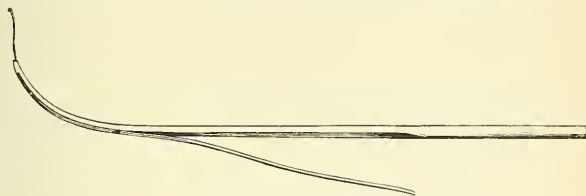


FIG. 57.—Tunnelled sound.

an accurate guide to the course of the urethra. Once an instrument is passed (even if only a filiform bougie) into the bladder, the case is practically under control, as a tunnelled staff can be threaded over it and pushed through the stricture, the operation being then completed as in ordinary perineal section.

The practicability of instrumentation, therefore, determines the safety of the operation of perineal section. Cases are rare in which operation without a guide is necessary, for a period of temporizing, no matter how prolonged, is better than proceeding at once to so serious a measure as section without a guide. Electrolysis may be tried if all other means of penetrating the stricture fail.

In considering the operation of perineal section without a guide we must admit that, although exceedingly rare, cases of practically impermeable stricture may be met with. These may be termed surgically impermeable. Complete obliteration of the urethra can only be produced by injury or sloughing of the mucous membrane and corpus spongiosum from some cause. Even in cases in which fistulae coexist with an old and indurated stricture the urethra is rarely impervious to either instruments or urine. It is conceivable, however, that it might become so as a result of diversion of the urine from its normal channel by a fistula, providing some lesion of the mucous membrane had existed that was capable of furnishing inflammatory exudation.

It is nothing unusual for the surgeon to discover at the time he proceeds to make the perineal section that anesthesia has relaxed the parts, so that an instrument of moderate size may be readily introduced. Whenever, therefore, such operations are determined upon, an attempt should be made to pass instruments after the patient has been anesthetized, in the hope of either providing a guide for the cutting operation or paving the way to treatment by dilatation, the rule being that when a stricture is permeable to fluid it is not impermeable to a bougie. It must be acknowledged that there are occasionally exceptions in which the urethra has become so tortuous and contracted, and the tissues of the perineum so indurated by inflammatory deposit—perhaps occurring as a consequence of extravasation of urine—that no instrument can be passed, although urination can be performed with compara-

tive facility. In cases of this kind a perineal section without a guide may be necessary.

Operations begun without a grooved guide or the insertion of a bougie to indicate the line of the urethra may often be completed with a guide after the anterior surface of the stricture has been exposed, a filiform bougie being passed through the latter.

Operation.—There are two ways in which perineal section without a guide may be performed: (1) The urethra is opened in front and the stricture is divided from before backward. What is known as the Wheelhouse operation is the best method for this procedure. (2) The urethra is opened posterior to the stricture, and the latter is divided from behind forward. The first method is the preferable one, the classical procedure being the *boutonnaire* (button-hole) operation. A sound or catheter of moderate size is passed down to the face of the stricture. It is then turned around so that the point of the instrument projects in the perineum in front of the stricture. An incision about an inch and a half long is now made directly down upon the point of the instrument until the urethra is exposed. A small incision is then made into the latter just in front of the stricture, and the sound hooked up into the angle of the wound. A ligature is passed through each side of the incision and given to an assistant; these, in conjunction with the hook-like action of the staff, serve to hold the lips of the wound apart and facilitate inspection and exploration of the stricture. A special angular, hook-like staff is used by Wheelhouse in this maneuver. After the hemorrhage has been checked the opening through the stricture will usually be readily seen. A fine probe or small director is slipped into this if possible, and a fine-bladed tenotome is passed along the guide so as to divide the strictured tissue. Great pains should be taken to search for the orifice of the stricture, for if a filiform bougie or bristle can be passed through it, the operation is greatly simplified, the danger of the operation being that the surgeon will lose the urethra, and in his aimless efforts to find it severe or even fatal hemorrhage may be produced. The author recalls a case of this kind in which a very capable surgeon experienced so much hemorrhage in the operation that the patient died within a few hours. In another case he completed an operation after an experienced surgeon had failed to find the urethra after two hours' search.



FIG. 58.—Shirted cannula.

Should it be impossible to pass a guide through the stricture after its anterior surface has been exposed, the urethra may be opened up posterior to it and an attempt made to pass a probe or bougie from behind forward. Failing in this, a dissection must be made from before backward in the normal direction of the urethra. In a case of this kind the author would be inclined to perform suprapubic section and retrograde catheterism. This procedure has on several occasions been invaluable to him.

After the stricture has been freely divided a good-sized sound should be passed into the bladder to demonstrate that the passage is clear. The sound is then removed, and a catheter passed and tied in as in the operation with a guide. The sound should be passed at proper intervals, as after the ordinary operation of perineal section.

Instead of passing a catheter through the entire length of the urethra and allowing it to remain in the bladder after the operation of perineal section, perineal drainage is excellent. This comprises the passage of a large soft-rubber catheter into the bladder *via* the wound in the perineum. This is tied in and allowed to drain into the urinal. It may be removed in two or three days. Such a drainage-tube facilitates washing the bladder and the perineal wound with antiseptic solutions and prevents infection.

Hemorrhage after perineal section may usually be controlled by pressure. If venous oozing be free, the wound may be packed with styptic cotton. Irrigation with very hot water is often efficacious. When the bleeding is obstinate a petticoated or "shirted" cannula (Fig. 58) may be introduced, as in bleeding after lithotomy. In one case the author found the following device to act very well: A stiff gum catheter was passed through an ordinary condom and into the bladder. The condom was then blown up by a small catheter introduced into the outer end, and tied firmly about the catheter left in the bladder, so as to prevent the air escaping. By this device sufficient pressure was secured to stop the hemorrhage. A perineal crutch may become necessary.

One word of caution to the operator may not be untimely. He should begin his operation, if possible, early in the day, and be sure and secure plenty of light. A dark day and a hurry have been fatal to not a few patients in the practice of different surgeons.

COMPLICATIONS AND RESULTS OF STRICTURE.

False Passages.—False passages are rare occurrences in the practice of surgeons who exhibit the necessary patience and gentleness in the introduction of instruments. They are rarely caused by the use of large instruments in the ordinary performance of dilatation, and are very exceptionally produced by other than metallic sounds and catheters.

Forcible instrumentation was formerly occasionally practised for the purpose of relieving retention. A catheter was passed down to the face of the stricture and forcibly crowded on in the direction of the bladder. Very rarely indeed did the instrument pass through the stricture. More often it was forced entirely beyond the urethral walls and passed along in the cellular tissue. Once in a while the operator succeeded in reaching and evacuating the bladder. The result of such surgery was the frequent occurrence of false passages. When an instrument is passed in this manner it may enter an enlarged follicle of the urethra and produce rupture at that point. More frequently the instrument enters a pocket in the anterior surface of the stricture, the false passage taking its point of departure at this spot. The signs indicating the occurrence of this accident have already been enumerated.

Treatment.—When the surgeon suspects that a false passage has been made, he should practise strict non-interference for a couple of weeks unless retention exists. Further attempts at instrumentation will only result, in all probability, in a chronically indurated condition of the false passage. There will at first be slight hemorrhage from the urethra, and within a few days more or less purulent discharge. As a rule, the passage will be found to have closed within two or three weeks. It may, however, in spite of conservatism, become chronic. Such accidents as urinary fever, infiltration of urine, abscess, and fistula are occasional results of accidents of this kind.

In passing instruments into a canal in which a false passage is known to exist great care should be taken to avoid entering it with the instrument. The oftener such a passage is dilated the longer will it persist, and it may

become absolutely incurable if such manipulations are persisted in. The deviation in the direction of the instrument, the sensation imparted to the hand, and the patient's own subjective sensations usually indicate the position of the instrument. A careful study of the case is necessary to determine the location of orifices of old false passages. As a rule, the instrument engages in the orifice of a false passage much more easily than in that of the stricture, and the comparative facility with which the instrument is passed into an abnormal channel may mislead the surgeon into the notion that he is dilating the stricture. A false passage may sometimes be avoided when its location has been determined. It may be necessary, when an instrument has once been passed into it, to allow it to remain *in situ*, other and finer instruments being passed in the hope of engaging one in the orifice of the stricture proper. The expedient of filling the urethra with filiform bougies is sometimes successful, one or more instruments finally passing the stricture. An excellent plan, and one which has been very useful to the author, is to pass an endoscopic tube down to the face of the stricture, a filiform being passed through it and an attempt made to enter the proper channel; if necessary the tube may be filled with the filiforms. When once an instrument is passed through the stricture it should be allowed to remain *in situ*, and the stricture either dilated to a moderate extent by a Thompson's dilator slipped along a filiform guide or treatment by continuous dilatation begun. If it is found impossible to pass instruments through the stricture and retention exists, aspiration above the pubes should be performed, while attempts at instrumentation are still persisted in.

The best operation for stricture complicated by false passages is external perineal section with a guide. Should it be absolutely impossible to introduce a guide, it is necessary to operate without it.

Retention of Urine.—Retention of urine is the most frequent complication occurring in stricture of the urethra. In all cases of stricture of small caliber the patient is constantly menaced with the danger of practically complete closure of the urethra incidental to spasm or congestive and inflammatory infiltration—*i. e.* plus conditions—at the site of the lesion. The liability to this accident is greatly modified by the constitutional condition of the patient, his habits, and, what is quite as important, the delicacy of the manipulations instituted for the cure of the disease. Chilling of the feet and legs, indulgence in alcoholics even to a moderate extent, over-eating, and sexual excitement with or without gratification are the most frequent exciting causes.

When retention of urine becomes complete the bladder soon becomes distended to its utmost capacity, and perhaps yields to the pressure of the contained fluid until it fills a large portion of the abdomen; as a result of this distention there are considerable pain and constitutional disturbance. It now becomes urgently necessary to speedily evacuate the bladder. If this be not done, overflow may occur after a time or the urethra will yield posterior to the stricture, with consequent extravasation of urine either in front of or behind the triangular ligament. Gangrene of the cellular tissue with profound prostration, a typhoid condition, and usually death, will ensue if the extravasation be extensive, or in more fortunate cases an abscess may form that subsequently discharges and leaves a fistula. In long-standing cases in which the bladder is dilated and sacculated, rupture of the bladder itself may possibly occur with an inevitably fatal result. After an attack of retention the bladder is always left in a much worse condition than before, and perhaps may remain in a more or less acutely inflamed state.

Treatment.—It is well to avoid the passage of instruments at this time where it is possible to do so, as the contact of a catheter with the inflamed area is apt to increase the irritation. Antispasmodics should be given and the patient placed in a full hot bath. Morphia may be given by the mouth or hypodermically until the full narcotic effect of the drug is produced. If these measures fail, an attempt should be made to pass a small catheter. Contrary to what might be expected, an instrument sometimes passes through a stricture more easily where retention of urine exists than under other circumstances. This is probably because a slight degree of absorption of the indurated tissue occurs as a consequence of the inflammation. In addition, it is probable that the pressure behind the obstruction serves to stretch the stricture apart to a slight extent, thus facilitating the entrance of an instrument. If necessary, an anesthetic should be given. Attempts at catheterization are not complete until anesthesia has been produced. The surgeon should never despair of being able to introduce a catheter until he has failed with the patient under an anesthetic. If a catheter cannot be introduced primarily, a filiform bougie may possibly be passed. This should be left in the bladder for some time, and if when it is withdrawn the urine does not flow, as it is likely to do, a small catheter may usually be introduced. When once an instrument has been passed the case is under control. The instrument should be tied in the bladder. Leeches may now be applied to the perineum.

Free catharsis by means of salines usually benefits in a derivative manner. Derivation may also be produced by the hypodermic injection of pilocarpine.

Should it be impossible to relieve the retention *via* the urethra, it is usually wise to temporize by the employment of an aspirator in preference to operations of a radical character. In by far the majority of cases the urine will flow by the natural channel a short time after the distention of the bladder has been relieved by the aspirator. Should this not occur, however, the aspirator may be again used, and if necessary a number of times, the surgeon meanwhile proceeding with his antiphlogistic and derivative measures and cautious and gentle attempts to pass an instrument.

Should the surgeon be unable to see the patient frequently, it would be well after the introduction of a filiform bougie or small catheter to pass a tunnelled Thompson's dilator over it as a guide, the stricture being moderately stretched. Divulsion and internal urethrotomy are not to be recommended at this time, as a rule. The passage of a catheter for the relief of retention should usually be considered as the commencement of treatment by continuous dilatation.

Where other means fail it may be advisable to perform section without a guide.

Infiltration of Urine.—Infiltration of urine is perhaps the most serious complication of stricture of the urethra. It may occur in any one of five ways:

1. As a consequence of rupture of the urethra or bladder incidental to prolonged retention.

2. By rupture of the dilated and ulcerated point of the urethra behind the point of obstruction from prolonged and violent straining efforts at micturition.

3. By laceration of the urethra due to over-distention of the canal produced by the passage of large sounds. In this instance infiltration occurs at the next act of urination.

4. Division or rupture of the urethra incidental to the operations of internal urethrotomy or division.

5. Burrowing of urine between the layers of the tissue about the margins of the wound produced by external perineal section.

Infiltration of urine occurs in three forms: (a) Escape and extravasation of urine into the cellular tissue of the pelvis, as a consequence of rupture of a dilated, thinned, and sacculated bladder. (b) Rupture of the urethra within the confines of the deep layer of the superficial fascia of the perineum or Buck's fascia. (c) Infiltration produced by rupture behind the triangular ligament or deep perineal fascia.

The most common method of extravasation of urine is the giving way of the urethra immediately behind the stricture. This structure, already thinned and dilated, becomes over-distended, and eventually ulceration occurs at some point, usually upon the floor of the canal. As a consequence of retention of urine or straining efforts at micturition, a few drops of urine escape into the surrounding cellular tissue, and an extension of the ulcerative process immediately begins, with perhaps more or less sloughing of the tissues. As a consequence, the trifling aperture in the urethral floor becomes enlarged, and in a short time the urine escapes in considerable quantity into the cellular tissue of the scrotum, perineum, groin, and, if Buck's fascia gives way, the thighs. In some instances the dilated follicle in the urethra becomes acutely inflamed, as a consequence of which its duct becomes occluded. Within the follicle a drop of urine is retained with the products of decomposition and inflammation. After the closure of its duct this little pseudo-cyst becomes distended with pus and the irritating products of urinary decomposition. Under these circumstances it is apt to give way, either into the urethra or externally. Should it give way externally, extravasation of urine may not occur, the process remaining as a folliculitis or, if more extensive, a periurethral phlegmon. The abscess may be quite extensive. If the contents of the dilated follicle escape back into the urethra, an opening is thus afforded to the passage of urine. Later on the follicle ruptures as a consequence of over-distention, and abscess occurs. Fistulæ may result from such abscesses. In some instances an abscess ruptures externally and subsequently opens into the urethra. Under such circumstances serious extravasation of urine is not apt to occur, the entire extent of the fistula having become lined with a pseudo-membrane that protects the surrounding tissues from burrowing of urine. In other instances rupture of the urethra occurs, with the formation of an abscess or sloughing of the tissues; the process finally appears externally, and a fistulous opening into the urethra is thus immediately established. The slower the process of infiltration the more apt it is to be confined by inflammatory exudate, which acts in a conservative manner by preventing serious infiltration.

The slighter forms of infiltration of urine may occur in any portion of the urethra and produce folliculitis, periurethral phlegmon, or abscess and fistula. When general extravasation of urine occurs, the portion of the canal that usually gives way is the membranous urethra between the layers of the triangular ligament. At this point the walls of the canal are rather weak, there being a lack of support by the tissues about it. It is at this point also that dilatation and thinning are most apt to exist, the location of the obstructing stricture being most frequently at the bulbo-membranous junction. Strictures anterior to this point are more often of comparatively large caliber, and are not apt to lead to those conditions which predispose to or excite general extravasation. The infiltrated urine finds its way after a time

through the anterior layer of the triangular ligament at the point where it is penetrated by the urethra. It is now beneath the deep layer of the superficial fascia of the perineum—*i. e. within the confines of Buck's fascia*; this fascia, as long as it is intact, subsequently guides the course of the urine. This structure, it will be remembered, is attached to the anterior layer of the triangular ligament in the perineum, and laterally to the rami of the ischia and pubes as far upward as the pubic spine, where it becomes continuous with the deep layer of the superficial fascia of the abdomen. This latter fascia in its turn is attached anteriorly along Poupart's ligament as far as the crest of the ilium. The infiltrated fluid, therefore, invariably takes a direction, first, forward into the perineum and scrotum, and, second, upward upon the genitalia and the anterior abdominal wall and outward along the groin upon either side. Were it not for the limitation of the extravasation by Buck's fascia, the fluid would be governed by the force of gravity, and pass backward and downward, extravasating about the rectum and down the thighs. Should Buck's fascia give way, the infiltrated urine may gravitate backward, and may also pass laterally upon the thighs.

The effects of infiltration of urine are two—*viz.* general and local. The general symptoms are from the first, in some instances, of an asthenic and irritative character. Even in the strongest patients extensive infiltration is soon succeeded by a condition of asthenia with typhoid symptoms, low muttering delirium, dry brown tongue, sordes, and finally coma and death. If the treatment is unsuccessful in relieving the infiltration in cases in which the infiltration is limited, an abscess results with the same symptoms as are observed under ordinary circumstances, with the exception perhaps that there is more marked prostration.

The local effects of infiltration of urine are very marked. The results of infiltration of urine are not those of contact of urine *per se*, but of urine which has become vitiated by decomposition and the addition of the products of inflammation. Perfectly normal urine has been shown to be harmless when injected into the cellular tissue.

When urine is infiltrated into the perineum and about the genitals, the effect of the irritant poison is immediately manifest wherever the areolar tissue is touched by the fluid. A diffuse cellulitis is set up, and the tissues are converted into dark, pultaceous, stringy sloughs, mingled with fetid pus of a dark color and decomposing ammoniacal urine. If the urethra gives way suddenly, the irritant fluid is forced into the tissues for some distance in and about the affected portion of the canal. Under these circumstances the destruction produced is very extensive. The scrotum may slough, leaving the testes absolutely bare. The patient is likely to die before this occurs, however, so that such a condition is rare. In some cases the extravasation occurs more slowly, as has already been indicated. A few drops of the irritant fluid escape from the canal through a slight solution of continuity in its coats; this gives rise to inflammation of a phlegmonous character in the tissues about the urethra that limits for a certain time, and perhaps indefinitely, the progression of the extravasated fluid. This inflammation usually causes an abscess which may break internally or externally and be followed by general extravasation or fistula. When extravasation is rapid and extensive the perineum becomes brawny, and finally boggy, the scrotum distended and edematous, the parts presenting a dusky or purplish-red color; the tissues speedily become gangrenous.

If the patient is able to resist the depressing effects of the extensive destruction of tissue, repair may be very rapid. The reparative power of

the parts is certainly remarkable, and is noted not only in these cases, but in phlegmonous erysipelas and cellulitis affecting this region. The extravasation rarely extends farther than the groins and lower part of the abdominal wall, but has been known to reach the level of the ribs. When in retention of urine the urethra gives way between the layers of the triangular ligament, a sense of relief is experienced by the patient, with a sensation as though the tissues had ruptured in the perineum, this being attended perhaps by more or less pain. The symptoms may be obscure for some little time, and very little swelling may occur, but in a few hours, or perhaps not for a day or two, a sense of heat, throbbing, or lancinating pain and burning will be experienced in the perineum; later on, a boggy, diffuse, purplish-red swelling appears in the perineum and scrotum and extends forward very rapidly.

When the infiltration takes place entirely behind the triangular ligament, a similar sense of relief is experienced, but the symptoms are subsequently even more obscure. After a time, if the patient survives, deep, throbbing pain will be experienced, with perhaps swelling of the perineum. Examination per rectum may detect the boggy fluctuation characteristic of infiltration. In cases of rupture posterior to the ligament the fluid is likely to burrow into the pelvis and about the rectum and prostate, and destroy life without any positive external manifestations.

Infiltration from rupture of the bladder is one of the rarest forms of complication of stricture. Its method of production and effects, although more obscure, are almost precisely identical with infiltration from rupture of the urethra. If the bladder be tolerably healthy, retention of urine is not likely to produce rupture unless traumatism be superadded. A fall or blow upon the abdomen may produce it under such circumstances. Relief is usually afforded by rupture of that portion of the genito-urinary tract which offers the least resistance—*i. e.* the dilated and diseased portion of the urethra behind the stricture—or by overflow. A certain amount of urine may escape by distention of the diseased portion of the urethra, although the bladder cannot empty itself. In some cases overflow occurs as a consequence of subsidence of the inflammatory and spasmodic elements of the obstruction. By this time, however, the bladder has become so atonied by over-distention that it cannot empty itself. When the bladder is ulcerated, as it may be when a calculus complicates stricture or an instrument has been allowed to remain in contact with the vesical walls for a long time, the bladder-walls may yield at the weakened point. In cases of extreme dilatation and sacculation of the bladder the walls of the viscus are apt to yield to the pressure of the contained fluid at the point of least resistance—*i. e.* the thinnest and usually the largest sacculi. When rupture of the bladder occurs the urine escapes into the cavity of the peritoneum.

Treatment.—The treatment of infiltration must be prompt and energetic. As soon as symptoms indicating rupture of the urethra occur perineal section and division of the stricture should be at once performed. Vesical drainage should be instituted by the insertion of a large rubber tube into the bladder. Thorough antisepsis by irrigations with very weak solutions of bichloride of mercury should be at once established. If diffuse swelling of the tissues of the perineum, scrotum, penis, thighs, or groins exists, a free incision should be made at each prominent point.

Whenever lancinating and throbbing pain with more or less circumscribed swelling occurs in the perineum, whether the scrotum be involved or not, perineal section should be made. An examination per rectum will sometimes

detect extravasated fluid in cases in which the symptoms are otherwise very obscure. Under such circumstances the perineal operation should be performed, and a deep incision made in the direction of the perirectal infiltration. In making this incision the left index finger should be passed well up into the rectum to protect the gut from injury.

The only hope of saving life in cases of extensive extravasation consists in free incisions at all points where the infiltrated fluid can be reached. Even if the extravasation and subsequent cellulitis and sloughing be severe, a favorable result may often be secured by these radical measures. It is not sufficient to liberate the fluid that has already escaped, but it is necessary by section of the stricture and perineal drainage to prevent further extravasation.

Having obtained an outlet for the morbid urine, sloughs, and inflammatory material incidental to extravasation, some antiseptic dressing should be applied that will not only tend to maintain the parts in an aseptic condition, but will preserve the vitality of the cellular tissue. Both indications may be fulfilled by the application of hot poultices composed of equal parts of charcoal and linseed meal, sprinkled liberally with brewer's yeast or hot sublimate solution. All sloughs should be detached as soon as they become loose, and the parts irrigated daily to remove discharge as fast as formed. As the sloughs separate free purulent discharge occurs, constituting a severe drain upon the already depressed system. Liberal support, both dietetic and medicinal, will be required. Milk punch, egg-nog, large quantities of milk, and concentrated broths should constitute the diet. A liberal quantity of stimulants, either brandy, whiskey, or the heavier wines, should be administered. Should the patient's stomach be irritable, champagne is required. Digitalis, carbonate of ammonia, quinine, and tincture of the chloride of iron constitute the only reliable remedies against asthenia in these cases, and should be given in liberal doses.

Rupture of the bladder incidental to stricture demands the same treatment as under other circumstances, but is inevitably fatal.

Periurethral abscess is intimately associated with extravasation. The latter may be of comparatively trifling importance *per se*, the collection of pus being relatively of much more serious moment. Abscess about the urethra may arise from several causes. (1) The escape of a drop or two of toxic urine into the cellular tissue as a consequence of solution of continuity of the urethral walls. (2) From the escape of a drop or two of urine into a dilated follicle, with subsequent free suppuration and rupture of the latter. (3) Inflammation of the follicles due to the passage of instruments. (4) Puncture or rupture of the urethral walls by the beak of an instrument. (5) Phlegmonous inflammation due to the absorption of organic poison by the lymphatics from behind the stricture: this poisonous material, coming in contact with the cellular tissue, sets up suppurative inflammation.

Periurethral abscess bears a distinct relation to periurethral phlegmon and folliculitis. When decomposing urine escapes into the periurethral areolar tissue, it sets up inflammation which induces a plastic exudate; in some instances the exuded material closes the orifice through which the urine escapes and prevents further extravasation, thus circumscribing the abscess. Abscess of this kind may occur at any portion of the urethra, but is generally seen in the perineal part of the canal on account of its frequent association with stricture at the bulbo-membranous junction. It may subsequently lead to extravasation, because of its opening into the urethra, thus permitting the escape of the urine into its cavity, the walls of which subsequently yield, or

it may burrow to the surface and heal externally without difficulty. Again, it may open internally and burrow externally without extensive extravasation, the track of the pus being limited by plastic deposit. Under these circumstances a fistula results. These abscesses are rarely dangerous *per se*, their importance being chiefly due to the danger of general extravasation and the formation of urinary fistulæ.

The amount of mischief done by urinary abscess will depend greatly on the particular side of the urethra that is involved. When, as usually happens, it forms at the lower surface of the canal, it readily comes forward without extensive burrowing; but when situated on the upper wall of the urethra (this is very rare) or at the upper part of the side of the canal, it may burrow widely before it points, occasioning great induration, infiltration, and destruction in neighboring parts.

The symptoms of periurethral abscess consist of the appearance of a small, circumscribed, tender, painful, and hard tumor somewhere in the course of the urethra. There is usually little or no constitutional reaction. Sometimes, however, in extensive abscesses more or less fever is noticeable. When located in the perineum this part may become tense, hard, and brawny, considerable weight and lancinating pain being complained of. Abscesses of this character are very slow in coming to the surface because of the comparative density of Buck's fascia which binds them down. If the pus escapes from its environment of plastic exudate, it is most apt to follow the course taken by infiltrating urine, there being less resistance to burrowing within the limits of Buck's fascia than to its escape externally.

Treatment.—The treatment of periurethral and perineal abscess consists of free incision with antiseptic precautions. It is bad practice to wait for fluctuation. When the penile portion of the canal is affected nothing is warrantable but a small puncture to relieve the distention of the abscess and prevent rupture into the urethra. Even in these cases, however, if puncture demonstrates the presence of pus, the abscess-cavity should be laid freely open. In perineal abscess a free incision should be made into the induration in the median line. Delay in these cases may lead to extravasation of urine. The after-treatment should consist of the ordinary surgical measures for the treatment of abscess.

Urethral Fistulæ.—Urethral fistulæ result from extravasation of urine and abscess. They are usually located in the perineum and scrotum, but have been noted in the groin, the inner aspect of the thigh, and upon the anterior abdominal wall as a consequence of extensive burrowing of pus. Their point of departure is generally in the vicinity of the bulbo-membranous junction; exceptionally they are met with in the scrotum and about the pendulous urethra. When they occur in the perineum they are often multiple, several openings being found about the perineum, nates, scrotum, and perhaps the inner aspect of the thighs. In a case reported by Civiale over fifty external openings were found to communicate with the perineal portion of the urethra. There is something remarkable in the manner in which the pus will creep about and form secondary fistulæ in these cases.

The number, location, size, and length of fistulæ are cardinal points in deciding their importance. Small perineal fistulæ with a single or perhaps two openings are not of very great importance, as they will close spontaneously in most cases as soon as all obstructions in the urethra have been removed.

The size of fistulæ depends entirely upon whether or not a loss of substance has occurred and upon the extent of the destruction. They may be

large enough to admit several fingers. They are generally tortuous, narrow, and extend for a considerable distance; the external orifice may be very small, and may heal from time to time only to reopen, as in the case just related. Under such circumstances the urine remains in the course of the fistula, decomposes, and again produces suppuration with external discharge. In some instances burrowing occurs, resulting in tributary fistulæ running in various directions. In cases of multiple fistulæ the tissues of the scrotum, penis, and perineum become extremely hard and thickened, feeling to the fingers almost like cartilage. Where the stricture is tight and the fistula large the urine may not pass through the normal channel at all, escaping entirely *viâ* the fistula. Rarely indeed does the stricture become agglutinated, although such an accident may possibly occur in cases of traumatic stricture.

Treatment.—The treatment of fistulæ depends upon their location, number, and the question of loss of substance. The first principle in their management consists in the removal of all obstructions to the outflow of urine. A contracted meatus and penile stricture require incision as under ordinary circumstances. Care should be taken to restore completely the caliber of the urethra, for the more perfectly this is done the less resistance there is to the outflow of urine. By this procedure we take advantage of the physical principle that fluid tends to flow in the direction of least resistance. Should there be at any point in the course of the canal sufficient obstruction to produce distention of the urethra behind it, the backward and outward pressure will necessarily force a portion of the urine into the internal orifice of the fistula and thus prevent healing. The majority of simple perineal fistulæ will be found to close spontaneously as soon as the normal caliber of the urethra has been restored. The tissues in this situation are thick, and reparative action is consequently much more active than is the case in the penile portion of the canal. Then, too, the parts are not disturbed by erections, which, by depriving the affected tissues of rest, necessarily interfere with granulation and retard the process of healing.

Should simple fistulæ show a disposition to become chronic in any portion of the canal, the patient should be instructed in the use of the catheter and directed to draw his urine at regular intervals, thus obviating the possibility of the passage of the fluid through the fistulæ. Should such measures, however, tend to set up irritation of the urethra and bladder, it will necessary to discontinue them.

The process of repair may often be stimulated by cauterization of the track of the fistula. A good plan is to enlarge the external orifice of the fistula and pare its edges; its track may then be cauterized by passing a fine platinum wire attached to a galvano-cautery apparatus. This is passed into the fistula when cool, and then heated to a white heat and rapidly withdrawn. A fine probe, coated with a bead of sulphate of copper or nitrate of silver, may be used for cauterization. After the operation a soft, moderate-sized catheter should be left in the bladder to prevent any escape of urine through the fistula: it should be allowed to remain in the bladder for several days. The viscus should be irrigated with a warm, mild antiseptic solution at least once daily. Applications of the tincture of iodine upon a cotton-wrapped probe are sometimes effectual in promoting healing.

If the stricture be hard, resilient, or irritable, the best plan is to perform perineal section. All branching fistulæ that can be reached had best be laid open and left to granulate. After perineal section in stricture complicated by fistulæ the Harrison method of drainage should be adopted. This not

only drains the bladder, but prevents the urine—which is invariably irritating—from coming in contact with the fistulæ. *Fistulæ* located in the scrotum often require free incision after the removal of urethral obstruction. Such *fistulæ* will often be found to be connected with unhealthy, sloughy abscess-cavities. These should be laid freely open.

Siphon-drainage has been recommended for simple *fistulæ* in the perineum. This method consists of tying a moderate-sized soft catheter in the bladder, which is attached to a rubber tube of considerable length passing into a receptacle containing carbolized water. Four cases cured in this manner are reported by Chiene.

Urinary *fistulæ* occasionally open into the rectum, in which event we have superadded to the obstacle to healing afforded by the contact of the urine an additional element—viz. the escape of fecal matter and gases. These latter materials are likely to pass not only into the fistula, but entirely through it into the urethra. *Fistulæ* of this sort are not apt to heal even after the urethra has been restored to its normal caliber. The ordinary operation for rectal fistula should be performed in such cases, the rectum and the greater portion of the track of the urinary fistula being laid into one cavity and made to granulate from the bottom. The rectal extremity of the fistula having healed, there may still be an opening in the perineum, the urine alone being sufficient to keep the urethral extremity of the fistula from healing. The perineal fistula may now be treated as under ordinary circumstances.

Thompson records an instance of successful treatment of recto-urethral fistula by position, the patient being instructed to pass urine only in the prone position.

Large *fistulæ* due to greater or less destruction of the tissues by which they are surrounded require, as a rule, special measures of operative treatment. The same may be said of *fistulæ* that fail to heal under the measures of treatment already outlined. *Fistulæ* in the penile portion of the canal, whether there be any loss of substance or not, are apt to be intractable to treatment. This intractability is due to the extreme tenuity of the tissues, which is unfavorable to plastic exudate and repair, and to the variable position of the organ incidental to erection and the performance of the sexual function, which prevents the necessary rest. Even with considerable loss of substance in the perineum *fistulæ* in this region will often close spontaneously, granulation and repair being very active and the parts being relatively infrequently disturbed. Loss of substance may occur in cases of *fistulæ* due to gangrene and sloughing, extensive abscess, phagedena, or the prolonged contact of instruments with the canal. Necessarily they are most often noted in severe cases of stricture.

Urethroplasty is usually necessary in large *fistulæ* of the penile urethra. Astley Cooper, however, reported a case in which the application of nitric acid was successful in closing a fistula as large as a good-sized pea after two successive plastic operations had failed.

Perineal *fistulæ* may often be closed by a comparatively simple operation. The edges should be liberally pared and brought together with the quilted or shotted suture. The author has succeeded in curing several of them by repeated suturing after preliminary cauterization.

Scrotal *fistulæ* require free paring of their edges. The tissues about the fistula should be extensively dissected up to secure thick, good-sized flaps of skin and areolar tissue. These should be stitched together by silver wire or by the quilted or shotted suture. Several operations may be necessary

before the cure is complete, each operation making the fistula smaller. The urine must be drawn in all instances by the catheter. If the urethra be tolerant of the instrument, a moderate-sized soft catheter may be left in the bladder for several days. Irrigation of the bladder is necessary to maintain it as far as possible in an aseptic condition, so that in case urine comes in contact with the wound it may not prevent healing.

As a substitute for plastic operations Dieffenbach proposed a much simpler operation. A concentrated tincture of cantharides is applied to the edges of the opening and tract of the fistula. As soon as the epithelium has become detached and the surfaces are sufficiently raw a good-sized soft bougie is introduced into the canal; a needle armed with a strong, well-waxed silk thread is now introduced about a quarter of an inch from the edge of the fistulous opening. This is passed into the tissue of the corpus spongiosum for a short distance, and then made to emerge. It is re-introduced at the point of emergence, passed along, and brought out again in the same manner and at the same distance from the edge of the fistula. This procedure is repeated until the ligature completely encircles the fistula and terminates at the first point of introduction. The thread bears the same relation to the fistula that a draw-string does to the mouth of a bag. The two ends of the ligature being drawn together, the freshened surfaces of the fistula are closely approximated. A knot is now tied and allowed to sink into the point of puncture. The urine is to be drawn at regular intervals by means of a catheter. The ligature is allowed to remain for three or four days, then cut and withdrawn. Several operations may be necessary before the fistula is completely obliterated. The operation is only applicable to fistulae of small size.

In the penile portion of the canal it is quite difficult to perform a successful operation of urethroplasty on account of the thinness and looseness of the integument and the sparsity of cellular tissue in this part. So scanty are

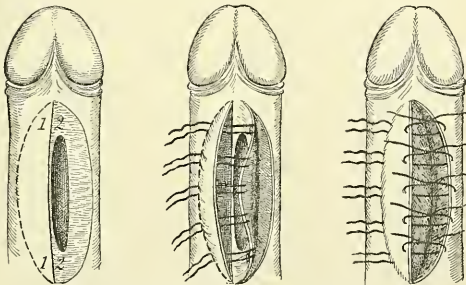


FIG. 59.—Szymanowski's operation for a large fistula.

the tissues that the surgeon naturally hesitates to pare the surfaces of the fistula sufficiently to obtain the desired result. Obviously, flaps with thick edges, such as can be secured in the perineum, heal much more readily than the thin ones which it is practicable to secure in the penile portion of the canal. Erections frequently occur and constitute another obstacle to success, as they produce tension and absolutely prevent the necessary rest.

Several special operations of urethroplasty have been devised. One of the best of these is that of Szymanowski (Fig. 59). This operation is per-

formed in the following manner: When the fistula lies in the long axis of the penis, a straight incision is first made, beginning just in front of the fistula and terminating a short distance behind it. The integument upon one side (1, 1) is then dissected up so as to be freely movable. A half-oval flap (2, 2) of skin on the other side of the fistula is then outlined and dissected up, excepting at the edge of the fistula, its epidermis being first removed. The dissected flap is then inverted and pushed under the skin which has been freed upon the opposite side, as into a pocket. It is then retained in position by sutures passed into and through the bottom of the pocket. The movable skin is then slid over it and also stitched. An elastic catheter is passed into the bladder and there retained.

Nélaton's operation has been somewhat popular. It is performed in the following manner: The edges of the fistula should first be freely pared; the surrounding skin for an area of about an inch in breadth and extending a little beyond the fistula anteriorly or posteriorly should then be dissected subcutaneously by a narrow-bladed knife introduced posterior to the fistula. The raw edges of the latter are then brought together by fine sutures.

Another method is proposed by the same surgeon. The edges of the fistula are first pared and the skin separated for about half an inch upon each side of the opening. Lateral incisions are then made at a distance of about half an inch from the pared edges of the fistula for the purpose of relieving tension. A slip of thin india-rubber tissue may then be passed underneath the flaps of skin in order to prevent contact of urine with the raw edges and consequent disturbance of adhesions. Should the fistulous opening close, the lateral incisions very promptly heal. In both of these operations the extensive separation of the skin causes abundant granulations to spring up, with the result of closing the fistula.

In cases of extensive fistulæ of the penile urethra perineal drainage may be established after a plastic operation has been performed.

Ricord recommended for cases in which perineal or scrotal fistulæ coexist with fistulæ in the pendulous urethra that a catheter be passed through the lower fistula for the purpose of draining the bladder during the treatment of the penile lesion. He also suggested puncturing the bladder. Erichsen recommends that this be done through the rectum, but perineal drainage is far better. The opening made in the perineum by this latter operation will almost invariably close spontaneously when it has performed its function.

An operation for extensive penile fistula was recommended by Le Gros Clark. This is performed as follows: The edges of the fistula having been thoroughly pared, a transverse cut about an inch in length is made through the integumentary coverings of the penis a little distance in front of the fistula. Two transverse incisions are then made at the peno-scrotal angle, each being about an inch and a half in length. These transverse incisions are connected at each end of the fistula by a short longitudinal incision. The flaps of skin thus outlined are dissected up and brought together by means of clamps or the quilled suture. By this procedure two broad raw surfaces are brought together instead of a narrow raw edge of skin, and there is therefore a much better prospect of successful union.

DISEASES OF THE TESTICLE AND ITS COVERINGS, THE CORD, AND THE SEMINAL VESICLE.

BY EUGENE FULLER, M. D.

THE SCROTUM.

IN considering the diseases especially relating to this part such cutaneous affections as more properly belong to the dermatologist will be omitted, while at the same time mention will be made of numerous conditions not properly classified as diseases of the scrotum, which, however, present peculiar and characteristic features in relation to this organ.

Edema.—The scrotum, being so elastic and distensible, is especially liable to be invaded by general dropsical effusions, under which conditions it becomes pale, cold, glistening, and tense. On being elevated and subjected to pressure, as by being squeezed between the palms, it will be found an easy matter to press out much of this effusion if it be recent, leaving behind shrunken normal scrotal tissue. Where, however, scrotal edema has been continuous for a long period and extensive, then inflammatory changes occur in the scrotal tissues. These structures become hard and brawny, and surface-blebs form on the dependent portions, followed by epithelial desquamations and by ulcerations, and occasionally by gangrene. The organ also in such an excoriated condition is exposed to germ-infection of various kinds, which may be followed by abscess-formation and sloughing.

In scrotal edema treatment should be directed toward the source of the effusion. Local measures should be conservative, and should consist in supporting and elevating the parts and in applying gentle pressure as with a flannel bandage. If excoriations occur, very mild antiseptic washes, followed by dustings with drying powders, such as powdered starch or talcum, are advisable. Punctures with needle or trocar and scarification are not usually to be recommended, since the benefit from them is temporary, and since such measures are apt to encourage ulceration and local gangrene.

Abscesses are not infrequent, generally involving the lateral walls of the scrotum. These usually form in hot weather, due to surface-infection at the seat of excoriation arising from chafing. After incision such abscesses heal without difficulty.

Urinary extravasation frequently invades the scrotal tissues, causing a tumefaction much as in simple edema. The urine, however, excites greater irritation than serous effusion; consequently the scrotal tissues speedily become infiltrated by inflammatory exudates, causing them to feel hard and firm like pork. If such effusion is not speedily relieved, abscess-formation usually results. The treatment should consist of prompt and free incisions.

Emphysema sometimes occurs in this part, causing a swelling much like that of simple edema. Verneuil under the heading of pneumocele classes emphysema in this part under two divisions: (1) benign, where gas is introduced into the tissues through a local wound, or where its source is

from some distant wound which communicates with the air-passages or bowels; and (2) malignant, where gas is generated in connection with bacterial fermentation. The benign form gets well spontaneously. For the malignant form incision, drainage, and thorough disinfection should be attempted.

Gangrene in this part may be associated with extreme and prolonged forms of edema occurring in the course of debilitating diseases in which dropsy is a feature; also, secondarily to urinary extravasation and after traumatism. In such instances the gangrenous process is usually of limited extent and of minor importance. There is, however, a form of gangrene in this connection which occurs occasionally and which exhibits marked characteristics. This form is called "spontaneous gangrene." It appears suddenly and with little or no warning. The scrotum quickly swells, often to a great size. At first it is red. This color, however, rapidly becomes dusky, and soon the parts markedly involved become dark gray or black. After a day or so the line of demarcation forms, and then gradually the lifeless tissues

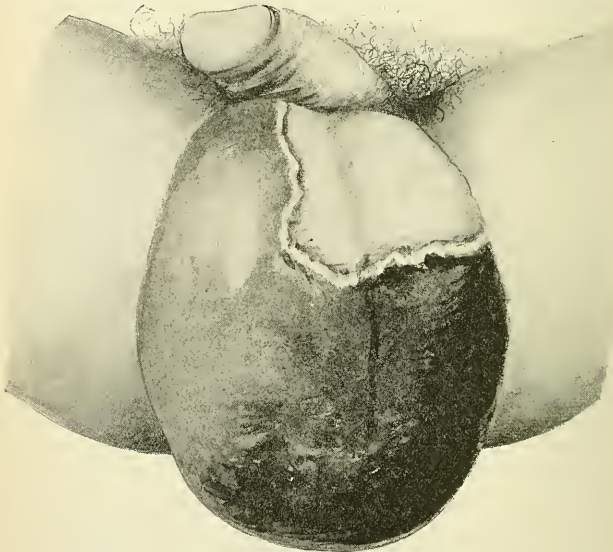


FIG. 60.—Gangrene of the scrotum (Allen).

slough off, leaving one or both testicles, according to the extent of the slough, exposed. Sometimes this destructive process is so extensive as to involve the penis as well as the scrotum. The exact cause for this form of gangrene is not known, though it is probably of bacterial origin. It occurs mostly in those addicted to alcoholic excesses, making its appearance directly after or during a prolonged debauch. Some of these cases are complicated by an emphysema. Surgical treatment in these conditions should always be most conservative. General supporting measures should be employed, together with careful attention to nutrition. The scrotum should be supported, dis-

infected, and enveloped in charcoal poultices. Necrosed masses should be removed as fast as they become detached. They should not, however, be cut away along the line of demarcation, lest live tissues be damaged, thus exposing the system to further septic absorption. After the slough has become entirely detached the remaining scrotal flaps should be left to granulate and to extend by cicatrization over the exposed testicles. It is wonderful to what an extent Nature, if left to herself, will accomplish repair in these cases. C. W. Allen of New York has lately published an interesting article on this subject.

Elephantiasis.—The scrotum is a favorite seat of this affection. When so attacked this organ may become of great size (Fig. 61). In fact, it has

been known to reach the weight of 150 pounds. The disease is slow, painless, and progressive. It is almost wholly confined to hot countries. The Barbadoes, parts of India, Egypt, China, the East Indies, and Brazil furnish most of the cases. It also exists to a limited extent among negroes in our Southern States. The scrotal tissues, especially in long-standing cases of the disease, become very hard and fibrous. The surface of the organ is not smooth, as might be expected, but is rough, furrowed, and studded with tuberosities. The growth is due to interstitial hypertrophy. Lymph-serotum is a term applied to an enlarged tumefied condition of the scrotum caused by a blocking of its efferent lymphducts. Such a blocking is caused by



FIG. 61.—Elephantiasis of the scrotum in a native of Fiji (Thorington).

the presence in the efferent lymphatics of the male and female worms, the larvæ of which are the *filaria sanguinis hominis*. In this condition the scrotum is not hard, but boggy to the feel. Its surface is tense, but not smooth, however, as it is covered with little lymph-vesicles. Such a scrotum on being removed collapses, if the disease is not of long standing, as the lymphatic engorgement drains off. If a lymph-serotum is of long standing, then interstitial changes take place in connection with the connective tissues, causing a condition either of true elephantiasis or one which cannot be distinguished from true elephantiasis. There has been much discussion regarding the etiology of elephantiasis. Numerous authorities hold that no distinction should be made between the two conditions; in other words, that all cases of elephantiasis, just as is the case with lymph-serotum, are due to parasites which block the efferent lymph-channels.

The medical treatment of these hypertrophies has hitherto been unsatisfactory and negative. Very recently Flint of New York has published some cases of *filaria sanguinis hominis* which have apparently been cured by the internal administration of methylene-blue for a considerable period. If these results are substantiated by further investigations, it may be that we shall have a cure for elephantiasis or such forms of it as may be dependent on filaria. Generally quite satisfactory results can be obtained by surgery in these cases. The pedicle is clamped and the scrotal tissue removed, care being taken to leave the testicles and penis. The exposed testicles become

covered by granulations and cicatrization. The chief danger with reference to the operation lies in septic absorption from the stump, but with careful attention to antisepsis death from this source should not be frequent. Formerly, before it was customary to apply a clamp to the pedicle, the danger due to hemorrhage was considerable, since the blood-vessels which have to be secured are numerous and large.

Tumors.—Dermoid cysts of the scrotum occur occasionally. Mermet has recently reported 2 instances of such tumors occupying the median scrotal

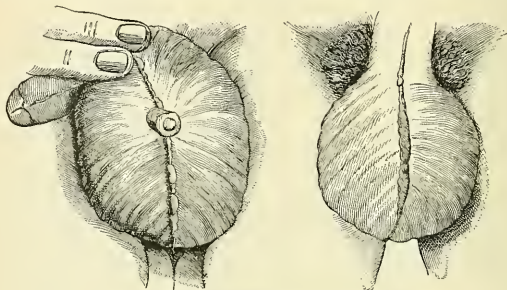


FIG. 62.—Dermoid tumors of the scrotal raphé.

raphé (Fig. 62). Sebaceous cysts are common. They frequently attain the size of a pea. Such growths may stud the whole scrotal surface. If one of these becomes inflamed, a localized abscess forms. Cystic, fatty, and fibrous tumors also occasionally occur. Cancer in this part is customarily epithelial, although scirrhus and medullary varieties have been noted. Epithelial cancer of the scrotum is confined almost exclusively to England, and in that country chimney-sweeps are the class of people affected. Butlin of London has recently considered this subject most thoroughly. He finds that chimney-sweeps of other countries, owing apparently to differences in dress, rarely have this form of disease. The disease begins as a soft moist wart, which gradually spreads over the entire scrotum, associated with more or less induration and ulceration. Sarcoma is rarely found here. Occasionally such growths are melanotic. Benign growths are easily and successfully removed. Malignant ones should in all cases be attacked by the knife, unless the neighboring structures are too much involved, if the general condition of the patient is such as to warrant radical measures. It is best while doing a radical operation to remove the inguinal glands as well as one or both testicles, should these organs be at all adherent to the scrotal structures.

Redundancy of the scrotum is every now and then a cause of complaint. Such an apparent condition of affairs may be due to an interstitial hyperplasia following an eczema or a condition of long-continued irritation, such as may be caused by pruritus, by pediculi, or long-continued tension. A relaxed condition, however, of the dartos accounts for most such instances. Varicocele generally accompanies this latter condition. When such is the case a cure of the varicocele will usually be followed by a cure of the redundancy. If, therefore, the varicocele is eliminated, it is not necessary, except in a very few extreme instances, to remove any of the scrotum in order to accomplish a cure.

Varicose veins occasionally occur in the scrotum itself of sufficient size to occasion disagreeable dragging sensations. Varicocele usually complicates this condition. To cure such a case the veins should either be tied or the portion of the scrotum chiefly affected removed. The scrotum is rarely the seat of nevus.

Traumatisms in the form of lacerations and contusions are quite frequent. In a case of laceration little or no tissue should be removed at the time of the accident. The parts should be cleansed and dressed antiseptically. If a slough occurs, it should be removed only after nature has clearly shown its extent. When contused the parts should be supported and cooling lotions applied.

THE LOOSE CONNECTIVE TISSUE SURROUNDING THE SPERMATIC CORD.

This structure is rarely invaded by serum, blood, or pus. When invaded by serum a swelling is formed which has been called diffused hydrocele of the spermatic cord. Such a swelling is more or less pyramidal in shape, the base being downward. The base is determined by the firm fibrous tissue which just above the testicle forms a septum, below which the effusion cannot extend. The lateral walls of the cone are made up of the firm fibrous sheath investing the cremaster muscle. The apex of such a tumor extends upward with the cord, so this limit is somewhat indefinite. Pott refers to an extreme case of this nature in which the effusion extended upward along the cord clear to the abdominal cavity. When these serous tumors are recent their interior contains a network of loose fibrous tissue. This network, however, in time gradually gives way, so that it does not appear at all or only partially if the effusion is of long standing. Hemorrhage into this loose fibrous tissue, such as occasionally occurs as the result of a traumatism or of some special muscular effort, will cause a tumor to occur of similar dimensions and position as the serous one just described. Such a collection of blood has been called diffused hemocele of the spermatic cord.

Suppuration in this connection, although rare, is of importance, owing to the difficulty which often attends its diagnosis. When a suppurating tumor exists, its limits are not as sharply defined, especially if it is of some duration, as is the case with the other fluid tumors just described. The upper portion of the tumor, instead of being conical and limited, is apt to be sausage-shaped, boggy to the feel, and without defined upward limits. In many instances the external inguinal ring cannot be made out, owing to the mass of induration which surrounds it. The scrotal tissues also external to the fascia beneath the cremaster muscle frequently become secondarily involved to such an extent that they present a thickened, edematous appearance.

A serous tumor in this part can be distinguished from a vaginal hydrocele, since the testicle can be felt loose and movable below it. Its shape and generally ill-defined outlines will serve to distinguish it from an encysted hydrocele of the cord, from an encysted hydrocele of the testicle, or from a spermatocele. A tumor of this nature is especially apt to be mistaken for an inguinal hernia. Like an inguinal hernia, it can in many instances be more or less compressed while the patient is recumbent, reappearing again shortly after he stands up. In some such cases it is probable that the fluid from the tumor can be pressed up along the cord to the abdominal cavity. It differs from an inguinal hernia, however, in the following particulars: It does not, as a rule, obscure the feel of the external inguinal ring, that structure appearing normal; there is no impulse to be felt by the finger at the external ring when the patient coughs. On reducing an in-

guinal hernia by digital compression, especially when the patient is lying down, the tumor when it disappears does so suddenly, and with the characteristic feel of slipping away suddenly. With a serous tumor, however, digital pressure will only at best cause a partial disappearance of the tumor, and such a disappearance will be very slow, never sudden and never associated with a slipping sensation. The serous tumor may be transparent, but not always so, owing to the thickness of its walls. The percussion note is always flat. With inguinal hernia, however, containing a knuckle of gut the note is resonant. A partially descended testicle associated with hydrocele, as also a hydrocele of an old hernial sac, might be mistaken for a serous effusion into the loose tissue about the cord; but, as these conditions are very rare, a consideration of the differential distinguishing points will not be here attempted. Much that has been said regarding the differential diagnoses with respect to a serous tumor in this part applies also to a hemorrhagic one. A hemorrhagic one, however, differs from a serous one in that it always appears suddenly after a traumatism or great exertion. It is not in the least transparent. It may be quite tender, especially when recent.

Between a suppurating tumor of this part and suppuration generally in connection with a hernial sac it is often impossible to differentiate, the exact diagnosis being determined only after a free incision has been made.

The treatment for these different fluid tumors is free incision, antiseptic irrigation, and thorough drainage. Great attention also should be paid by careful dressings to maintain strict antisepsis after the operation, since in these loose structures infection if once introduced may extend rapidly. Before the days of antiseptics such operations were attended with some risk, but with our present methods bad results should be very rare. Occasionally serous collections will not reappear after puncture with a trocar or aspirator, so these mild means had better be tried in such instances before a radical measure is attempted. To inject them, however, after aspiration, as is done in the case of vaginal hydrocele, is not advisable, since they have no serous lining, and consequently the inflammation so set up might extend upward along the cord and into the abdomen.

Varicocele.—This consists of a varicose condition of the veins accompanying the cord and lying in the loose fibrous tissue surrounding it. These veins convey blood from each testicle and epididymis. Varicocele is far more commonly met with on the left side than on the right. This occurrence has been accounted for partly by the fact that the spermatic vein on the left side, by reason of its passing beneath the sigmoid flexure, is more or less compressed, especially in constipated subjects, and also because on the left side the spermatic vein enters the inferior vena cava indirectly through the left renal vein, whereas on the right side the entrance of the spermatic vein is directly into the inferior vena cava. Both of these conditions by tending to impede the blood-current would tend to make the fluid-pressure in the veins on the left side greater than on the right. If one examines these long spermatic veins and follows their course through the narrow inguinal canal, where under so many conditions of exercise their calibers must be compressed, the fact that their dependent branches become frequently varicose can be easily understood, especially when it is seen that the branches which become enlarged lie in a loose fibrous meshwork which of itself gives no external support to the venous walls. These intra-scrotal veins, especially on the left side, are probably slightly enlarged in the majority of young adults. Such slight enlargements should not, however, be noted as of pathological importance. It is only when these veins are so enlarged as to become visible to the eye and feel

and to cause some scrotal relaxation that the term varicocele should be applied to them. Varicocele generally makes its appearance in young adults of sixteen to twenty-five years of age. From the time of its appearance up to middle adult life it may be the cause of much inconvenience. In later life it rarely gives trouble. In fact, in many instances it spontaneously disappears after middle life. It is thus seen that its limit of greatest development corresponds closely to that of the greatest sexual development. Sometimes it appears in young boys of ten or eleven. In most cases of varicocele no special causes aside from the general ones just enumerated seem to exist to account for the complaint. In numerous instances, however, varicocele has first become noticeable and troublesome after violent exercise, long-continued sexual excitement without relief, and sexual excesses or abuses, so that it is reasonable to suppose that such agencies may be classed as contributory causes.

Varicocele, after being once seen and carefully considered, can generally be readily recognized in the future. The testicle on the side affected hangs lower than normal and the scrotal covering is relaxed, thin, and atonic. Occasionally both sides are affected, in which case corresponding appearances exist on both sides. On inspection a convoluted tumor appears, generally especially prominent in the middle lateral portion of the scrotum, though in some extreme instances the whole lateral sac may seem to be distended by it. To the feel it appears soft, slippery, and compressible. It has been likened in appearance and to the feel to a bundle of earth-worms done up loosely in a bag. If the patient so affected lies down on his back, the tumor immediately and entirely vanishes. On this account it is like an inguinal hernia, but in all other respects it is very different, for with varicocele, if one examines the external inguinal ring it will be found to be normal and on coughing there is no impulse. When a patient affected with inguinal hernia lies down, the finger applied to the external inguinal ring will prevent the resulting scrotal tumor from reappearing when the erect posture is resumed. The same maneuvers in the case of varicocele will not only not prevent the scrotal tumor from reappearing, but will cause it to reappear of greater size than normal, since the finger so applied will serve to dam up the flow of venous blood and thus to over-distend the already diseased veins. In all cases where a varicocele is at all extensive an examination of the corresponding testicle will show that organ to be soft and undersized, owing to the fact that its blood-supply is diminished. This diminution in blood-supply is caused not only by the fact that the outflow of blood from the testicle is impeded by the distended and diseased condition of the efferent veins, but also by the pressure which the venous tumor exerts on the gland. It is probable that the soft and wasted testicles encountered in severe grades of varicocele have lost their function.

The subjective symptoms dependent on this condition consist chiefly of dragging sensations in connection with the scrotum. These sensations are often associated with pain, which may be dull and localized or sharp. When it is sharp it often radiates upward along the spermatic cord, and from there sometimes on toward the kidney or back toward the sacrum. These painful sensations are especially noticeable after exercise, such as horseback, tennis, etc., after and during prolonged sexual excitement, and as the result of standing about or walking for a long interval. Consequently the existence of varicocele is considered a sufficient disability to act as a bar to those seeking such positions as policemen, cavalrymen, and the like. It is commonly supposed, and to a considerable extent true, that the presence of varicocele occa-

sions sexual weakness. As has been seen, an extensive varicocele causes more or less atrophy of the testicle in connection with it, and it is often to be noted that after a cure of a varicocele the hitherto partially withered testicle becomes firm and equal in size to its mate, while at the same time the sexual vigor increases and regains its old-time force. Still, it is very unsafe for a surgeon without studying the case to argue to a patient suffering from varicocele and also sexual weakness that a cure of his varicocele will lead directly to a cure of his sexual weakness, since sexual weakness is far oftener due to other causes, chief among which is seminal vesiculitis, than to varicocele, and should any one attempt, as is often done, to cure a case of sexual weakness due, for instance, to seminal vesiculitis, by operating on an existing varicocele, not only will the sexual weakness remain unimproved, but it will in many instances be intensified. Therefore the surgeon, although he may have cured the varicocele, will yet be brought into discredit, since he has reasoned on a false hypothesis. The only way in such instances, and in fact in all instances, is for the surgeon to investigate his case carefully before giving his prognosis. The treatment of varicocele may be palliative or radical. Palliative measures consist of local support, such as may be rendered by a well-fitting suspensory bandage, cold douches alternated at times with hot ones, external applications, and the avoidance of the causes such as we have seen to be conducive to the development of the disease. Internal medication does no good. The treatment by means of a suspensory bandage is generally unsatisfactory, since if one once begins to wear such a support to relieve symptoms due to varicocele, it generally has to be worn indefinitely. Cold douches, especially such as are found in hydropathic establishments, which throw a strong stream vertically upward, often do much temporary and sometimes continuous good by stimulating the muscular tone of the parts. In some instances stimulating lotions will be found to do some good, probably by exercising a like stimulating effect. The only satisfactory methods of treatment, however, are the radical ones, by which the diseased veins are obliterated or removed by surgical procedures. With reference to the choice of procedures to be adopted to accomplish such results there is still considerable discussion. These methods can be classed as subcutaneous and open. Then there is another surgical method, which aims by ablation of a portion of the scrotum, in cases where that part is much relaxed, to support the testicle and its varicocele by the formation, as it were, of a natural suspensory.

The subcutaneous method deserves, in the writer's opinion, first mention, as being the most satisfactory procedure. It is the least dangerous; it entails the least confinement in bed, five days to a week being all the time required; and the after-results are satisfactory in cases where the operation is properly performed. Against this method it can be said that it requires more skill and assurance in its performance than the other operations. This is because the patient during all or most of the operation is not under the influence of an anesthetic. No anesthetic can be given, at least during the early steps in the operation, since it is necessary that the patient should remain standing while the ligatures are put in place; otherwise, if in the supine position, the veins to be ligated become collapsed and consequently indistinguishable. The surgeon, therefore, doing the operation under the eye of the patient feels that any tardiness or clumsiness on his part in placing the ligatures will be or may be noticed, and if he does not know the steps of the operation well, he is liable on this account to become bewildered and to place his ligatures badly, and consequently to make a fizzle of what ought to have resulted to his credit. Many, after failures of this description, unjustly blame the sub-

cutaneous operation, just as poor workmen blame their tools. Keyes of New York has done much to develop this operation and to make it a success by employing heavy Chinese silk for ligatures in the place of catgut, which he formerly used, which was productive of unsatisfactory results, since it became absorbed and loosened before the obliteration of the diseased veins had been accomplished. Other arguments advanced against the operation are that the cord may be tied in by mistake, and that many tissues and nerves are harmfully included in the ligation, causing subsequent atrophy of the testicle. If the cord is tied in, it is the fault of the operator and not of the operation. Atrophy of the testicle does rarely occur after this operation, and this fact should always be mentioned to the patient before doing the subcutaneous operation for varicocele, or, in fact, the open operation, as occasionally atrophy follows that also. Just why atrophy of the testicle occasionally occurs is not definitely determined, but it is probably due to injury to the nerves supplying the part. In the vast majority of instances the nutrition of the testicle in connection with a varicocele is aided by the operation, owing to the improvement which follows in the circulation of the blood through the organ. Consequently the testicle after a time

is apt to increase in size and become firm to the feel. As the steps in Keyes' operation are now so well known to the profession, a detailed recital of them will not be here attempted. It suffices to say that the patient stands nude, with the exception of a short shirt, on a rubber cloth supported by the arm of an attendant. The scrotum and genitals after being shaved are carefully disinfected. The bunches of veins are separated from the cord. Then two straight previously-threaded Reverdin needles are plunged through the scrotal tissues in the space between the cord and the veins, the position of the upper needle corresponding with the top of the varicocele, while the lower one is just above the level of the epididymis (Fig. 63). Sometimes in severe varicoceles a third needle is needed to tie

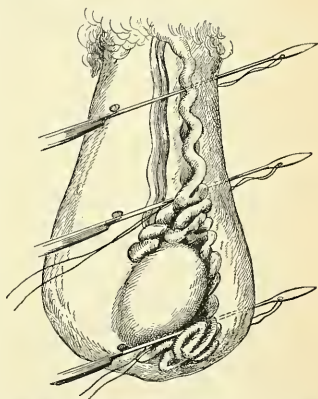


FIG. 63.—Diagram showing operation for varicocele (Keyes).

a cluster of veins below the epididymis, but a description of this ligature will not be given, since its technique is similar to that of the others. In placing each ligature the following manipulation is necessary: The point of the needle piercing the back wall of the scrotum brings with it a loop of the ligature. With a little tenaculum the loop is seized, and one end of the ligature is pulled through and the needle unthreaded. Then the needle is so withdrawn that its point is just within the dartos at the anterior scrotal puncture. Next the point of the needle is gradually worked around the bunch of veins until it arrives at the posterior dartos puncture, extending through which has been left the farther end of the silk ligature. The point of the needle is then again brought out through its original posterior scrotal puncture alongside of the ligature. A loose loop of the posterior end of the ligature is then re-threaded into the eye of the needle and the needle withdrawn, its point leaving the scrotum at the original anterior puncture. It will thus be

seen that the ligature is left placed about the veins. Each ligature is thus placed. No tying is done until all the ligatures are in position. The patient is now allowed to lie down. If he is fearful of pain, a whiff of chloroform can at this time be given, so that he will not feel the tying of the ligatures, the only really painful step in the operation. The ligatures should be tied very firmly, three square knots being employed. Then the dartos round about all the ligatures should be forcibly pulled away, allowing them to retract widely from the surface of the scrotum. The scrotum should be covered with antiseptic gauze, packed in wool or cotton, and left well supported by a suspensory bandage. There is no blood, no oozing, and little after-treatment required besides rest in bed for five days to a week. A firm mass remains at the site of the varicocele, which is gradually absorbed. Occasionally a silk ligature does not become encysted, but gradually works its way to the surface.

The open method of operation consists in making a longitudinal incision through the scrotum of sufficient length to enable the operator to expose the diseased veins. When this has been done one firm ligature is placed about the vessels above the varicocele and another about those at the bottom of it. The intermediate venous mass is then excised. The results from such a procedure are good, but no better than those in connection with the subcutaneous method. The danger is far greater, since infection has to be carefully guarded against, and convalescence is much slower, two or three weeks in bed being required.

Ablation of the scrotum in order to form a natural suspensory is a procedure generally attended with but moderate success. Oftentimes this operation is combined with the one just described under the open method. When once the varicocele is destroyed the scrotum almost always so contracts as no longer to appear redundant. Therefore ablation of the scrotum in connection with excision of the veins is rarely necessary.

Hydrocele.—When this term is used without an adjective to define its variety the ordinary form of hydrocele is always implied. This form, which is more particularly described as vaginal hydrocele, consists of a collection of fluid, more or less serous, in the cavity of the tunica vaginalis. The scrotal tumor resulting from such a collection generally assumes an egg-shaped contour in connection with the side of the scrotum involved, its larger end being the dependent one. A small hydrocele may appear as large as a billiard ball, a large one the size of an ostrich egg; while rarely the collection of fluid may make a tumor sufficiently large to extend downward nearly to the knee. The scrotal outline of the tumor is generally quite smooth. It is not tender to the feel when of the ordinary chronic variety. On holding it in one hand and tapping it sharply with a finger of the other, a wave of transmission can generally be detected, the percussion note being flat. The walls of the tumor are generally tense except in old hydroceles which have been tapped, in which instance, the old sac having but partially refilled, the walls may be flabby. An important feature in connection with a hydrocele, especially of this description, is its transparent quality. This transparency can be demonstrated, except in rare instances of old hydroceles with very thick walls, by darkening the room and then placing the tumor, its scrotal coverings being made tense, in the line of vision between the eye and a bright light. Oftentimes by so doing a dark spot can be detected marking the position of the testicle, which lies in the tumor largely surrounded by fluid. The fact that in vaginal hydrocele the testicle is within the fluid tumor, and consequently cannot be felt outside of it, is a point of much diagnostic importance. Aspiration will demonstrate the fluid contents of the tumor. If one bears in mind

the characteristic features of vaginal hydrocele, there ought commonly to be little difficulty in making a differential diagnosis. Occasionally, however, an extensive hydrocele may simulate an inguinal hernia. Hematocele also resembles hydrocele in many respects. The points of difference, however, will be studied when this latter condition is considered. If hydrocele is not of considerable size, its upper rounded margin can be felt below the external abdominal ring, and consequently inguinal hernia can be immediately excluded. Sometimes, however, the upper border extends so far up that it seems to the feel to be continuous with the external ring, and it is such cases that resemble more or less closely inguinal hernia. The following are, however, the important points of difference: The history of hydrocele is that of a dependent tumor which has gradually extended upward; with hernia it is the reverse. The development of hydrocele has been slow,



FIG. 64.—Hydrocele (Keen and White).

painless, and constant; with hernia it has generally been sudden, while at times the tumor would disappear suddenly, and then in like manner reappear, associated with more or less painful sensations. Hydrocele is transparent, hernia opaque; hydrocele on percussion is flat, hernia, especially if of large size, somewhat tympanitic, owing to its intestinal contents. With hydrocele no testicle can be felt; with hernia that organ appears distinctly outside of, and generally below, the tumor. Occasionally hydrocele and inguinal hernia coexist. Such a complication ought, however, to be correctly diagnosed, since the point of approximation of the two tumors can generally be felt and their differences in consistency detected.

Another most important point in diagnosis is to determine whether a case of vaginal hydrocele is one of true hydrocele, or whether it is one where the hydrocele exists simply as a symptom of some underlying disease, as cancer, tubercle, or syphilis of the epididymis or testicle. In true vaginal hydrocele the disease lies apparently in the secreting epithelia lining the sac, other structures being normal. Consequently, the prognosis and treatment of simple hydrocele and of hydrocele symptomatic of disease of the epididymis or testicle are widely different. The only way to settle this question in cases where the hydrocele is tense is to draw off by aspiration a portion of the fluid in order that the testicle and epididymis can be felt. If then the parts feel normal, a positive diagnosis of simple hydrocele can be given, with a good prognosis as regards the outcome of the disease as well as its cure.

The form of hydrocele under consideration is chronic. There is an acute variety of vaginal hydrocele, but as this is simply associated with and symptomatic of some correspondent inflammatory condition of the testicle or epididymis, it needs no further mention here. The etiology of vaginal hydrocele is not well understood. The cause for it seems to lie in the secreting serous epithelia. The disease generally begins insidiously, and especially affects men round about or after middle life. When it once begins, it generally persists until cured by surgical measures. When hydrocele is not of long standing its walls are thin and elastic. These eventually, however, become thick, sometimes to the extent of one-fourth of an inch, hard, and unyielding. This is caused

by a fibrous proliferation in connection with the subserous connective tissue. Rarely the thickened walls become infiltrated with lime-salts. This thickening of the walls, besides making diagnosis more difficult, interferes somewhat with satisfactory resolution after operation.

The fluid drawn from hydrocele is usually of light specific gravity and pale straw color. Sometimes, however, it may be thick like syrup, or its color may be darkened somewhat by blood-pigment. When a fluid is so darkened, however, underlying disease of the epididymis or testicle may be suspected.

Treatment.—Hydroceles which are simply symptomatic of morbid conditions of the testicle and epididymis depend for their continuance on those conditions, and consequently need no special consideration as regards treatment. The remarks here apply only to true vaginal hydrocele. Internal remedies and external applications given in the hope of promoting absorption are useless. Very rarely hydrocele gets well spontaneously, but commonly the fluid has to be drawn off in order to reduce the tumor. To do this an aspirating needle or a trocar and cannula are necessary. The tumor after being disinfected should be taken in one hand, its scrotal covering put on the stretch, and the needle, held in the other hand, plunged in until its end is felt to be well within the fluid cavity. In selecting the spot for the needle to pierce care should be taken to avoid the testicle. This organ generally, though not always, lies behind. If the transparency of the spot to be pierced is first determined, the testicle can always be avoided. Care also should be had to avoid wounding scrotal vessels. The fluid generally is of such consistency as to run freely through the needle, leaving the sac collapsed. This process is called tapping. It is not a painful procedure, and it is almost devoid of risk if done in a cleanly manner. Rarely, however, if care is not exercised to avoid the testicle and epididymis, a blood-vessel may be wounded, followed by a hemorrhage into the sac, hematocele resulting. Such treatment, though it gives relief for weeks or months, is not radical, since the fluid reaccumulates in the sac and the procedure has to be repeated. Radical treatment consists in injecting the sac with some irritant immediately after it has been tapped, in making an incision into the sac followed by drainage, and in excising more or less of the parietal lining wall of the sac. This last method is called the Von Bergmann operation, and is especially intended for such old cases as have very thick and infiltrated walls. The injection method is suitable in most cases, and is the author's method of choice in the great majority of them, since its results are good and radical, while it subjects the patient to but little pain, to the least confinement, and to the least danger, although the question of danger is not a prominent one in connection with any properly performed operation for this disease. The material to be injected into the empty sac is 95 per cent. carbolic acid to the extent of from 30 to 60 minims. Other substances, especially compound tincture of iodine, have been used, but have not been found efficacious like the strong carbolic-acid solution, while at the same time they have been productive of much pain. The technique of this operation is as follows: The fine needle, detached from its syringe, which contains the carbolic-acid solution, should first be plunged well into the sac and left there. Then the larger-calibered aspirating needle (or better a trocar and cannula attached to an aspirator) is introduced and all the fluid drawn off. Next the syringe containing the carbolic solution is attached to the fine needle without withdrawing it from the sac, and the solution injected. The injection causes a peculiar pain for a moment or so, after which the patient generally experiences little discomfort. If the hydrocele is very large and tense, it is better as a preliminary measure to draw off most

of the fluid, and then later, when it is smaller, to draw off the fluid again and inject it. When a failure to cure follows this operation, it is generally due to the fact that the hydrocele was not thoroughly emptied of its fluid prior to being injected. After the hydrocele has been successfully injected the sac partially refills very promptly, due to the inflammatory reaction caused by the carbolic acid. This inflammatory exudate, however, is gradually reabsorbed after the inflammatory process giving rise to it has subsided. No anesthetic is required in this operation. After the operation the scrotum should be supported for some time, but the patient need not be confined to bed. The operation by incision and drainage requires confinement in bed until such time as the sac has been obliterated by the formation of adhesions between its parietal and visceral walls. This commonly, however, does not take many days. In performing this operation the sac is opened in a dependent position under antiseptic precautions, and a rubber, catgut, horse-hair, or wick drainage inserted and kept in position until the necessary adhesions have been formed. Some advocate stuffing the sac loosely with iodoform gauze, and then gradually removing the packing as the adhesions form. The results from this operation are generally satisfactory. An anesthetic may or may not be required.

The operation by excision of a portion of the sac is perhaps the most radical of all, and at the same time the most extensive. It is only called for in a few very old hydroceles with very thick walls, and especially where the thickening of the walls is due to sclerous and calcareous changes in the subserous tissues. In such an operation the cavity formed by the sac has to be obliterated by granulation. Consequently thorough drainage must be maintained until the process of repair is complete.

Encysted Hydrocele of the Testicle.—Many times a hard, rounded tumor can be felt in connection with the epididymis or testicle, bulging out under the the visceral layer of the tunica vaginalis. Such a tumor is generally small, not larger than a pea or a grape, although it may rarely attain to the size of a goose-egg or even larger. In many instances such tumors are multiple, especially in connection with the epididymis. On aspiration they will be found to be cystic. The fluid drawn from them is generally transparent, though it may be more or less opalescent, due to suspended fatty degenerated particles. It may also be somewhat albuminous. These cysts, when occurring in or originating from the crease between the epididymis and testicle proper, consist of a localized serous effusion in the folds of the tunica vaginalis, which effusion is cut off from the general cavity of the tunica vaginalis by the natural adhesions which here occur between the folds of serous membrane. Cysts of this nature may be of considerable size. In most instances, however, they are subserous, and when originating from the epididymis they may oftentimes be identical with the hydatids of Morgagni. The name "encysted hydrocele of the testicle" has been applied to tumors of this description. Transparency cannot always be demonstrated in them.

Spermatocele.—The same general description applies to spermatocele as that just given in describing the gross appearance of encysted hydrocele of the testicle, except that spermatocele in size averages larger (it frequently being as large as a walnut or hen's egg), and its situation, especially when it is connected with the body proper of the testicle, may be and often is deeper seated than is the case with encysted hydrocele of this part. This difference in situation is easily understood when the difference in etiology between the two conditions is taken into account, spermatocele being a retention-cyst formed by an occlusion of a secreting duct. However, the clinical appear-

ances of these two varieties of cysts are so similar that the only way to differentiate between them is by aspiration. Then if examination of the fluid shows spermatozoa to be present, the tumor is classed as a spermatocele: if these organisms are absent, it is called an encysted hydrocele of the testicle. This differential diagnosis may not always be pathologically correct. The fluid drawn from spermatocele is generally opalescent, and sometimes almost milky; consequently the tumor is not transparent.

These two conditions of the testicle and epididymis may be confounded with encysted hematocele, pyocele, or a solid growth of the part, and the aspirating needle may be called for to settle the question. The treatment for both these preceding conditions is the same. Simple tapping will usually prove of but temporary benefit, just as with ordinary vaginal hydrocele. For radical cure tapping followed by carbolic-acid injection is recommended. In these instances, however, since the sacs are usually small, a small quantity of 95 per cent. carbolic-acid solution, say from ten to twenty minims, will be sufficient for injection.

Encysted Hydrocele of the Cord.—Occasionally a cystic tumor lies in the loose tissue alongside the cord. Such a tumor is generally oblong, its long diameter corresponding with the direction of the cord. Its upper circumference can generally be easily made out below the external inguinal ring, although at times it may extend up to that part, and rarely even into it, in which cases it may simulate inguinal hernia. Its lower circumference also can be felt free and independent of the testicle, that organ lying below in all cases, except occasionally where the cyst is very large, in which instances the testicle may be pushed to one side. Rarely more than one cyst of this description may occur in a given instance. Such a cyst is called encysted hydrocele of the cord. Its walls are lined with serous membrane, and its contents are similar to those of vaginal hydrocele. Its occurrence is due to a localized non-obliteration of the folds of the serous membrane, which usually become obliterated at birth. It can be distinguished from inguinal hernia in those cases in which that affection is simulated by the following characteristics: It is transparent, flat on percussion; coughing produces no impulse in it; it is permanent, never disappearing or reappearing suddenly; and it is firm and non-compressible to the feel.

The rare condition already described as effusion of serous fluid into the loose subserotal tissues about the cord, diffused hydrocele of the cord, can usually be readily differentiated by its shape and by the fact that its outlines are less well defined. The treatment advised is aspiration and carbolic-acid injection.

Spermatocele of the cord has been known to occur. Vautrin reports such a case and refers to several others. This condition, owing to its great rarity, simply merits mention in this connection.

Congenital Hydrocele.—When the knuckle of peritoneum drawn down with the testicle in its descent maintains a connection with the peritoneal cavity, that knuckle which makes up the tunica vaginalis becomes distended with peritoneal fluid, forming a tumor which is called congenital hydrocele. Such a hydrocele is prominent at birth and for a few months afterward. The connection between the two cavities, however, almost always soon closes, thus shutting off the cavity of the tunica vaginalis from that of the abdomen, and then after a time the fluid in the hydrocele is absorbed, a natural cure taking place. Before the connection between the two cavities is closed the hydrocele on being squeezed can be diminished somewhat in size, since a certain amount of its contents flows back into the abdomen. Con-

genital hydrocele need never be mistaken for a hernia, since, owing to the thinness of the scrotal walls in the young subject, its transparency is most apparent. This form of hydrocele generally gets well spontaneously. Its absorption, however, can often be hurried by a few pricks with a surgical needle. Injection with carbolic is not advisable, lest the inflammatory reaction caused by it extend upward into the abdomen in case the connecting passage should still be pervious.

Hydrocele of the Hernial Sac.—Rarely an old hernial sac may remain filled with abdominal fluid, its communication with the abdominal cavity having been more or less completely closed by omentum, bowel, and adhesions. Such a tumor is called hydrocele of the hernial sac. It should not, of course, be injected. False hydrocele of the hernial sac occurs in cases of strangulated hernia, where a serous effusion takes place between the walls of the sac and those of the incarcerated gut.

Hematocele.—This term as ordinarily applied refers to a tumor caused by a collection of blood in the cavity of the tunica vaginalis. It differs from hydrocele in that it is not transparent. Its advent is always sudden, thus corresponding to the hemorrhage which occasioned it. It is usually associated with some traumatism, and it is apt to be accompanied by some inflammatory symptoms if it has not existed for any time. Any variety of hydrocele as well as spermatocele may rapidly refill with blood after being tapped, thus forming hematocele. As has already been described, hemorrhage may take place into the loose tissues about the cord, forming a tumor sometimes called diffused hematocele of the cord. After what has been said regarding differential diagnosis with reference to hydrocele, nothing further on that subject is here necessary, since the remarks with reference to hydrocele refer in a general way also to hematocele. For treatment the sac should be incised antiseptically, the clot removed, the cavity irrigated, and drainage established and continued until such time as an obliteration of the sac by granulations has been accomplished.

Pyocele.—This name can appropriately be given to encysted collections of pus which occur generally in connection with the epididymis, rarely with the testicle and cord. Such collections are of the nature of cold abscesses. They are very chronic, develop slowly, and have no clinical inflammatory symptoms. They are generally tubercular, lined with a pyogenic membrane, and filled with cheesy pus, frequently of such thick consistency that it will not flow through any but a coarse aspirating needle. Oftentimes such cysts can be distinguished from a spermatocele or encysted hydrocele only by a resort to aspiration. The treatment advised consists of free incision combined with thorough curetting of the lining walls and the establishment and maintenance of drainage until the cavity is well filled with granulations. Iodoform suspended in glycerine often makes a very efficacious injection to stimulate healthy granulation in these cases.

Free bodies in the tunica vaginalis are rarely found closely resembling those occurring in the knee-joint.

Lipoma.—A tumor of this description occurs occasionally in the loose tissue in close relation to the cord, and may consequently resemble a cystic tumor of the part. An attempt at aspiration will always settle the diagnosis.

ANOMALIES WITH RESPECT TO THE TESTICLES.

A cryptorchid is one who was born and has remained without either testicle in his scrotum; a monorchid is a similar individual who has never

had but one testicle. The study of the question of arrest of development, which accounts for these cases, falls beyond the scope of this treatise, and will consequently not be here considered. There are varying degrees in this arrest of development. When a testicle remains in the abdomen inside the internal abdominal ring, it is spoken of as *undescended* testicle. When it remains in the inguinal canal, at the external ring or just without the external ring at the top of the scrotum, it is spoken of as a *partially descended* testicle. It is very rare for a testicle undescended at birth to descend afterward. A testicle, however, partially descended at birth may in a short interval afterward work itself down into its proper position, especially if aided by artificial manipulation. Inguinal hernia often accompanies partial descent of the testicle.

A **misplaced testicle** is one which, although it has descended, has not entered the scrotum, but forms a prominence in the perineum or at one side of the scrotum in the inguinal fold (Figs. 65, 66).

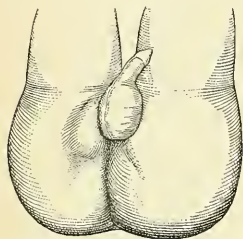


FIG. 65.—Misplaced testicle (Pollard).

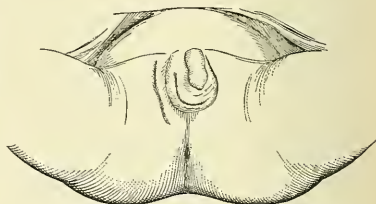


FIG. 66.—Misplaced testicle, after operation (Pollard).

Supernumerary testicles probably occur, since competent observers have reported such cases. Still, when an instance of supernumerary testicle is reported such a diagnosis can justly be regarded with some suspicion, since on careful investigation most of such cases prove to be wrongly diagnosed, the extra testicle turning out to be a cyst, a lipoma, or some morbid growth. When a testicle does not descend, but remains either in the abdomen or inguinal canal, thus subjected constantly to outside pressure, it does not fully develop, but remains soft and incapable of secreting viable seminal elements. With a cryptorchid the penis does not fully develop, the hair on the pubes is scant and thin, and the general characteristics of such an individual are much like those of a eunuch who has lost his testicles at an early age. A monorchid suffers in no such manner, however, but may be sexually vigorous and potent. Sometimes this monorchid condition is inherited. If undescended testicles are brought down into their natural scrotal positions before the age of puberty is fully established, for instance from twelve to sixteen, the hitherto soft and withered organs oftentimes fill out, becoming of good size and firm consistency; and in case the individual has been a cryptorchid, these changes in the testicles are accompanied by erections, emissions, the awakening of sexual desires, and even by the ability to impregnate. Experiments on animals have also shown that retrograde changes of an opposite nature ensue in cases where the testicles are replaced and retained in the abdomen.

When a testicle is undescended it occasions the individual no localized inconvenience. When, however, it is partially descended it is a frequent cause

of suffering and of danger, because, owing to the position of the organ with reference to the inguinal canal, it is exposed to many forms of traumatism. Every injury inflicted upon it causes much localized pain, the organ becoming swollen and occasionally gangrenous. Besides this, such a testicle, as the result of continuous traumatism, oftentimes undergoes malignant degenerative changes.

Orchidopexy is the name given to the operation which has for its object the bringing down into the scrotum of an undescended or partially descended testicle, the making of a scrotal nidus for its reception, and the retention of the organ in its natural position until firm healing has taken place. The first step in the operation, the securing the organ and bringing it down into place, is not difficult. If the organ is undescended, the inguinal canal has to be opened. If it is in the canal and cannot be forced out by manipulation, the external ring only has to be divided; otherwise the inguinal canal is not disturbed. The next step, making a scrotal nidus, often requires considerable dissection and stretching of the parts. It is the last step in the operation, however—namely, the retaining the testicle in its scrotal position—which is the difficult one. This is because the cord in connection with such testicles is undeveloped and consequently short, and also because there exists an elastic fibrous band, the gubernaculum, which is attached to the testicle and tends to draw it up. This fibrous band should always be carefully dissected away, so that there should remain only the shortness of the cord to contend against. If the testicle is only kept in position a certain period of time, the length of the cord soon corrects itself to correspond with the new position of the testicle. To prevent retraction the scrotal folds between the testicle and the external ring should be brought closely together by sutures, thus acting like buffers, as it were, while at the same time outside pads of antiseptic material should be so placed outside the scrotal folds as to aid those tissues in counteracting the pressure brought against them by the testicle.

Treatment.—If both testicles are undescended, no bodily harm comes to the patient from leaving them alone, and such has formerly been the advice in these cases. Since, however, a few brilliant results have been obtained in cryptorchids by the employment of orchidopexy, such an operation is advisable, certainly in selected cases, in order that those so afflicted may be able to marry and perform their sexual functions. In a monorchid, where the testicle is undescended, no surgical interference is advisable. In all cases where one or both testicles are partially descended palliative or radical surgical treatment is advisable. Palliative treatment is intended to get the testicle out of the inguinal canal and to keep it out. If a testicle is in the inguinal canal and cannot be pressed forward, then it should be pressed back into the abdomen and kept there by the application of a suitable truss. If it can be pressed out—and this is far better—that should be done, and a pad adjusted, if possible, at the external ring so that the organ cannot slip back, and the organ should be pulled down daily as nearly as possible into its scrotal position, so as to stretch and distend its cord and gubernaculum, in the hope that after a time it will stay in place. Much can be done by a careful and painstaking parent in so bringing a testicle into place, and often a perfect result can be thus obtained. If palliative treatment fails and the offending testicle cannot be kept out of the inguinal canal, where it is exposed to traumatism, radical surgical measures should be employed. These consist of orchidopexy or castration. Orchidopexy of course is to be preferred in all cases where it is practicable. The best results from this operation have so far been obtained in boys of from ten to fourteen years of age. In very young children, where

a radical operation is demanded, castration may be necessary, since the patient cannot well be prevented from tearing off and soiling the dressings, thus jeopardizing such an operation as orchidopexy. Where partial descent of the testicle is complicated with hernia, then both conditions have to be taken into consideration, and in doing a radical operation on the hernia the testicle is generally sacrificed, castration being employed.

The treatment for misplaced testicle is to put it in its proper place in the scrotum. To do this considerable dissection may oftentimes be necessary, but when the organ is once put in place, it generally tends to stay there, since no traction from a short cord, such as may interfere with orchidopexy, is to be expected.

Strangulation of the Testicle from Torsion of the Cord.—This accidental condition was first demonstrated a few years ago by Nicoladoni, since which time numerous examples of it have been reported, showing it to be not infrequent. It has been shown that torsion of the cord occurs chiefly in connection with testicles where descent into the scrotum has not been complete. In most such cases the gubernaculum by the traction it exerts seems to favor the torsion. In examining a case of this description the testicle will be found to have undergone several complete lateral rotations, thus tightly twisting the cord, together with its accompanying blood-vessels and nerves. The result of such torsion, if it is all complete or if it is not speedily relieved, is to stop all circulation through the testicle, strangulation resulting. The symptoms attending this condition closely simulate those of strangulated inguinal hernia, and in most of the cases so far reported it has only been after an incision has been made, with the expectation of discovering and relieving a strangulated hernia, that a strangulated testicle from torsion of the cord has been diagnosed. There are, however, differences which ought, especially if the case of torsion is seen early, to be sufficient to enable the surgeon to make a correct differential diagnosis, except perhaps in those instances where inguinal hernia occurs as a complication. Cases of torsion manifest themselves suddenly as a severe stabbing pain in the testicle affected. Such an attack of pain generally occurs during or shortly after some violent exercise. The scrotum on the side affected quickly swells, owing to an internal effusion of plastic lymph and serum. If the testicle is felt, it will be found to be more or less drawn up and to be quite rigidly attached to the cord. The cord cannot be distinctly felt, a thick tumefaction occupying its place. Oftentimes when the rotations have not been complete the epididymis will be felt in front of or to one side of the testicle, and not behind, as it should be. If the case is recent, so that complete strangulation of the testicle has not taken place, an attempt at lateral rotation of the testicle if in the direction of the torsion will serve to intensify the pain which the patient is already suffering by twisting the cord still more tightly. If, however, lateral rotation in the opposite direction is practised, then relief from the pain will be immediately experienced, since the twist will be loosened. In strangulated inguinal hernia, of course, the testicle can be felt natural and easily movable independent of the tumor. Vanderpoel has reported a case of torsion of the cord in which a moderate degree of torsion, but not sufficient to cause strangulation of the testicle, has occurred on numerous occasions. On each occurrence of the accident, however, natural relief had been experienced largely from a spontaneous retwisting of the cord.

Treatment.—If the case is seen early, before gangrenous changes in the testicle have been established, the torsion should be promptly untwisted. Nash has reported a successful case from prompt treatment of this descrip-

tion. If the testicle is already gangrenous, then the only treatment is to remove it promptly and to drain and disinfect the parts thoroughly.

Hemorrhagic Infarction of the Testicle.—This condition is of rare occurrence. It is to English that we owe most of our knowledge on the subject. It is occasioned by a thrombosis in connection with the internal spermatic artery or the pampiniform plexus, or both these structures. The thrombosis seems in some cases to be caused by infection. A case of this description generally first manifests itself by symptoms similar to those of pelvic peritonitis. Then the scrotum, one or both sides, may be affected, swells greatly, presenting the appearance of phlegmon. This condition has also been observed in male babies shortly after birth, there having been a breech presentation. Expectant treatment is advised in all forms of the disease.

Variations in Size and Consistency of the Testicle.—Large-sized or firm testicles are found in those full of sexual vigor and activity. In individuals also who have but one functioning testicle, that organ is generally somewhat above normal in size. Anything, however, approaching great hypertrophy in a healthy testicle does not occur. In old age the testicle generally undergoes degenerative changes which reduce its size. These changes consist of fatty degeneration of the secreting epithelia and sclerosis in connection with the interstitial tissue. At what age these changes begin depends entirely on the individual, some men retaining their sexual potency until very late in life. Complete atrophy of the testicle is not rare. It may occur without any assignable cause, in which case some disturbance in the nerve-supply to the part probably exists. In such instances, while the atrophic changes are taking place, complaint is often made that the organ is painful and very tender to the touch, though no inflammatory signs are present. It is more common, however, for atrophy of the testicle to be found following closely after the subsidence of an inflammatory disturbance affecting the part. Orchitis due to mumps is a form of inflammation which is especially prone to be followed by atrophy. Operations for varicocele, for hernia, and occasionally the wearing of a truss which presses on the cord may all be followed by atrophy of the testicle, probably due to some injury which they have caused to the nerve-supply of the part. Then, on the contrary, the epididymis and a large part of the cord may be removed, and still the testicle which is left will usually remain permanently firm and of natural size. Where atrophy of the testicle is occasioned by a derangement of the nerve-supply, both organs are usually affected, provided the derangement is centered in the spine.

Neurotic sensations in connection with the testicles are common and may be due to a variety of causes. Thus the pain of a pyelitis, especially when it is due to calculus, is liable to be referred to the testicle on the corresponding side. The same is especially true also of the pain due to urethral obstruction. During the paroxysms of pain referred to the testicle that organ is frequently so retracted that it is held close against the external inguinal ring. Neuralgic pain in the testicle may also be a prominent feature in certain cases of seminal vesiculitis. More rarely vesical and deep urethral inflammations may be attended by such symptoms. Excessive sexual indulgence and long-continued sexual excitement without relief are among other not infrequent causes. Sometimes a testicle remains extremely tender and painful after the subsidence of an inflammatory process in connection with its substance. In these last cases the preceding inflammation has probably partially obliterated some of the secretory ducts, thus interfering with the function of

the organ. In attempting to treat a neuralgia of this description great care should be exercised by the surgeon first to diagnose its cause correctly, for if the attention is simply centered on the testicle, efforts at relief are generally futile.

Traumatisms, by causing laceration of the scrotum, may lead to exposure of the testicle. The testicle itself may also be bruised or lacerated. Sometimes individuals suffering from melancholia or remorse mutilate or excise their testicles. If a testicle is simply exposed by an injury to its coverings, it suffers no harm. If its substance is badly bruised, subsequent atrophy is common. If the tunica albuginea is torn, the organ is destroyed unless the rent is such that it can be promptly sutured, since its secreting tubules by the force exerted by the cicatricial and natural contraction of the interstitial capsule protrude, forming with their granulations a fungous mass.

Castration is an operation which hitherto has generally been practised only to remove localized disease, unless it be in a few instances of operation for hernia where the cord might interfere with the result, and also occasionally to abate extensive sexual disorders. At the present time, however, double castration is being quite extensively employed with the intention of producing prostatic atrophy in old men suffering from the effects of prostatic senile hypertrophy. The results of castration in some of these latter cases have been brilliant, the prostatic hypertrophy largely or apparently wholly disappearing, and in some the results have been negative. So at the present time just what will be the outcome of this treatment in a given instance has not been determined. White of Philadelphia was the first to suggest castration for prostatic hypertrophy. To perform the operation a small longitudinal cut should be made in the scrotum above the testicle if the organ is not adherent to the parts. Then the testicle should be pushed through this elastic hole. The spermatic artery should be ligated by itself. The veins, however, can be ligated *en masse*. Then the cord should be divided, and also the blood-vessels below the ligatures, care being exercised not to allow the stump of the cord to retract up into the inguinal ring until it is evident that all of its blood-vessels have been securely tied. Temporary drainage should be provided until it is evident that no suppuration will occur. In young or middle-aged subjects, antiseptic precautions being of course carefully observed, the mortality after this operation should be almost *nil*. In old men, however, who are dependent on the use of the catheter the operation of double castration, according to White's statistics, is attended with considerable mortality. In a number of these cases death was from sepsis, the wound having become infected after the operation, probably from urinary dribbling consequent on the use of the catheter and from the frequent disturbance of the dressing which in some instances the catheterization necessitated. In a few of these aged individuals a marked mental disturbance was observed after the removal of the testicles, which occasionally was sufficient of itself to cause death.

INFLAMMATIONS OF THE SEMINAL VESICLE, THE CORD, THE EPIDIDYMIS, AND THE TESTICLE PROPER.

Pathology.—The great majority of inflammations involving the epididymis and testicle have their origin directly or remotely in the urinary tract, extending thence down the ejaculatory duct into the seminal vesicle, and from there still farther along the cord into the epididymis, and perhaps

into the testicle itself, thus traversing the full extent of the genital tract. In order that inflammation of the urinary tract may involve the ejaculatory duct it must have extended into or originated in the deep urethra. Where the inflammatory process in the deep urethra extends along the ejaculatory duct into the vesicle, and from that organ promptly along the cord and into the epididymis, then the resulting epididymitis, as is evident, has originated directly from the deep urethral inflammation. This inflammatory extension from the deep urethra, however, is not always—and in fact very frequently is not at all—rapid in its extension. In many such cases the inflammation penetrating the seminal vesicle frequently sets up a chronic seminal vesiculitis. Then, after an interval perhaps of years, as the immediate result of some disturbing factor, the old inflammation in the vesicle, becoming exacerbated, suddenly extends down along the cord, setting up an acute epididymitis, the remote origin of which was the old inflammation of the urinary tract. As the old original inflammation has probably passed away, and perhaps been largely forgotten, and as the chronic seminal vesiculitis as such may not have been known to the patient or his doctor, it is natural that the cause which tended to stir up the chronic seminal vesiculitis, or, in fact, anything unusual which may have occurred just previous to the testicular inflammation, should wrongfully be ascribed as the source of the epididymitis. Thus it is that we commonly hear of epididymitis due to cold, malaria, sexual strain, alcohol, and what not. It must not be supposed, however, that an inflammation after it has once entered the ejaculatory duct must speedily or remotely invade the whole genital tract, or that it necessarily deals alike with the different parts which it does reach. Sometimes it spends itself on the seminal vesicle, setting up a very acute disturbance there which may end in perfect resolution, leaving the organ as good as ever it was. Then, again, it may treat the vesicle very kindly and transiently, but spend its fury on the epididymis and cord. When the cord is severely affected, however, the seminal vesicle is usually also much involved. It is not uncommon for the epididymis and testicle to escape largely in cases of extreme involvement of the testicle and cord.

Some forms of inflammation originate in the seminal vesicle, and from that focus may extend either downward along the cord to the epididymis and testicle, or outward, involving the ejaculatory duct and even the urinary tract. Lastly, the epididymis and testicle may be the source of inflammation. When the epididymis is the source, the inflammatory process may in some instances ascend the cord. When, however, the testicle proper is the source, the process does not ascend the cord, nor in fact apparently tend to involve the epididymis.

The forms of inflammation which may invade the genital from the urinary tract can best be classed as simple, gonorrhœal, those resulting from urethral lesions originating from gonorrhœa, and tubercular.

The forms originating in the seminal vesicles are simple and tubercular. Those originating in the epididymis are simple, syphilitic, and tubercular. Those originating in the testicle proper are simple, syphilitic, and rarely perhaps tubercular. There are a few inflammatory conditions, chief among which is that occurring in mumps, which it is impossible with our present knowledge to include in this classification. Such irregular conditions will be considered by themselves. It might be said that inflammations associated with neoplasms should have been mentioned. Neoplasms, however, together with their methods of extension, will be considered by themselves, and whatever true inflammation they may cause by their presence will be classed, as

it should be, under simple inflammation, since it is in no wise characteristic of the neoplasm which it happens to accompany.¹

The simple inflammations of the urinary tract which may secondarily invade the sexual apparatus by way of the ejaculatory ducts are such as may be caused by the passage of a sound or catheter along a healthy urethra. If a subject is young, such a result from the use of instruments in a healthy urethra is not very common. In an elderly subject, however, suffering from prostatic enlargement, it is frequent. Sometimes in prostatitis, where there is much vesical tenesmus, the urethral inflammation may extend itself, even though no instrumentation has been employed. The same is also true where vesical calculi, gravel, polypi, etc. by reason largely of the vesical tenesmus they cause set up inflammation of the deep urethra. Perineal traumatism by injuring the deep urethra may cause like results. The inflammations of the genital tract resulting from such causes are not apt to be severe. The vesicle becomes moderately swollen and its contents semi-purulent. Its walls, however, are but moderately involved, and it is very rare that the perivesicular tissues are invaded. The inflammatory process generally stops at the vesicle, but occasionally extends to the epididymis, setting up a light-grade inflammation which renders the part extremely sensitive, but which is not usually productive of much swelling. The cord is not apt to be swollen or tender. An exception to this description may, however, be sometimes observed in elderly prostatitis who are being broken in to catheter life. In such cases, if the epididymis once becomes involved, the inflammation may be kept up and intensified by the continual use of the catheter, and the epididymitis may become so severe as to be purulent. It may extend to the testicle, setting up an orchitis, and the cord may become so swollen that it approaches the index finger in size. In such extreme cases incisions may be required to drain off the pus and the testicle may be destroyed.

Inflammations of the genital tract due to gonorrhoeal infection of the part are serious, not so much for the severe pain they may occasion as for the lasting lesions they may leave. Gonorrhoea in the genital tract may run a rapid acute course, associated with great pain, or it may pursue a slow and more insidious one, associated with but little severe pain. The acute course is more rare. When it invades the vesicle, that organ becomes swollen to the feel and approaches the size of a goose-egg. On touching it through the rectum pain almost unbearable is experienced. The cavity of the sac is distended with pus, and its walls, together with the perivesicular tissues, are swollen and edematous. Sometimes this perivesicular inflammation is extensive enough to involve the neighboring pelvic peritoneum, thus setting up a localized process which has been known to have eventually become general. In a percentage of these cases of acute gonorrhoeal seminal vesiculitis the inflammation does not penetrate along the canal beyond the vesicle. Oftentimes, however, it does extend so as to involve the epididymis, but rarely, if ever, the testicle. In these cases the cord does not, as a rule, escape manifesting marked evidences of inflammation. It generally swells,

¹ It will be seen that the classification of inflammations in this connection is new and original. For a proper understanding of inflammatory processes in connection with the seminal vesicle, together with its ejaculatory duct and the vas deferens, it is advisable first to thoroughly study the anatomy of the part, together with its physiology, which last includes an explanation of the manner in which the testicular secretion reaches the cavity of the seminal vesicle, and also of the mechanism of ejaculation. As such considerations are beyond the scope of a text-book, those who desire to perfect themselves in these particulars, and at the same time make a special study of the derangements of the part, are referred to Dr. Eugene Fuller's book on *Disorders of the Male Sexual Organs*.

sometimes to the diameter of the thumb. Under these circumstances the cord itself is not very sensitive, but it causes great distress by pinching the nerves which accompany it in its passage through the inguinal canal. Its length also, owing to the swelling, becomes much shortened, thus tending to draw up the testicle toward, and in some extreme instances almost to, the inguinal ring. Occasionally in these acute cases, where the cord is the most involved, the inflammation in the epididymis may be very slight, but ordinarily the epididymitis associated with this acute gonorrhœal condition is very intense. The epididymis may swell to such an extent as to appear double the size of the testicle, accompanied by a serous effusion into the tunica vaginalis, thus constituting an acute hydrocèle. The scrotum also becomes thick and edematous. In extreme instances the scrotal tumor may nearly equal the size of a cocoanut. Such extreme size, however, can only occur when there is much serous effusion. Under proper treatment, which will be described later on, it is wonderful to observe the extent of the resolution which usually takes place in these very acute cases, especially with reference to the seminal vesicle. The common form of gonorrhœal invasion, however, and the one really more to be dreaded owing to the lesions it leaves, is that which progresses slowly along the ejaculatory duct and into the vesicle, causing many functional disturbances, but comparatively little acute direct pain. It is in this form that the gonococci, as has been described by Finger, show a great tendency to penetrate the lining epithelia and even the subserous structures, degenerating, perhaps, and remaining at times more or less dormant, but existing there all the same, ready when some acute disturbance may arise to resume their active infectious qualities. Under the influence of this chronic gonorrhœal process the epithelium lining the part of the genital tract involved loses largely its columnar qualities and becomes hard and pavement-like, and the subserous structures grow hard and sclerosed by interstitial proliferation. By a wise provision of nature, as demonstrated in the author's book (reference to which has been made), the ejaculatory ducts, by reason of their lying in a lymph-space, the infundibulum of the prostate, cannot become encased by plastic lymph—the way the urethra can, for instance—and consequently, although their lining membrane may be altered by a chronic gonorrhœal process, no stricture of their canals can result. Although the author was the first to point out the reason for this peculiar exemption from stricture enjoyed by the ejaculatory ducts, Guelliot had previously called attention to the fact that the ejaculatory ducts apparently always remained free from occlusion, or, if occlusion had ever existed, that the fact had never been anatomically or pathologically demonstrated. With the seminal vesicle proper, however, nothing exists to prevent sclerous interstitial changes from taking place beneath the lining epithelium. Such changes oftentimes affect the interstitial tissue throughout the entire thickness of the vesicle-wall. When the inflammatory process is as extensive as this, it rarely confines itself to the vesicle-walls, but invades the perivesicular connective tissue. When such is the case the surrounding tissues are first invaded by an effusion of plastic lymph, which in extreme instances may be sufficient in quantity entirely to fill up the post-prostatic recto-vesical space. These tissues then show to the feel the presence of hard edema. This is a condition which one unskilled in the rectal feel almost invariably diagnoses as prostatic hypertrophy. After a time this plastic lymph becomes organized into hard sclerous tissue. This hard sclerous tissue is much less bulky, however, than the plastic effusion. Sometimes, generally in strumous subjects, gonorrhœal perivesiculitis, be it chronic or acute, may be suppurative. This chronic gonorrhœal process generally does

not extend along the genital tract beyond the seminal vesicle. It may, however, involve the cord and epididymis. In such cases the cord is not apt to appear much if at all enlarged. The inflammation of the epididymis is less than in the acute gonorrhœal condition just previously described, while at the same time it is more severe than would ordinarily be expected from a simple inflammation. There is almost never complete resolution in the part after gonorrhœal epididymitis, a hard kernel of induration remaining in the tail of the organ, generally about the size of a pea, and sufficient in most instances to prevent spermatozoa from passing beyond it. Very rarely the testicle seems to become somewhat involved by an extension of this form of epididymitis.

The inflammation resulting from urethral lesions originating from gonorrhœa, which may invade the genital tract, is really of the same nature as simple inflammation, since the gonococcus has been eliminated from it, and consequently the lesions it may produce in the genital tract, being also similar, need no further mention.

Tuberculosis originating in the kidney, bladder, or urethra may, and frequently does, invade the genital tract. In fact, such is the common course of genital tuberculosis in the male. Tubercular inflammation in this connection may be acute, subacute, or chronic. The acute variety is not common. In a general way much that has been said regarding the pathological appearances and characteristics of acute gonorrhœal inflammation in this connection can also apply to acute tuberculosis, with, however, the following modifications: The painful sensations are not apt to be so severe. The lesions, however, are more extensive and lasting than those caused by acute gonorrhœa, and in many instances they are permanent, thus serving as foci for further inroads of the disease. In acute tuberculosis of the seminal vesicle the inflammation rarely confines itself to the sac and its walls, but shows a marked tendency to involve the perivesicular tissues. Such perivesicular inflammation may contain purulent foci. Like acute gonorrhœal inflammation, it often extends along the cord into the epididymis. The epididymitis so caused, although representative of a severe grade of inflammation, occasions much less pain and tenderness than the corresponding gonorrhœal variety. It does not extend into the testicle proper, but often suppurates, forming multiple abscesses, many of which finally coalesce. By this suppuration much of the scrotal tissue may become involved with burrowing abscesses, some of which discharge themselves externally, a fistulous opening presenting. This form of tubercular epididymitis may be accompanied by acute hydrocele. The tubercular process which extends from the urinary tract may be, and often is, subacute. This form represents a very mild grade of inflammation, and it is accompanied with few subjective symptoms. The walls of the seminal vesicle become moderately thickened. The feel, however, reveals but little tenderness. Such cases may end in resolution. This form of tuberculosis rarely, unless aggravated by some exciting cause, extends beyond the seminal vesicle.

Chronic tubercular inflammation extending from the urinary tract represents a severe pathological disturbance. Both the acute and subacute forms may become chronic, or the inflammation may start with features of chronicity. The chronic form, although not very painful except when subjected to irritation, is always accompanied by marked subjective symptoms. In connection with the seminal vesicle the inflammation always shows a marked tendency to involve the perivesicular tissues, filling in the post-prostatic rectovesical space with a hard inflammatory extravasation, so that by the rectal

feel it is impossible to define the posterior prostatic border. In severe cases this perivesical effusion may contain pus-foci. This form of inflammation generally extends along the genital tract beyond the vesicle. When such is the case the cord becomes thickened, always moderately and occasionally extremely. It is, however, but slightly sensitive to manipulation, though in extreme cases it causes much pain by squeezing the nerves accompanying it through the inguinal canal. The resulting epididymitis also is not acutely painful, the sensations from it being usually of a dull, dragging character. The epididymis at first becomes very hard and much enlarged. Then as the process progresses inflammatory exudates are generally thrown off into the surrounding tissues. These exudates, however, always maintain a firm attachment to the true periphery of the epididymis. They sometimes extend laterally, following the course of the parietal layer of the tunica vaginalis, thus forming thick lateral crustations which have given to the epididymis a feel which has been likened to that of a clamshell. When this condition of affairs exists, the cavity of the tunica vaginalis is distended with a chronic inflammatory effusion. In many instances this hydrocele has to be tapped before the true condition of the epididymis can be appreciated. After such a hydrocele has been tapped, it usually refills rapidly. After the chronic process has persisted for a time, pus-cavities form in the structure of the epididymis. Sometimes these pus-cavities dry up, leaving partially encysted cheesy foci, or, the suppuration becoming more active, it may extend beyond the capsule of the epididymis into the outlying inflammatory exudates. Pus-cavities here forming may coalesce, and there may be much burrowing, and finally the pus may discharge itself externally, fistule persisting. Oftentimes in these conditions pus may discharge itself into the cavity of the tunica vaginalis in case there has been hydrocele. If, however, hydrocele does not occur early in chronic tubercular epididymitis, it does not occur at all, since the cavity of the tunica vaginalis, if not distended, soon becomes obliterated by plastic adhesive inflammation as the disease progresses. The testicle proper is almost never involved in this form of inflammation, although from its being oftentimes apparently imbedded in the exudates from the epididymis it may deceive the surgeon into thinking that it is.

There is a form of compound inflammation which is frequently met with. It is usually severe and demands mention. This is where gonorrhœal inflammation becomes grafted upon one of the grades of tubercular inflammation. In such instances the worst features of both forms of inflammation may predominate. Thus it is that tuberculosis is often said to follow gonorrhœa. In many such instances a subacute tubercular process may have existed unnoticed, ready to be stirred into activity by the advent of the gonococcus. In a much less marked degree a simple inflammation, such as may follow the passage of a sound, may stir a slumbering tubercular process into activity.

Inflammations originating in the seminal vesicle may, as has been said, be simple or tubercular. Simple inflammations originate in some derangement in the mechanism of ejaculation. Such inflammations are at first of a light grade. They may, however, as the author has shown in his book, become severe, generally by reason of germ-infection. This infection may be introduced along the ejaculatory duct or it may come from the rectum, the germs passing through the intervening tissues, as Reymond has shown they can do. In such cases the bacillus coli commune is the germ often causing the infection. Simple inflammation of this character can extend along the cord, and involve the epididymis in exactly the same manner as simple inflammation the source of which was from the urethra.

Tubercular inflammation can apparently originate in the seminal vesicle. The author has observed a number of cases in which evidences of a tubercular character have been detected in a vesicle before any similar evidences have been discernible in connection with the urinary tract or elsewhere in the genital tract. On keeping these cases under observation, however, evidences of an extension of the disease to the urinary passages or epididymis have been noted. After what has been said regarding tubercular extension in the preceding connection, no further notice of it is here necessary, since the pathological appearances are alike in both instances.

Simple inflammation arising in the epididymis is always due to traumatism from without. It is rarely severe, although, of course, its intensity depends much on the natural violence of the traumatism. Such inflammation in this part is very rare. It is not rare, however, for some violent exercise to cause an epididymitis from the extension to that part of the inflammation in connection with a slumbering seminal vesiculitis. Without careful examination such an epididymitis from extension may be easily mistaken for simple primary inflammation of the part.

Syphilis may attack the epididymis, and when such is the case this disease does not reach the organs by an extension from some other part of the genital tract. Syphilis in this connection may appear in its secondary or late stages. Secondary syphilis of the epididymis is not rare. As, however, it occasions little or no inconvenience during its continuance, it usually escapes notice. It was first described by Dron. It usually appears in the third or fourth month of the disease, and, like the secondary cutaneous lesions, it is only temporary, and when it disappears leaves behind no evidences of its previous existence, being in this respect different from the gonorrhoeal inflammation. It generally involves the head of the organ, appearing as a hard, movable, insensitive lump, varying in size from that of a pea to that of a hazelnut. It is not unlike oftentimes, to the feel, the induration left after a gonorrhoeal inflammation, except that such an induration, besides being fibrous and permanent, is situated also in the tail of the epididymis. Late syphilis in connection with the epididymis is rare. As, however, its lesions, when it does occur, are serious and apt to be confounded with tuberculosis or cancer, the fact that it may be found in this part should always be kept in mind. It generally occurs after the completion of the second year of the disease. The epididymis becomes greatly enlarged and very rough to the feel, owing to masses of adhering inflammatory exudates. These exudates, however, are generally thrown out mostly laterally, involving for a considerable distance the parietal walls of the tunica vaginalis, the cavity of which is always filled, so far as has been observed, with effusion, thus causing hydrocele of considerable size. Sometimes the fluid drawn from such hydrocele is clear and serous. Oftentimes, however, it is bloody. After the fluid has been partially drawn off, then the characteristic feel of the epididymis is apparent, with its thickened lateral projections into the walls of the tunica vaginalis. Such an inflammation is not painful or sensitive. It does not involve the testicle proper. Oelsnitz and Ozenne, pupils of Reclus, as was mentioned in the author's article in *Morrow's System*, were the first to describe this form of syphilis. These writers, however, thinking from the thickened condition of the parietal walls of the tunica vaginalis that the disease originated there, thus overlooking its primary source in the epididymis, entitled their article "Syphilitic Pachyvaginalitis." The syphilitic process in these cases may be gummatous. It may so closely resemble a tubercular process or malignant disease that a differential diagnosis can only with certainty be made by a

resort to antisyphilitic measures. Tubercular disease may rarely originate in the epididymis, in which case it may remain localized, or, what is more to be expected, extend upward along the cord and into the cavity of the seminal vesicle. The lesions it may produce in the epididymis when so arising differ, however, in no wise from those already described in connection with this disease when its source has been from above.

Inflammation arising in the testicle itself is rare except when due to syphilis. Interstitial and degenerative changes, as have been seen, occur in old age, but such changes consequent on natural decay can hardly be said to cause orchitis. Simple orchitis when originating in the testicle may occur spontaneously, no well-defined cause existing to account for it. When it so occurs, however, the individual is usually suffering from general debility. It may sometimes develop during the course of a septic fever, such as typhoid. Gout may rarely cause it, in which case the inflammation is largely peripheral, consisting of the characteristic gouty inflammatory changes in connection with the visceral portion of the tunica vaginalis. Traumatism may also, as have been seen, cause an orchitis. When orchitis is at all acute (whether it originates in the part itself or is transmitted there makes no difference) severe localized pain and tenderness are present. This is owing to the fact that the dense fibrous sheath, the tunica albuginea, which envelops the organ, prevents its medullary substance from swelling, as it naturally would at the onset of the attack, the result being great engorgement. For this same reason the organ when so involved, especially in the early stages of the attack, remains little altered in size and shape. It is, however, extremely hard, and the least manipulation gives rise to intense pain. The epididymis, except of course in transmitted cases, remains natural. After the attack has existed for some time the visceral portion of the tunica vaginalis becomes inflamed, the result being usually an adhesive inflammation of the whole sac, thus causing its obliteration, or more rarely a serous effusion causing hydrocele. Resolution in these cases may be very slow and tedious. The organ, after being hard, dense, and somewhat enlarged for a considerable interval, may gradually become smaller and smaller, and finally atrophy; in which instances there are to be found fibrous contraction of the interstitial connective tissue associated with fatty degeneration and absorption of the secreting structures. Sometimes, however, the primary engorgement stage is followed by abscess-formation, in which case the abscess or abscesses, remaining confined in the central portions of the organ, may after a time become encysted in fibrous sheaths and gradually absorb, leaving cheesy or calcareous foci to mark their previous positions. At other times, however, the collection of pus may gradually work its way to the surface of the organ, and finally succeed in breaking through the capsule. While this process of perforation has been in progress adhesive peripheral inflammation has obliterated the sac of the tunica vaginalis, so that the pus escaping through the tunica albuginea forms a soft fluctuating scrotal area over the point of its escape. In a comparatively short time after escaping from the testicle the pus succeeds in discharging itself through the scrotal wall, leaving a sinus which may persist for a long time unless atrophy of the testicle ensues. Sometimes in a given instance the scrotum and testicle may be riddled by such sinuses. Frequently a bunch of granulations may be heaped up over the sinus opening, and sometimes some of the medullary substance of the testicle may protrude, forming a so-called hernia testis. In simple inflammations, however, hernia testis is rare. Simple orchitis, which is chronic in character from its commencement, is rare, and may be dependent on some dyscrasia, such as occa-

sions arterio-sclerosis in cases where senility and syphilis can be excluded as factors.

Orchitis is sometimes said to occur in the new-born, especially after breech presentation. In these cases it is probable that hemorrhagic infarction, as English has observed, rather than inflammation, is the cause of the swelling, and hence the term orchitis is a misnomer.

Syphilitic orchitis is a late manifestation of the disease, and its occurrence in this part is not rare. It may assume two forms, the interstitial and the gummatous. In the interstitial form the testicle at first becomes enlarged, generally to about double its normal size. The process of enlargement, however, is slow and occupies many months and sometimes a year or more. It is not a painful condition, and, aside from some discomfort caused by the dragging attendant on the increase in size of the organ, it rarely occasions complaint. The condition is frequently accompanied by moderate hydrocele, although at times the cavity of the tunica vaginalis is obliterated by plastic adhesions. In the first stage of this form of orchitis there is a connective-tissue proliferation associated with plastic exudation. The organ becomes very hard and non-sensitive. After a time sclerous connective tissue takes the place of cellular proliferation and plastic exudation. The organ decreases in size, so that it usually becomes much smaller than normal, and so remains hard, fibrous, and non-sensitive. The hydrocele, should one have existed in the earlier stage, also disappears. In the gummatous form, the condition the better recognized in literature, the testicle affected generally becomes in the early stage much larger than in the interstitial variety. It may reach the size of an orange, though that of a lemon is more usual. In this condition also there is little or no pain or tenderness. Hydrocele may or may not coexist, just as is the case with the other variety. The testicle is not so hard to the feel as in the interstitial form, and it seems somewhat edematous. It is usually regular in outline, preserving sometimes the natural contour, although it is often more spherical. As the gummatous process develops it works its way from the medullary portion of the organ, its starting-point, to the periphery. The central portion of the gumma breaks down into a liquid mass, and perforation of the tunica albuginea takes place, just as we have seen sometimes occurs with abscess of this part. Before this perforation occurs, however, the plastic lymph thrown out ahead of the advancing process serves to obliterate the sac. Consequently, after the perforation a localized soft, fluctuating area appears under the involved portion of the scrotum. There is no heat, no tenderness, nor, in fact, any evidences of inflammation in connection with this fluctuation other than redness. After a time there is perforation of the scrotum associated with a discharge of glairy material characteristic of gumma. Then, eventually, if the process is allowed to run its course, a red fungous mass appears protruding from the hole made by the perforation. This mass if examined will be found to consist of true medullary testicular structure covered with granulations. This protrusion is due to the fact that the secondary sclerous changes in the capsule of the testicle caused by the gummatous inflammation, by reason of the contraction which they exert, squeeze out most that remains of the secreting structure after the gumma discharges itself. Hernia testis and benign fungus of the testicle are terms often applied to this condition, which is encountered now much less frequently than formerly, since its course of destruction is generally stopped by treatment. These syphilitic changes are seen occasionally in boys who have inherited the taint.

A tubercular process (barring military tuberculosis, which is largely a

general condition) which originates in the body of the testicle is certainly very rare. In numerous cases of tuberculosis of the epididymis associated with suppuration and burrowing of pus the testicle proper may eventually become so obscured by being buried, as it were, in the inflammatory exudates originating from the epididymis that it may appear to be not only involved by the disease, but even the source of it. If, however, in such an instance the inflammatory mass be incised and explored, the testicle itself when cleared of the surrounding débris will be found to be natural in size, consistency, and structure. Hence in such instances, as will be seen in studying treatment, the testicle proper can often be spared in an operative procedure, the epididymis, cord, and surrounding indurations alone requiring to be sacrificed.

There are a few inflammatory agents, as has been said, which attack the genital tract in a manner which is at present but little understood. Chief among these is mumps. Formerly it was taught that this disease when it involved the genital organs confined itself to the testicle proper. Now, however, there is reason to doubt this fact. Catrin, who has studied this subject probably more thoroughly than any one else, since he has investigated 159 cases, asserts that the inflammation begins in the epididymis and that the testicle proper is attacked secondarily. The author has seen a case of this disease where the seminal vesicle shared with the epididymis and testicle in the inflammatory process. It is certain, however, that the body of the testicle is the part most severely dealt with when this disease involves the genital organs. The orchitis so caused is often of a severe grade, although suppuration does not occur. The organ becomes much enlarged, so that with the scrotal effusion and edema it may attain the size of an orange. It is extremely tender and painful, and accompanied oftentimes by considerable general disturbance, such as high fever and occasionally delirium. After the subsidence of the inflammation atrophic changes in the testicle frequently occur, resulting in its complete destruction. With regard to complete atrophy, however, Catrin holds that it is less common than is usually supposed. He also considers that in many of these cases a partial atrophy occurs, which, however, is only temporary, the organ after an undetermined period of time regaining its former size and consistency. When atrophy does not occur after mumps the testicle generally is uninjured as regards its secreting function. Orchitis is every now and then reported to occur in the course of fevers of various kinds, rheumatism, gout, etc. Idiopathic orchitis, so called, has also been written up. In many such instances, however, as has already been mentioned, it is probable that the affection of the testicle, be it epididymitis or orchitis (many medical writers often confound the two), has probably resulted from an inflammation which has extended down the cord, its source having been a slumbering seminal vesiculitis which the general febrile or some other disturbance has stirred into activity. At any rate, by careful examination the non-existence of seminal vesiculitis should be determined before a case is reported as one of spontaneous orchitis occurring either as the result of some general disturbance or idiopathically. When this is done, it will be found that these cases of orchitis indefinite as to cause will greatly decrease in numbers and frequency.

Subjective Symptoms.—In describing the pathology of the appearances presented by the inflammatory conditions just considered, mention has always been made of the accompanying pain and tenderness, aside from which little has been said regarding subjective symptoms. Some of these inflammations are quite barren of such symptoms, and consequently demand little attention in this particular, while the reverse is true of others. Inflam-

mations of the epididymis and testicle can, as a rule, be said to give rise to few symptoms aside from the direct pain and discomfort they may occasion. On the contrary, inflammations of the seminal vesicle when not acute are often accompanied by very many subjective symptoms, but by no localized pain or tenderness. The intense pain in an orchitis is generally localized in the testicle, and is not relieved by supporting the part, while with an epididymitis support by a properly fitting bandage is often very grateful. In epididymitis also the pain often radiates upward into the corresponding groin, and sometimes still farther into the flank. During acute inflammation of these parts sexual desire is generally *nil*, but otherwise that function is not affected. In chronic epididymitis there is often complaint that sexual excitement or activity is followed by a dull congestive pain in the affected testicle, supposed to be due to the fact that the secreting function of the organ has been stirred into activity, while at the same time the old inflammation, by obliterating the efferent ducts, prevents any of the secretion from finding a way out. This theory is probably well founded, since it has been observed that the secreting substance of a testicle does not atrophy, no matter how long its efferent ducts may be blocked. When an inflammation is associated with an intense degree of pain centered in the inguinal region, and from there radiating down the thigh and to a less degree upward into the flank, a marked swelling of the cord is generally found, the pain being caused by the pinching of the nerves which accompany that body along the inguinal canal. In acute epididymitis or orchitis there is generally considerable fever during the active stage of the disease, but in the chronic forms of inflammation there is little or no rise of temperature unless it be rarely in instances where there is suppuration.

In acute seminal vesiculitis the symptoms presented are almost wholly those due directly to the inflammatory process. In the early stages of the inflammation priapism and other evidences of excitement of the sexual center are often present, but as the disease progresses these generally disappear. There is often a great throbbing pain in the perineum or rectum, increased if the patient sits or walks, and partially relieved if he lies down, especially on his abdomen or sides. There is much tenderness in the suprapubic region corresponding to the side on which the vesicle is situated, and in very severe cases there may be a localized peritonitis in this part. Such peritonitis has in a few recorded instances become general, thus causing a fatal result. The bladder-functions are generally disturbed, especially during the early stages of the inflammation, the symptoms being frequent and painful urination, together, oftentimes, with evidences of spasmodic stricture. When the disease is on the increase, as indicated by the unabated continuance of fever, the urine voided is usually clear or nearly so. Then as the fever drops and the acute pain decreases the urine will be found to be loaded with pus, caused by a natural discharge along the ejaculatory duct. This purulent condition of the urine continues for some time until the sac is pretty well drained. Should the patient have in convalescence an involuntary emission, as sometimes happens, the ejaculated mass is apt to be tinged more or less with blood and the act is accompanied with a sensation of pain.

In subacute and chronic seminal vesiculitis during periods of exacerbation there may be painful sensations of a mild grade, much as have just been described as associated with the acute form of the disease. In very many of these chronic forms of inflammation, however, the associated painful sensations are slight, and in a certain percentage of them there exist no painful sensations at all. Oftentimes symptoms of pain and discomfort caused by

the disease may be so reflected as to be associated in the patient's mind with other parts. Thus painful sensations in one or both testicles, in the scrotum, cord, along the urethra, at the end of the penis, in the bladder, and even in the pelvis of the kidney, may be complained of. The rectum, coccyx, and small of the back may likewise be the seats of such pain. The author has seen instances where pain due to seminal vesiculitis has so closely simulated intestinal colic and sciatica as to mislead able practitioners. Numerous and varied bladder and urethral symptoms may be thereby caused. Thus the urinary act may be made frequent, urgent, and painful. Then, again, it may be inhibited, it being impossible at times to urinate at all or at best only drop by drop. After the urinary act has been thus inhibited for several hours, the spell may all of a sudden pass off, the result being a full, free stream. If these cases are carefully watched, it will often be found that the vesical symptoms, such as have been described, are most intense after sexual excitement. Then, again, inflammatory symptoms may exist in connection with the urethra chiefly, less often with the bladder, which are dependent entirely on an associated seminal vesiculitis. Some time since in a thesis the author demonstrated these interesting facts. In such cases an urethral discharge or vesical pus will be found, there being no lesion in the urethra or bladder to account for the inflammatory evidences, and no amount of treatment directed toward the urethra and bladder will be found of any avail in curing the inflammatory evidences. As soon, however, as a cure of the seminal vesiculitis may be effected, then these associated symptoms will be found to disappear permanently. Rarely the urethral discharge in such instances may be of such a severe grade as to be bloody. In some instances where seminal vesiculitis has become infected by a foreign germ, as the bacillus coli commune, the bladder may also become infected. When such is the case, it will be found impossible to rid the bladder of the germ-infection until after the focus of infection in the seminal vesicle has been eliminated. Then, when this has been accomplished, the germs will disappear spontaneously from the bladder if that viscus be in an otherwise healthy condition.

Another fairly common complaint in chronic seminal vesicular disease is that, after straining at stool, especially over a hard, bulky movement, there is apt to appear at the meatus a mass of glairy, sticky material.

In this class of affections, however, derangements of the sexual function are most marked and furnish the most important group of symptoms. When the disease is not of very long standing the active evidences of irritation usually result in symptoms of sexual excitement, such as an undue amount of erections associated with an increase in sexual desire. Anything the least suggestive will be sufficient to excite the sexual center. Involuntary emissions are in such conditions frequent, often occurring by day. These emissions are generally followed by a feeling of discomfort locally and by depression generally. They may sometimes cause acute perineal pain. They lack force, and the amount of material ejaculated at a given instance is small. In some extreme instances there may be a feeling of ejaculation without any result, no fluid appearing at the meatus. If in such cases sexual intercourse be attempted, there is usually a premature ejaculation, accompanied sometimes with pain and followed by failure of erection. In all such cases, however, whether there be premature failure or not, little satisfaction is obtainable from the act, the sexual craving still persisting undiminished by the sexual attempts. As the case becomes more chronic feelings of sexual weakness grow more pronounced, and after a time there may be positive impotency. As the erections grow weaker and finally fail, so also do the sexual desire and craving,

together with a cessation from emissions. In a small number of instances potency may persist apparently unimpaired, although sexual desire and satisfaction may be lessened. In a few cases the sexual function remains undisturbed.

The character of the seminal fluid is altered in chronic seminal vesiculitis. It is often purulent and stained with blood. In other instances, where the inflammation is very quiescent, it may be thick and jellified. In most cases the spermatozoa which it may contain are dead on ejaculation. Neurotic sensations, some of them curious and indefinite, are often caused by seminal vesicular disease. Thus complaint is frequent that the penis is shrivelled, bloodless, cold, numb, etc. The testicles are often retracted and supposed to be atrophying. Bad feelings in the head and sometimes sharp headaches may occur after all sexual excitement. Mental depression and melancholy are common in aggravated and long-continued cases of this disease. The disposition may change, a placid person becoming irritable and quarrelsome.

The study of mental conditions dependent on seminal vesiculitis is very important, and a clear distinction should be made between such cases and those in which a psychological derangement is accompanied by sexual symptoms, there being no disease of the sexual apparatus.

The symptoms and evidences derived from the digital feel per rectum are most important, not only in determining the grade and nature of the existing seminal vesiculitis, but also in differentially diagnosing it from other affections. To be skilled in this feel the finger of the genito-urinary surgeon requires fully as much education as does that of the gynecologist in the vaginal touch. The finger of the beginner reveals nothing to its owner. The only way to become skilled in this respect is to practise the feel repeatedly under careful instruction. The finger should first become familiar with the feel of normal conditions in order later on to appreciate what is abnormal. To practise the rectal feel the patient presenting himself with a partially or wholly distended bladder should while standing straight bend his body forward from the hips, so that he assumes what the author has called the "leap-frog" position. A fore finger of the surgeon is then well lubricated and introduced as far as possible into the rectum, considerable force being used by the remaining closed portion of the hand to overcome the resistance of the perineal muscles in cases where these structures are rigid. During this time counter-pressure is maintained with the free hand against the lower abdominal wall in order to bring the seminal vesicles into easier reach of the fore finger. By so doing the various inflammatory conditions of the vesicles, such as have been already described, can be mapped out and appreciated. In case the finger detects evidences of vesicular disease, then the author's method of stripping the vesicle should be employed in order that a specimen of the contents of the sac may be obtained. In order to do this the tip of the fore finger, after reaching along the body of the vesicle as far as it is possible, is bent downward and then slowly but firmly withdrawn along the line of the vesicle and of its ejaculatory duct. The counter-pressure exerted by the free hand on the suprapubic region acts as an aid to this manipulation. The vesicle may be stroked in this manner several times by the finger-tip in order that the stripping may be thorough. As a result of this stripping the pathological contents of the sac are forced out along the ejaculatory duct into the prostatic urethra, from which part, if the expressed fluid be abundant, it flows along the urethra and finally drips from the meatus. After the stripping the urine should be voided into a glass. The urine thus passed will show evidences of the expressed seminal material. It is a good plan before the

stripping for the patient to pass a little urine in a glass, so that this, a natural specimen, can be compared with the one containing the expressed seminal fluid. When the contents of the seminal sac are largely purulent, the specimen of urine passed after the stripping will appear more or less cloudy, while that passed before the manipulation may be wholly clear or much less purulent. Where the vesiculitis is quiescent or very chronic there may be no purulent elements in the contents of the sac, in which cases the expressed material will appear in the urine voided after stripping as a partially transparent jelly-like mass, some of which may be globular and some cylindrical. Such cylinders are moulded in the ejaculatory duct. This jelly-like condition of the expressed seminal fluid lasts, however, but a few moments in the urine, since the acidity of that liquid quickly serves to dissolve it. There are many grades in the quality of the expressed seminal fluid between the purulent and the jellified conditions, but such gradations cannot here be specially considered. Blood may be mixed with the vesicular material, in which instances it lends its characteristic coloring to the material appearing in the urine after stripping the sacs. If the bleeding is recent, the coloring is red, its intensity depending on the quantity of blood-pigment. Where the hemorrhage is not recent, then a brownish discoloration takes the place of the red. Degenerative changes in connection with pus may likewise cause greenish tinges in purulent vesiculitis. Oftentimes also, especially after purulent conditions, shreds made up of vesicular epithelial desquamation occur among the expressed material. A microscopical examination should be made in these cases in order to demonstrate the presence of spermatozoa. Sometimes in light forms of simple inflammation of the ejaculatory duct there will be seen in the urine passed after stripping the vesicle a transparent flake, which floats just under the surface of the urine. In stripping, the apex of the vesicle is beyond the reach of the finger-tip in many instances; still, in most cases, after some practice, the main cavity of the sac can be evacuated. A perfectly healthy vesicle is so freely movable under the finger and its walls, as well as those of its ejaculatory duct so contracted, that little of its contents are forced out by stripping. In such cases the urine passed after stripping is usually slightly amethyst in color.

When one has perfected the digital rectal feel, together with the process of stripping the seminal vesicles, he is able positively to diagnose seminal vesiculitis in cases where from the existing subjective symptoms the disease may have been suspected, and at the same time to exclude numerous conditions of the prostate which it might be impossible otherwise to differentiate. Thus also psychological conditions, functional impotence, hysteria, and sexual weakness due to general debility can all be differentiated from seminal vesiculitis. Chronic pyelitis is a disease which may sometimes require to be differentiated from chronic seminal vesiculitis associated with a purulent condition of the urine, since a small amount of albumin frequently exists in the urine in both disorders. The rectal feel here will determine much, since in pyelitis it should be normal. Then, again, in chronic seminal vesiculitis associated with purulent urine the purulency of the urine which is voided after stripping will be increased in the case of chronic seminal vesiculitis, while it will remain unaltered in the case of chronic pyelitis.

Treatment.—**Acute Orchitis.**—In this affection the patient should be promptly put to bed. He should lie flat on his back, and his testicles should be so elevated and supported that they rest on the pubic bone. The object of this position of the body and of the testicles is to reduce to a minimum

the blood-tension in the inflamed organ. This is a most important feature in the treatment, since sudden engorgement of the part is to be feared, owing to its close confinement within the firm, inelastic tunica albuginea. To maintain this position of the testicles a firm band should be secured about the waist, and from this a strip of muslin about 3 to 4 inches wide should be attached anteriorly in two places, so as to form a loop the lower portion of which includes the testicles in their suprapubic position. From the lower dependent portion of the loop two back-straps should be fastened. These should extend outside the nates on either side and be fastened laterally to the waistband. This is done in order that the loop may not slip up, thus allowing the testicles to drop. A lateral strip of muslin is also often required to be fastened across the upper portion of the apex of the loop in order that the testicles may not slip over the support. As the organ is very tender in this affection, it should in all cases be protected from direct contact with the loop of muslin. Consequently, the loop should be lined with some soft yielding material. Lamb's wool is the best substance for this purpose, owing to its inherent elasticity. To combat pain, which is always severe, a hypodermic of morphine is often called for when the patient is put to bed, after which time it should be given as occasion may require. Local soothing and narcotic applications are frequently useful. Laudanum or tobacco stupes, or both combined, often prove very beneficial. To prepare these, laudanum or a strong tobacco infusion is sprinkled over a flannel which has been wrung out in hot water. The flannel is then wrapped about the testicles, a piece of oiled silk being slipped around it in order to get the full narcotic effect and at the same time to protect the wool and the bandage. These stupes should be changed every few hours, and if efficacious should be continued till the severe pain subsides. Belladonna ointment spread on a cloth and applied about the testicle may also be found very useful in subduing pain. Poultices should be used with caution, for they may by increasing the engorgement of the organ cause trouble. Sometimes very hot poultices used for a few hours early in an attack may by their direct heat produce comfort and do good. A longer continuance of such treatment, however, may cause a recurrence of pain and an increase of congestion. Formerly leeches were recommended to be applied at the onset of the affection in the region of the external abdominal ring. Many authorities recommend in cases where pain still persists in spite of palliative measures several incisions of less than one-quarter of an inch or so in length through the tunica albuginea in order to relieve internal tension and thereby prevent impending gangrene or suppuration. Such incisions are made with a fine bistoury through a narrow scrotal puncture. It can be argued against this procedure that more or less of the testicular structure may force itself out through the cuts in the capsule, and that thereby the testicle itself may be severely injured. Still, as the procedure is done to avert still greater evils which threaten, and as it serves besides to alleviate pain, it is to be recommended, although great care should be observed not to make the cuts into the testicle any deeper than is necessary in order to sever the capsule. If suppuration occurs, incision and drainage are recommended. The incision should be made as soon as fluctuation appears, in order, if possible, to avert extensive burrowing of pus. In spite of prompt treatment, however, the testicle generally eventually atrophies in case suppurative processes have once been established. When gangrene occurs a free incision should be made through the scrotum and the testicle removed. Castration is also advised in suppurative conditions where burrowing persists in spite of attempts at drainage.

Chronic orchitis is in the great majority of instances syphilitic in nature, as has already been seen, and consequently the treatment it should receive when of that origin is such as is appropriate for any late syphilitic manifestation. Iodide of potash or some salt of the iodide should be administered in doses of from 30 to 100 grains daily, combined with or in conjunction with a mercurial. After apparent resolution has taken place in the testicle, as is often the case, provided treatment has been recommended before the syphilitic process has caused actual destruction of tissue, the iodide can be omitted. A mercurial, however, should be continued for six weeks to two months after the stopping of the iodide. No matter at how late a stage a syphilitic testicle comes under observation, no surgical interference is warrantable until the patient has had the benefit of a thorough antisymphilitic course such as has been advised. After a course of this nature no surgery will be necessary, aside possibly from the removal of granulations in cases where there is benign fungus. If a chronic orchitis persists unaffected by an antisymphilitic course, then castration is advisable, lest some malignant growth may graft itself on the inflammatory process.

Chronic suppurative conditions which have originated in an acute orchitis have already been considered. In the rare instances where the testicle proper is affected secondarily to the epididymis, treatment should be directed toward the epididymis.

Acute Epididymitis.—Where this disease arises from a simple inflammation or from one remotely due to gonorrhœa it is apt to be of a much milder grade than when due directly to gonorrhœal infection. In such mildly acute cases, if the testicles be promptly supported by a well-fitting suspensory bandage and if the patient keeps reasonably quiet for a few days, the epididymitis will oftentimes speedily subside. In gonorrhœal cases, however, it is always different, and when once the epididymis is attacked the inflammation becomes severe. In such cases, if it is possible, the patient should be put to bed, the testicles being maintained resting on the pubic bone, just as has been described in the treatment of acute orchitis. By so doing not only is the blood-tension reduced to a minimum, but all drag is also removed from the inflamed cord. A hot flaxseed poultice, a little powdered slippery elm being added, should be so applied as to envelop the affected testicle. It should also be made long enough to cover the inguinal region on the affected side, and even also the corresponding suprapubic region should there be much tenderness along the line of the cord. A half ounce of fine-cut tobacco may be added to each poultice in case the pain is very sharp, although the simple hot poultice is generally sufficient of itself without being medicated. Morphine hypodermically may be required at the commencement of the attack. The epididymis generally continues to swell for three days. At the end of that time the tenderness is much less, and if the testicle has been properly supported the pain ought to have disappeared. The poultice can then be omitted, lamb's wool being packed about the scrotum. The patient ought to be kept in bed for several days after the poultices have been discontinued, and when he is allowed to get up the testicles should be kept firmly supported and packed in wool. The wool packing should be gradually removed. Drag, however, should be kept from the cord for a considerable interval until all the evidences of inflammation save the permanent induration in the epididymis have disappeared. This can be accomplished by means of a suspensory bandage. In such cases, however, it is not sufficient for the surgeon simply to order the patient to provide himself with a suspensory bandage. The bandage should always be examined by the

medical attendant in order to determine that it really performs its duties. In cases where the treatment just described can be thoroughly enforced little else is generally necessary. Many individuals, however, cannot lie up at all or at best only briefly. In such cases poultices, of course, are out of the question. The testicles should in these instances be packed in wool and firmly supported. The same local anodyne applications may be here useful as have been described under the treatment of Acute Orchitis. Very many other substances have also been advised to be applied locally in order to produce an anodyne effect. In fact, hardly a year passes without the appearance of a new remedy to accomplish this result. Among such new drugs recently recommended for this purpose are ichthyol and guaiacol. In severe inflammations accompanied by acute hydrocele much relief from pain may often be obtained by aspirating the hydrocele. Pain can also be speedily relieved in some instances by stroking very quickly and gently the tense scrotum over the affected area with a white-hot Paquelin cautery. Sometimes painting the scrotum with a 10 per cent. solution of nitrate of silver will accomplish the same result. Many times these and various other pain-killing devices are reported as methods to effect a quick cure of epididymitis. The word *cure*, however, in such instances is evidently wrongly applied, since a cure is not effected until the inflammatory products have been absorbed. In some instances hot poultices are not soothing in their effect and cannot be tolerated. In such cases pressure directly applied to the testicle may be productive of great relief from pain, and at the same time hasten the absorption of the inflammation. Such pressure may be applied by means of strips of adhesive plaster, the parts having first been freed from hair. Strips of this nature, however, are hard to remove, and do not adjust themselves to a decrease in the inflammation, and consequently are not advisable. The Horand-Langlebert suspensory is an elastic suspensory bandage devised to accomplish this purpose, and is useful in some instances. The best means, however, of effecting even and continuous pressure consists in the use of a light elastic rubber bandage about $1\frac{1}{2}$ inches wide. The testicle requiring pressure is bandaged with the elastic in much the same manner as a bandage is applied to the end of a finger. One or two circular turns are first made around the testicle high enough up, so that the band cannot slip off. Then several turns are made forward and back at right angles to the circular turns, thus covering in the lower apex of the testicle. After the apex has been covered in this manner, then a few circular turns are given in order to hold in place the turns over the apex. Such a bandage should be put on lightly and should be readjusted every four to eight hours. While the rubber bandage is in use the testicles should be supported in order that there may be no drag on the cord.

Sometimes resolution from an attack of acute epididymitis is very slow. In such cases, although the pain, and in great measure also the tenderness, disappear, still the mass of inflammation largely remains. Such a condition of affairs may indicate that a tubercular element has grafted itself on to the original inflammatory process. Generally, however, it indicates the existence of inflammation in the cord, in the seminal vesicle, or in both these parts. Such a persistence of the inflammatory evidences is almost always seen in cases of epididymitis, in the treatment of which proper attention has not been paid to supporting the testicle, thus relieving the inflamed cord from tension. If one feels the cord in such instances, it is generally found to be brawny and approaching in circumference the little finger. The treatment of such a condition is of course careful support of the testicle. Iodide of potash in 5- to

10-grain doses three times a day may act as an internal aid in hurrying absorption in some cases. If seminal vesiculitis exists, that condition should be cured before complete resolution in the testicle may be expected. After gonorrhœal epididymitis an obliteration of the efferent seminal ducts generally occurs in spite of the most careful treatment. Therefore if both testicles have been affected, the semen of the individual so attacked is commonly sterile.

Tubercular Epididymitis.—Formerly, when it was erroneously supposed that this affection commonly represented a primary focus of tubercular infection, prompt removal of the epididymis, together with the testicle and as much as was possible of the cord, found many strong advocates. Such treatment, however, is bad, as a more intimate knowledge of the pathology shows, unless it be possibly in a stray case where the disease might be primary. The treatment of this condition should be conservative as long as no suppuration or no active suppuration be present. It should be considered as a part of a more general process. The testicle should be supported, and should, if tender, be guarded against traumatism by being packed in wool. General hygienic measures, such as are useful in combating tubercular tendencies, should be prescribed. Cod-liver oil, if well borne by the digestive organs, is always of value. So also oftentimes are malt preparations, malt liquors, hypophosphites, etc. If suppuration becomes active, resulting in burrowing abscesses, external incisions should be made, glycerin, in which iodoform is thickly suspended (iodoform ʒij, glycerin ʒj) should be daily injected, and drainage-tubes, if necessary, inserted. If, in spite of such treatment, the suppurative process does not abate, then a free serotal incision should be made and the diseased epididymis removed, together with the distal portion of the cord should that part be thickened. The surrounding pus-cavities should be opened and eurented, and, should the pyogenic membrane constituting their walls be thick, it should be snipped off by the aid of curved scissors. The body of the testicle itself, thus freed from inflammatory products, will in all probability be found to be natural in size and consistency, and should be left unmolested. Drainage should be established, and the cavity of the wound carefully irrigated with mild antiseptics till healing takes place. If the healing is tardy, iodoform and glycerin injections will often be found useful. An operation of this nature is not so severe as complete removal of the testicle. The patient is commonly up and about wearing a support at the end of five days. The testicle is generally left well nourished, and after healing has taken place there is little in appearances to indicate that an operation has been performed. The fact that removal of the epididymis only is an operation which confines the patient in bed a less time than complete removal of the organ is perhaps the strongest argument in favor of this procedure, since confinement in bed is always to be avoided as much as possible in tubercular cases. Then also the surgical procedure, other things being equal, which accomplishes its result with the least mutilation is the one to be chosen. Bennett was the first or one of the first to call attention to the fact that removal of the cord produced no visible effect on the testicle.

Syphilitic epididymitis should, when occurring as a late lesion, be treated the same as chronic specific orchitis, and should end in resolution. The epididymitis occurring in secondary syphilis is a transient lesion, and needs no special treatment aside from that generally employed in secondary syphilis.

Acute Seminal Vesiculitis.—Rest in bed, the patient lying flat on his back, is a most important requisite in the treatment of this condition. The testicles also should be supported the same as in acute epididymitis. This should be done even in cases in which the epididymis is not inflamed.

Sometimes, where the conditions are very acute, the foot of the bed may be raised in order to minimize the vesicular pressure. Poultices should be applied over the tender suprapubic area. These should be of liberal size, so as to extend considerably beyond the limits of tenderness. Where the tenderness is so great that the weight of the poultice cannot be endured, as may be the case if localized peritonitis exists, then some light substance like spongeopyline can be substituted. Opiates should be administered in sufficient amount to rid the pain of its paroxysmal character and make it easily bearable. Careful attention should be paid to the bowels. The rectum should be kept free from fecal accumulations. This can be accomplished by light laxatives aided in most cases by enemata. The enemata should be given after the laxatives have affected the upper bowel. To give these a long soft-rubber tube should be employed. This should be well greased and worked up slowly beyond the sigmoid flexure. Hot water should then be injected until the patient feels considerable distention. In some cases, where the bowel is very sluggish, salt may be added to the hot water in sufficient quantity to make it very brackish. After the pus begins to discharge itself freely through the ejaculatory duct, then the anodyne and poultices can be omitted. Sometimes resolution can be hastened after the sac has begun to discharge itself by the administration of iodide of potash in gr. v to gr. x doses two or three times a day. If while the pus is discharging urethral and vesical symptoms become annoying, balsamics may be given. Neither urethral injection nor urethral instrumentation is allowable. The inflamed vesicle also should not be stripped or manipulated by the finger in the rectum. The finger should be inserted into the rectum only occasionally in order to note the state of the inflammatory process. The patient should remain in bed till resolution has taken place in the vesicle. This generally takes about a month. By adopting this method of treatment resolution generally takes place if the patient is not strumous. In case, however, suppuration should occur outside the vesicle, resulting in abscess-formation, then a perineal incision should be made after the manner advocated by Zuckerkandl and drainage established.

Subacute and chronic seminal vesiculitis should be treated by the author's method of stripping the diseased sacs at intervals of five days or a week. A more detailed account of this process than is here necessary has been given in the author's book, reference to which has already been made. The technique to be observed in the performance of this treatment has already been described in considering the clinical features of the disease. Although from the description it may seem to be an easy matter to strip a diseased vesicle, still, in the author's experience, comparatively few can do it well without considerable practice, and some seem incapable of being taught to do it efficaciously. Among the usual causes for failure in practising this treatment are—inability to reach or locate the vesicles, a false conception regarding the aim of the treatment, and an improper application of force with the finger-tip. In some instances the finger of the surgeon may be too short, but in most cases a failure to reach the vesicle is due to the resistance offered by the perineal muscles. To overcome this resistance firm pressure should be made with the closed fist minus the extended fore finger. In this connection it may be well to quote briefly from an article by the author in the *Journal of Cutaneous and Genito-urinary Diseases*, June, 1894:

“In some thick-set, rigid individuals the perineal pressure required may be very considerable, since in such instances counter-pressure on the hypogastrium with the other hand accomplishes but little. In such cases the muscular effort required to enable the fore finger to perform the necessary

stripping may be greater than an operator who is not physically fairly robust can command. As an aid in making perineal pressure where much resistance is encountered I have found that the knee corresponding to the arm used in manipulating can be made to play an important auxiliary rôle in pushing against the elbow. In order to carry out this maneuver a chair is drawn up behind the patient as he stands with his body bent forward in what I have been accustomed to term the 'leap-frog' position, and ready for the treatment. Then the foot of the operator corresponding to the hand to be aided is placed in the chair, thus bringing the knee up to the level of the elbow. By this arrangement the muscles of the thigh and leg, as well as of the arm and shoulder, all working together, can furnish pressure sufficient to overcome the resistance of the most rigid perineum. It is only occasionally that such extensive muscular efforts are called for. In weakly, loose-fibered individuals little or no perineal pressure is required to reach the vesicles, or even, if need be, much farther. In fact, in such cases with a little counter-abdominal pressure one can easily engage the tip of the fore finger in the sigmoid flexure."

Inability to locate the vesicles must be overcome by practice, and needs no further consideration here. The chief false conception regarding the aim of the treatment seems to be in confounding it with so-called "prostatic massage." In fact, some seem inclined to consider seminal vesiculitis a new term for prostatitis. A correction of this misconception, however, will come with a better general knowledge of the anatomy and physiology of the parts.

Then, again, many fail in stripping by exerting too little pressure with the finger-tip; a few, by exerting too much. It is a safe rule always to begin gently with a new case, where the parts are usually very tender, and to strive at first to get the patient accustomed to the manipulation before regular and complete strippings are attempted. If the stripping treatment is accomplishing the desired results, the parts should get gradually less and less tender, besides becoming more and more normal to the feel, and at the same time the subjective symptoms should show gradual improvement. When the treatment has been employed too vigorously or too often, then the finger will detect evidences of fresh engorgement; there will be a reappearance of tenderness, together with, oftentimes, an augmentation of subjective symptoms. The urine passed after the stripping will show the material expressed to be of increased purulency in purulent cases or to have become purulent in cases formerly non-purulent. Blood in greater or less amount may appear in the expressed material. Epididymitis may also result from an extension of the inflammation. In such conditions the treatment should be suspended till all the evidences of acuteness have disappeared. When this is done it will often be found that the parts are left better than before the over-treatment.

The duration of the treatment may be for a few weeks or months to a year or over. In simple non-gonorrhœal cases in youthful subjects, where the vesicular walls are atonic and no perivesicular inflammation exists, the cure is generally prompt, while in cases where the sac is bound down by extensive perivesicular inflammation or the individual is advanced in years the relief from subjective symptoms may be slow, and a positive cure of the pathological process can never be said to occur. Still, even in the worst cases time and attention will generally suffice to rid the patient of all local distress and inconvenience. During the active stage of treatment coitus should not be practised, and everything tending to produce sexual excitement should be avoided.

The stripping process effects a cure in seminal vesiculitis by aiding and strengthening the mechanism of ejaculation and by promoting a reabsorption of inflammatory exudates. In all forms of seminal vesiculitis the mechanism of ejaculation is impaired, and in some instances it is rendered wholly ineffective. The stripping process in large measure accomplishes the results of ejaculation, while the muscles concerned in the act remain passive, and it does in many instances what the weakened mechanism has been unable to do—that is, it expels the jellified pathological fluid from the sac. The muscular apparatus by the passive exercise recovers its tone: it becomes better nourished, and the inflammatory adhesions which may have bound it down grow elastic and disappear.

During the local treatment the patient should live well. He should take regular exercise, although of course such exercises as horseback-riding and bicycling are to be excepted as too severe, unless he is robust, and especially if there be inflammatory exudates to be reabsorbed. Cod-liver oil, malt preparations, and other blood-producers are often of value. In very chronic cases, where the progress toward recovery is slow, an entire rest from treatment for a month or so at a time is often of benefit.

Tubercular seminal vesiculitis should be treated largely by hygienic measures. Occasionally a very gentle stripping may be beneficial. Such treatment, however, is generally injurious, as it tends to stir up and intensify the tubercular process. In fact, the manner in which a tubercular seminal vesiculitis resents the stripping treatment can often be used as evidence in making a differential diagnosis.

Excirpation of the seminal vesicle has been practised on a number of occasions, generally for tubercular conditions. The results from such operations, however, have not so far been very brilliant. Occasionally, however, the operation may be required. The Zuckerkandl, the Von Dittel, and the Rydygier incisions, or combinations of these, represent the surgical methods to be employed.

GROWTHS IN CONNECTION WITH THE TESTICLE AND SEMINAL VESICLE.

Dermoid Cysts.—The testicle is the favorite seat of dermoid cysts in men, as is the ovary in women. These formations, however, are less frequent in the testicle than in the ovary. They are probably congenital, though oftentimes they remain quiescent in youth, not growing enough to attract attention until adult life. They may contain cartilage, teeth, bone, hair, etc. They may be situated in the central portion of the testicle or may be attached to its periphery. Oftentimes they cannot be differentiated from spermatocele or encysted hydrocele until incised. They occasion no subjective symptoms, unless they become inflamed, other than may result from their size. For treatment they should be removed, since occasionally they degenerate, becoming the starting-point for malignant disease. Occasionally, when such growths originate in the periphery of the testicle, the sac can be dissected off without sacrificing the testicle. In most cases, however, the testicle has to be removed with the cyst.

Cancer of the testicle is not rare. It generally occurs in young or middle life. It usually exists in the form of medullary carcinoma, although rarely it may be scirrhus. It generally originates in the body of the testicle, although at times the epididymis is its starting-point. When the growth is soft and succulent, its usual variety, it progresses very rapidly, especially

if its victim be young or robust. It soon extends beyond the confines of the capsule of the testicle, invading the loose connective tissue round about and also the scrotum. The cord itself is often involved. The scrotum when involved becomes brawny and adherent to the mass within it. Its veins also stand out prominently. Pain in the testicle itself is sometimes wanting, while at other times it is prominent and severe. As the disease advances the deep pelvic chain of lymphatic glands becomes involved, giving rise to much pain. Later on also, after the disease has extended beyond the testicle, the inguinal glands may become affected. The disease in its earlier stages

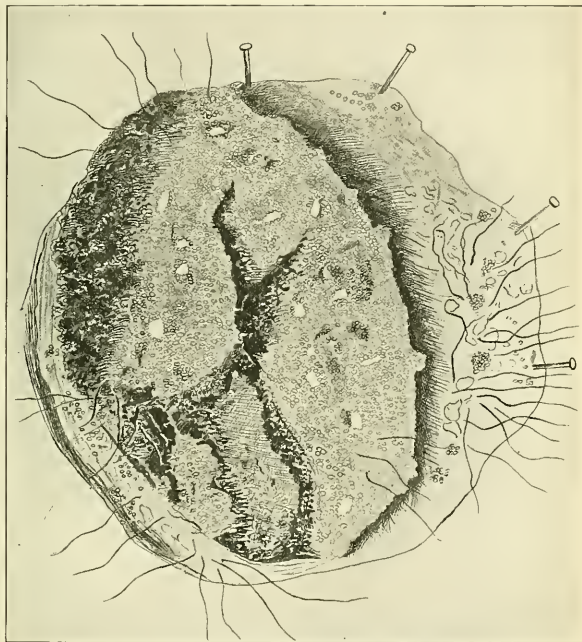


FIG. 67.—Dermoid cyst of the testicle (Reclus).

may be accompanied by hydrocele. It may also be more or less cystic. Its tissues may break down, forming local sloughs. Such spots appear through the scrotum as soft and fluctuating. They may eventually discharge themselves, leaving putrid sinuses from which fungous masses may project. Sometimes cancer of the testicle may attain the size of a head. The only treatment for cancer of the testicle is early removal. After cancer has developed to any marked extent its malignant nature can easily be recognized. At first, however, its appearance may be simulated by late syphilis of the part and rarely by tubercle or cystic disease. When a case is encountered wherein cancer of the testicle is suspected in one who has never had syphilis, immediate extirpation of the testicle, together with the cord, should be prac-

tised. If there is a strong suspicion that the disease may be syphilis, vigorous mixed treatment should be employed. Then, if after a week or so there has not been a change for the better in the testicle, that organ should be cut down upon and extirpated, except in case the close inspection which the scrotal incision has allowed has enabled the operator to decide that the affection is non-malignant.

Sarcoma of the testicle is also not rare. It occurs much as cancer does, and especially in the young and middle-aged. In most respects the description just given of cancerous affections applies also to sarcomatous ones, since a differential diagnosis between the two can rarely be positively arrived at without the aid of the histologist. Pain is apt to be a less prominent feature in connection with sarcoma than with cancer. Sarcoma also does not tend to involve the cord secondarily. It is more apt to grow as a compact mass, with a well-developed periphery, and to be free from outstanding nodules. The same treatment and the same remarks regarding when to operate in suspicious cases which were made with reference to cancer apply equally to sarcoma.

Enchondroma and adenoma of the testicle have been observed. Such growths, however, should always be regarded as suspicious, since the real line which separates them from malignant disease is often indistinct if not imaginative. Taylor has recently reported, as representative of mixed malignant disease of the testicle, a case which the histologist has pronounced to be a combination of sarcoma, cystic adenoma, and carcinoma. It is probable that some growths do not start histologically malignant, but rapidly become so, and Taylor's case may represent one of them in the stage of histological transition. These ill-defined growths should receive the same surgical attention as cancer or sarcoma.

Malignant Disease of the Seminal Vesicle.—It is not uncommon for cancerous affections of adjacent or connecting organs to extend to and involve the seminal vesicle. In such instances the cancer may be primary in the prostate, bladder, rectum, or testicle. Primary cancer of the seminal vesicle, however, is apparently quite rare, although, were digital rectal exploration of these organs more commonly and systematically practised, it probably would be found to be of much more frequent occurrence than the present statistics indicate. Guelliot, who has analyzed 14 cases in which one or both seminal vesicles have been affected by cancer, finds but 1 in which the growth was distinctly primary in the seminal vesicle. Gay reports a case of primary cancer of the seminal vesicle in which he made an unsuccessful attempt to eradicate the disease by extirpating the organ, an incision apparently similar to that of von Dittel being employed.

Sarcoma of the seminal vesicle, either primary or secondary, is of very rare occurrence. Zahn reports the only case of primary sarcoma of this organ.

Malignant growths of this part, if at all extensive, interfere with urine drainage, and to a less extent with the functions of the lower bowel and rectum. They are also accompanied by pain more or less localized. The recital of clinical symptoms, however, has been so meager in the few cases reported that an attempt at detail in this particular is impossible. Where disease is confined to the seminal vesicle speedy extirpation of the organ is advisable. Rydygier's incision, which is a modification of Kraske's, is the method which should be employed, since that cut gives the operator the space necessary to make the removal most thorough and complete.

DISEASES OF THE PROSTATE.

BY J. WILLIAM WHITE, M. D., AND ALFRED C. WOOD, M. D.

Definition.—Greek, *prostatēs*, one in the front rank, from *πρό*, *pro*, before, and *ἵστῆμι*, *histēmi*, stand, place.

Synonyms.—*Lat.* Prostata; *Ger.* Vorsteherdrüse, Prostata; *French,* Prostate.

Development.—The prostate gland can be recognized during the fourth (Kölliker) or fifth month (Mihalkovics) of fetal life as a series of branching evaginations of the epithelium of the upper extremity of the urogenital sinus. The evaginations later extend into wide, irregular cavities. The muscular tissue of the prostate is developed much later from the mesenchyma of the walls of the sinus. According to Torneux, the evaginations persist in the female in a more or less rudimentary condition.¹

The question of the analogy between the prostate gland and the uterus has been frequently raised. It is now believed, however, that the analogue of the uterus in the male is the prostatic vesicle, or sinus pocularis. The united portion of the Müllerian ducts later forms the foundation of the prostatic vesicle, or uterus masculinus, in the male, and of the vagina and uterus in the female. The upper or fore part of the Müllerian duct disappears in the male; in the female it forms the oviduct (Fallopian tube). The hydatis of Morgagni are believed to represent in the male the remnant of part of the Müllerian duct. In certain animals the prostatic vesicle of the male is prolonged into cornua and tubes resembling the uterus in the female.²

The large number of dissections made by Thompson, Charles Bell, Gross, Deschamps, Messer, and others have shown that the prostate is relatively very small in childhood, and that it grows but little until the age of puberty. At this period there are a rapid development of the glandular elements of the organ and a coincident increase in its size (Socin).

Anatomy.—**Description.**—It is customary to describe the prostate gland as though it were a distinctly defined organ with clearly outlined borders, whereas it is so intimately connected with the bladder and urethra that its limitations are difficult to determine. This fact led some of the older authors to deny that the prostate was a separate organ, and as such deserving of a special name and description. More recent studies have resulted in a better understanding of its functions in health and disease, and have shown its importance as an accessory sexual organ.

With this explanation the usual description of the prostate—that in the adult man it is about the size and shape of a horse-chestnut (the fruit of *Æsculus Hippocastanum*)—will answer, perhaps, better than any other. The exact size is very difficult to determine, for the reason already given. It is only the surface facing the rectum that is accessible to examination during life. The introduction of a metal bougie into the urethra during the digital

¹ Minot, *Human Embryology*.

² Quain, *Human Anatomy*.

rectal examination materially assists in estimating the approximate size of the gland.

Sabatier¹ described the following layers of the prostate: 1, mucous membrane; 2, longitudinal fibers; 3, deep circular fibers connected with the canal of the urethra and continuous with the circular layer of the bladder; 4, longitudinal fibers which are the terminations of the oval fibers of the bladder; 5, a very thick layer of circular superficial fibers which comprise almost the whole mass of the prostate: these fibers are eccentric to the deep circular fibers surrounding the canal of the urethra, and contain the glandular substance; 6, the capsule, composed of fibrous tissue which serves as a covering for the gland and as a tendon of insertion for some of the fibers of the bladder.

Pettigrew² says the fibers of the bladder and prostate with few exceptions form figure-of-eight loops. They are arranged in layers which may be divided into three sets of internal loops and three sets of external loops, with an intermediate or central set; the anterior and posterior fibers of the latter, according to Pettigrew, largely form the sphincter vesicæ. He also found that the fibers of the urethra are continuous with and drag on the median ridge (verumontanum); the ureters, acting together, tend to elevate the median ridge during contraction. The shape of the verumontanum is that of an inverted pyramid, the base of which is turned toward the base of the prostate. Its narrow end is consequently directed downward and forward; it is attached by one side of the pyramid to the prostatic urethra, the two sides that are free terminating in a well-defined crest. The prostatic portion



FIG. 68.—Diagrammatic sketches of transverse sections of prostate and urethra, showing the precise shape and degree of obliquity in the urethral canal at different points, and the part which the verumontanum plays in the closure of it (Pettigrew): *a*, urethra at base of prostate, oval in shape, and quite open; *b*, urethra a little further forward, oval, floor (*j*) slightly elevated; *c*, urethra somewhat triangular in shape, the verumontanum (*k*) beginning to project from the floor or base of the triangle; *d* and *e*, urethra more decidedly triangular, the verumontanum (*l* and *m*) projecting to such an extent as almost to obliterate the urethral canal; *f* and *g*, urethra bayonet-shaped and entirely closed by the projection of the verumontanum (*n*, *o*), which acts at this point as a mechanical wedge; *h*, *i*, *p*, *q*, urethra circular in form and again becoming patent.

of the urethra is triangular, and fitted so closely to the verumontanum that urine cannot be made to escape even in the dead subject without considerable pressure; it is therefore easy to perceive that in the living individual, when the parts are injected with blood, the obliteration must be very complete. In addition, the urine by its own weight acting upon the base of the wedge-shaped verumontanum would tend to make the closure more secure. When the bladder contracts the longitudinal fibers which connect the verumontanum with the ureters where they meet in the middle line have the effect of elevating or withdrawing the wedge, and thus assist in rendering the orifice of

¹ *Traité d'Anat.*, Paris, 1777.

² "On the Muscular Arrangement of the Bladder and Prostate, and the Manner in which the Urethra and Ureters are Closed," *Phila. Trans.*, part 1, 1867.

the urethra patent. Sabatier speaks of the verumontanum as the "gate-keeper" of the prostatic portion of the urethra.

Ellis¹ thinks the point where exquisite sensitiveness is experienced in passing a catheter, as the instrument approaches the neck of the bladder, is the verumontanum, and not the trigone. As pointed out by Guthrie,² in the normal bladder, when but moderately distended, even the triangular space is below the level of a catheter introduced through the urethra.

The closure of the urethra is favored by the contraction of the very oblique or circular fibers forming the urethra, and by the prominence of the uvula vesicæ (lutte vesicale) and median ridge in the female and by the caput gallinaginis or verumontanum in the male. The urethra from the disposition of the fibers should be considered as the proper continuation of the bladder anteriorly. The longitudinal fibers of the prostate and urethra are separated by a considerable interval, and the very oblique or circular fibers, which are widely distinct and have separate axes at the cervix where the sphincter is most fully developed, curve into and are blended with each other in the region of the verumontanum. This is important as showing how the sphincter may act independently of the prostate, and the reverse.

Measurements.—The following are the average measurements of the prostate: from base to apex, $1\frac{1}{4}$ to $1\frac{1}{2}$ inches (31 to 38 mm.); greatest transverse diameter, about $1\frac{3}{4}$ inches (44 mm.); greatest thickness, about $\frac{5}{8}$ to $\frac{7}{8}$ inches (16 to 22 mm.). These figures agree with those given by Deschamps, Gross, and Hodgson, but are less than those given by Dupuytren, which are—transverse diameter, $1\frac{2}{3}$ to 2 inches (42 to 50 mm.); thickness, $\frac{5}{8}$ to 1 inch (22 to 25 mm.). The former figures more closely approximate the true dimensions.

Weight.—The exact weight of the prostate is a matter about which it is difficult to make a definite statement. The difficulty of separating the gland accurately from surrounding structures, already alluded to, explains the lack of harmony existing between the figures given by different writers. It may be said, however, that from 4 to 6 drams (16 to 24 grams) represent the usual weight of the normal adult gland. The average weight in specimens dissected by Thompson was 4 drams and 38 grains (18 grams). Messer's figures correspond very closely with this—4 drams and 57 grains (19 grams).

Anatomical Relations.—The prostate surrounds the vesical end of the urethra, and is placed immediately in front of the bladder. It lies between two imaginary lines, both of which begin at the tip of the coccyx, one going to the upper border and one to the lower border of the symphysis pubis. The base is 20 mm. and the apex 10 mm. from the posterior surface

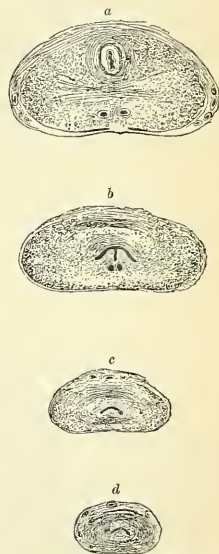


FIG. 69.—Cross-sections of the prostate, perpendicular to the urethra (Henle): a, near base; d, near apex; b and c, intermediate sections.

¹ "An Account of the Urinary and Certain of the Generative Organs of the Human Body," *Med.-Chir. Trans.*, vol. xxxix.

² *On the Anatomy and Diseases of the Urinary and Sexual Organs*, Lond., 1843, p. 6.

of the symphysis (Kohlransch). In the vertical position of the body with moderate inclination of the pelvis the prostate is vertical, the base being directed upward and the apex downward. The *facies pubica* (Mercier) is concave from side to side, is directed toward the anterior wall of the pelvis, and is attached to the symphysis by the pubo-prostatic ligament. The posterior surface, *facies rectalis* (Mercier), is more flat, and is connected with the anterior wall of the rectum by firm connective tissue which is devoid of fat. The lateral borders are convex; they stand out prominently, and are covered by the anterior portions of the levator ani muscles. The base or upper surface, *facies vesicalis* (Mercier) presents a depression in the middle. The apex, *facies urethralis* (Mercier), rests on the urogenital diaphragm (Henle). The gland is pierced by the urethra, which in this situation is designated the prostatic portion. In the upright position of the body the prostatic urethra describes an arc, the convexity of which is posterior, and the chord of which is nearly vertical.

The prostate surrounds, besides the urethra, the lower end of the spermatic ducts and the so-called prostatic vesicle. The ejaculatory ducts enter

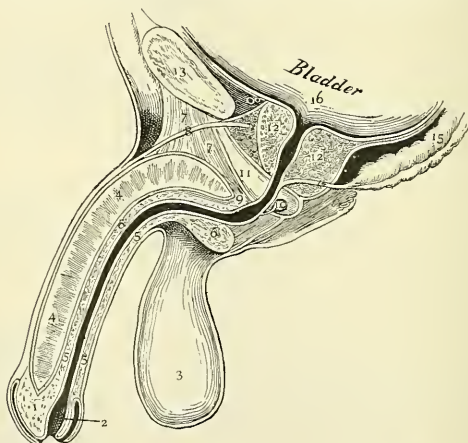


FIG. 70.—Vertical section of bladder, prostate, urethra, etc.: 1, glans penis; 2, fossa navicularis; 3, scrotum; 4, corpus cavernosum; 5, corpus spongiosum; 6, bulb; 7, suspensory ligament; 8, dorsal vein of penis; 9, crus penis; 10, Cowper's gland; 11, space between the two layers of the triangular ligament: the portion of urethra included in this space is designated "membranous," and is fixed; 12, prostate gland; 13, pubis; 14, ejaculatory duct; 15, seminal vesicle; 16, neck of bladder. The cut is, of course, diagrammatic. The urethra is represented as an open tube instead of as a collapsed canal, which it really is.

from above in the base of the prostate near its posterior surface, where they are 6 to 8 mm. distant from the urethra. In the prostate they are diverted a little toward the front and pass to the sides of the colliculus seminalis, opening into the urethra with slit-like openings. At their entrance into the prostate they are from 3 to 4 mm. distant from each other, while their openings in the urethra are separated only by the sinus pocularis, in the walls of which they run.

In the median line of the prostate the position of the urethra is represented by a furrow, more readily felt than seen, which divides the body of

the gland into two lateral halves, while the ejaculatory ducts in their course, already described, form the so-called "third lobe," which by many writers is said to exist pathologically only. This median portion has been erroneously described as lying between and behind the entrance of the ejaculatory ducts, whereas it is really in front of them. Cruveilhier considers the "middle lobe" abnormal, but admits a median portion which Mercier calls "*portion susmontante*." Thompson, after examining a large number of healthy prostates, does not accept the existence of the "third lobe" described by Home.

The deep perineal fascia, a portion of the pelvic fascia, descends from the posterior aspect of the pubic bones and adjacent ischia, closing in the pubic arch and investing the lower surface of the levatores ani. A prolongation of this fascia envelops the prostate and encloses the veins which pass on either side and in front of the gland. Numerous fasciculi pass inward to the proper capsule of the prostate. A continuation of the same fascia binds the seminal vesicles firmly to the base of the prostate and bladder.

The prostate is held in position in part by ligamentous and muscular attachments. The pubo-prostatic ligaments pass from the posterior aspect of each pubic bone at its lower border to the anterior surface of the prostate, and thence to the bladder, where they become continuous with the fibrous tissue surrounding the vesical neck. These ligaments consist of the recto-vesical portion of the pelvic fascia. A pair of muscles, one of which arises from an oblique line on the posterior surface of each pubic bone and joins its fellow, passes in front of and below the apex of the prostate, some of the fibers being continued along the lateral borders.

Histology.—Before the age of puberty the prostate is composed almost entirely of unstripped muscle, the glandular elements being inconspicuous.

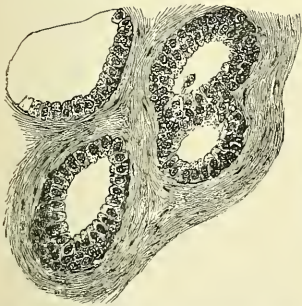


FIG. 71.—Prostate of a sixteen-year old youth (Socin).



FIG. 72.—Prostate of an adult (Socin).

When full development has taken place the gland-tissue comprises from one-fourth to one-third of the volume of the organ, and is distributed mainly in its posterior and lateral portions (Kölliker). The portion of the gland lying in front of the urethra is said by Jarjavay, who has examined 100 specimens with this point in mind, to contain no glands. Luschka affirms the truth of this observation, to which, however, he claims there are occasional exceptions.

The prostate, on section, has a reddish-gray color and is of spongy consistence. Microscopically, it consists of numerous (according to Kölliker,

thirty to fifty) branched tubular glands ending in blind extremities. Some doubt still exists as to whether the construction is acinous or tubular. Before puberty the tubules are narrow and there is a large amount of intermediate substance; after this period the glands expand and the intercellular substance diminishes. The prostate is covered by a capsule composed of muscular and connective tissue which is very adherent to the gland itself. Between this, which may be called the proper sheath of the prostate, and that before described is situated the prostatic plexus of veins, which is continuous with the dorsal veins of the penis. The muscular arrangement of the gland has already been described. The secretion of the prostate is acid.

Vessels and Nerves.—The blood-supply to the prostate is through the vesico-prostatic artery, a branch of the inferior vesical, which passes to the side of the prostate, and through small unnamed branches of the internal pudic and the middle hemorrhoidal branch of the inferior vesical arteries. In some cases the internal pudic artery is replaced by the accessory pudic. Quain describes the course of this vessel as follows: "In passing by the prostate and urethra—and it is here that the exact situation of this artery is of serious concern to the practical surgeon—the accessory pudic lies on the upper part of the gland, or it may be for a short space likewise on the posterior margin, and then, proceeding forward above the membranous part of the urethra, it reaches the perineum and divides into its terminal branches."

The veins of the prostate, which are known as the prostatic plexus, are formed mainly by the breaking up of the divisions of the dorsal veins of the penis, but they receive also smaller branches from the gland and from the neighboring muscles. The plexus surrounds the base of the prostate, being distributed most thickly on its anterior and lateral aspects, and communicates below with the tributaries of the pudic vein, while above it is continuous with the vesical plexus. In old persons these veins are generally much dilated and their valves become imperfect or even disappear.

The lymphatics of the prostate ascend to glands below the external iliac vessels.

The nerves of the prostatic plexus are of considerable size, and pass between the prostate gland and levator ani muscles. Some of the fibres pass to the prostate and to the seminal vesicles. The plexus is continued forward to supply the erectile tissue of the penis, where it receives the name "cavernous." The secretory fibers of the prostate come from the sacral sympathetic. The sensory nerves, according to Head, are derived from the tenth, eleventh, and twelfth dorsal, the first, second, and third sacral, and the five lumbar.

Malformations and Anomalies of the Prostate.—Entire absence of the prostate is found only in cases of extensive defects of the genital and urinary organs and pelvis. The formation of cloacæ and split bladder does not interfere with the development of the prostate and seminal vesicles.

Injuries of the Prostate.—Wounds of the prostate are rare by reason of its situation. It is possible to conceive of a blow on the perineum sufficiently violent to affect the prostate, but such an accident must be of great rarity. Blows on the perineum from a sharp body may easily involve the prostate, and it may be also wounded in cases of extensive fracture of the pelvic bones. The gland may also be injured by the trocar in the act of puncturing the bladder by either the perineal or rectal method, a procedure now rarely employed, by the introduction of foreign bodies into the rectum, and by clumsy attempts at passing urethral instruments. Wounds of the prostate are unavoidably inflicted during perineal lithotomy.

The symptoms of these injuries will depend upon the cause and the situation of the wound. The dangers are—1, if the urethra be involved, urinary infiltration; 2, hemorrhage; 3, infectious phlebitis. The extravasation of urine from a wound of the prostate may be in the direction of the perineum, in which case the ischio-rectal spaces will be involved, or it may be directed upward into the prevesical space, from whence it may spread rapidly through the areolar tissue of the abdomen, thighs, penis, and scrotum. In either case the tissues will be edematous and boggy, and either of a bright-red or livid hue. In wounds confined to the prostate the extravasation is usually restricted to the prevesical space by the layers of the recto-vesical fascia.

Hemorrhage may be slight in amount or very profuse; in the latter case a globular tumor is apt to form above the pubes. If the vesical neck be divided, the blood may flow backward into the bladder.

Infectious phlebitis causes an infiltration and induration of the coats of the prostatic plexus of veins. The vessels are hard and cord-like, the gland is very tender to the touch, and the fibrinous and serous exudations completely destroy its elasticity. The condition is rapidly followed by chills, fever, quick pulse, dry, coated tongue, nausea and perhaps vomiting, and sometimes by delirium. In other words, the typhoid condition is not uncommonly present. When suppuration occurs there is danger of serious hemorrhage from the breaking down of the walls of the veins.

Wounds of the prostate produced by forced catheterization for the relief of urinary retention due to enlargement of the prostate have not infrequently been followed by serious or fatal consequences. The practice should be unreservedly condemned, as the extent of the injury and the consequences must remain unknown to the operator.

Treatment.—In general, lithotomy and other wounds of the prostate made by the surgeon heal kindly, and are seldom followed by urinary fistula or obstruction of the urethra. A few cases are on record in which the contraction of the prostatic wound resulted in an interference with the action of the vesical sphincter and caused a more or less permanent condition of incontinence.

In the case of an external wound which does not involve the neck of the bladder the indications for treatment would be those common to all lacerated wounds—namely, the removal of foreign bodies, the thorough cleansing of the wound-surfaces, and the arrest of hemorrhage and drainage. Usually no ligatures will be required, the packing of the wound with iodoform gauze being sufficient to arrest any bleeding. A Nélaton catheter should be introduced into the bladder through the urethra and allowed to remain for a few days, as the inflammatory swelling which is apt to occur would probably cause retention and make the introduction of a catheter difficult at that time. If the vesical sphincter has been divided and there is evidence of hemorrhage into the bladder, a full-sized soft-rubber catheter should be passed through the urethra and the bladder thoroughly irrigated with warm boric acid solution. If it be impossible to introduce an instrument into the bladder, a perineal urethrotomy should be performed, and after washing out the bladder with the boric acid solution a catheter *en chemise* should be introduced. This will drain the bladder, and will facilitate the packing of the wound to control hemorrhage. A carefully applied tampon of iodoform gauze will always control hemorrhage in this situation.

The most careful asepsis in the treatment of these wounds is the only means we have by which to guard against the occurrence of infectious phlebitis. If this condition should supervene, it will be necessary to perform

frequent antiseptic irrigations of the wound, to secure free drainage, and to support the patient by the administration of quinine, strychnine, and stimulants. Gentle catharsis should be induced, and if pain is severe anodynes may be required. Lead-water and laudanum may be applied to the perineum to relieve pain and congestion. In the cases in which the bladder becomes filled with blood, as in forced catheterism for retention of urine due to an enlarged prostate, a catheter should be introduced into the bladder and the blood withdrawn. The coagula may be disintegrated by the injection of sterilized tepid water or, preferably, boric acid solution. If the return-flow is arrested by fragments of clot, suction may be made by means of a syringe. If it has been impossible to break up the clot, weak solutions of pepsin, faintly acidulated, may be introduced into the bladder two or three times daily. Even if the presence of the clot in the bladder does not give rise to either distress or retention, it is desirable to carry out the same treatment in order to avoid the possibility of infection and consequent severe cystitis. In cases in which there has been a possibility of infection it is wiser to use a more powerful antiseptic than boric acid, and a solution of carbolic acid, 1 : 200 in a 1 : 5000 solution of bichloride of mercury, may be employed. In all these cases urinary antiseptics, such as boric acid or salol, should be administered internally: 10 grains of either may be given three or four times a day.

Foreign Bodies in the Prostate.—These are usually portions of catheters which have broken off of faulty instruments during their introduction or calculi that enter from the bladder. Cases are occasionally met with in which various bodies have been introduced into the urethra for erotic purposes, sometimes by old men under the influence of sexual aberration and the excitation which often accompanies the early stage of prostatic hypertrophy.

Such bodies, having been introduced beyond the reach of the fingers, have eventually lodged in the prostatic sinus. By inflammation and ulceration they may work their way into the substance of the gland.

Symptoms.—There are usually considerable vesical irritability, pain, and tenderness in the perineum and a constant desire to urinate. By rectal examination the gland will be found swollen and tender to the touch. If the inflammation has gone on to abscess-formation, fluctuation may be detected.

Treatment.—Sometimes these bodies may be removed through the urethra by means of appropriate forceps. This is especially true of small calculi that lodge in the prostatic urethra, and to a less degree of fragments of catheter. If the foreign body cannot be removed in this manner, it will be necessary to explore the gland through a median perineal incision. If supuration is present, the abscess-cavity should be thoroughly curetted, irrigated, and drained either by means of rubber tubes or by packing with iodoform gauze.

Acute Prostatitis.—Two varieties of acute inflammation of the prostate are described: 1, that in which the inflammation affects chiefly the follicles, and 2, that in which the entire gland is involved, the parenchymatous variety.

Etiology.—Acute prostatitis as an independent and primary affection is rarely met with. Among the causes described are external influences, such as sudden exposure to cold or wet and blows on the perineum. In the vast majority of cases the inflammation of the prostate has been transferred from more exposed neighboring organs by continuity or has been developed in the course of one of the acute infectious diseases. The most common cause by far is acute urethritis. Occasionally a urinary calculus lodging in the prostatic sinus will excite inflammation. Olive observed acute prostatitis, fol-

lowed by severe cystitis and prostatic abscess, in a case after the application of a large plaster of cantharides. Prostatitis is an infrequent sequel of acute febrile diseases, and cases have been reported in patients suffering from small-pox, scarlet fever, typhoid, typhus, etc. Prostatic abscess is not uncommonly met with in cases of pyemia. Occasionally patients suffering from bed-sores develop thrombosis of the prostatic plexus, which is followed by suppuration. Infection by contiguity—as from the rectum, for example—is very rare, doubtless owing to the firm capsule that envelops the gland. Next to the gonorrhœal variety, those cases in which both infectious and traumatic factors enter are the most common. They follow the use of sounds or catheters that are not surgically clean, especially if some abrasion has been produced by their unskilful introduction. Tubercular prostatitis will be considered under a separate heading.

Among other causes which may be mentioned are—urethral stricture, which tends to produce inflammation of the parts posterior to it; the direct application of irritating agents, such as injections of strong chemicals, cauterization, etc.; horseback exercise, bicycle riding, drastic purgatives, etc. It does not appear at all established that either horseback exercise or bicycle riding under proper conditions predisposes to inflammation of the prostate. It is probable that this is a superstition promulgated by the laity chiefly, but somewhat heedlessly accepted by some in the profession.

Morbid Anatomy.—Opportunity is rarely afforded for examining the prostate in the condition of acute inflammation. Thompson has, however, examined such specimens and observed the following conditions: the gland was swollen to double or even quadruple its natural size, and felt tense and firm to the hand. The external blood-vessels were engorged with dark blood. On making an incision from the front aspect into the urethra the mucous membrane was seen to have a somewhat deeper tint than natural, although there was less change here than one might expect; the cut surface was redder than in health; pressure caused to exude a reddish, somewhat turbid fluid, a mixture of effused lymph and serum, of blood from loaded capillaries, of prostatic secretion, and a very small quantity of pus. The same fluids exuded, but in somewhat greater quantity, from sections through the lateral lobes. As the inflammation advanced the fluid contained a larger admixture of pus, and a section of the lateral lobes especially showed several minute spots of thickish pus—not abscesses, apparently, strictly speaking, but the gland-crypts, whose lining cells were then secreting pus and whose cavities were distended with it. As the morbid action continues these phenomena pass insensibly into others which indicate more permanent and organic changes in the organ, and which generally follow the preceding if resolution does not take place.

The changes that take place in the later stages are such as are common to inflammatory processes in general: the secretion of purulent matter and the organization of effused lymph lead to the formation of isolated deposits of pus or small abscesses in the substance of the prostate. These are found either numerous and small, or fewer and larger; the size of the abscesses varies from that of a grain of barley or a pea to that corresponding nearly to the entire gland. The larger abscesses result from the coalescing of the smaller deposits by the destruction of the intervening tissue. It is to be observed that the pus of a prostatic abscess has usually, if not always, a peculiar glutinous or adhesive quality, differing from the diffluent creamy character of ordinary healthy pus. Sometimes clots of blood are found, the result of small hemorrhages into the diseased gland-crypts or other cavities. Portions of the organ may soften

and break down. The mucous membrane of the prostatic urethra is reddened, sometimes thick and velvety, or it has patches of whitish and membrane-like material closely adhering to the surface—exudations of organized lymph. Again, a portion of the mucous membrane may be destroyed by ulceration or gangrene, and give exit to a collection of pus. This is one of the ways in which a prostatic abscess evacuates itself spontaneously.

Symptoms.—The symptoms in both the follicular and parenchymatous varieties are very similar; in the latter they are rather more severe, and are more frequently followed by abscess. The follicular variety usually depends upon a pre-existing urethritis; the parenchymatous form is much more rarely due to this cause. The earliest symptom is a feeling of heat and weight in the region of the perineum and bladder. Severe pain is soon felt on micturition and on defecation. Urination becomes frequent and is attended with tenesmus in proportion to the degree of involvement of the neck of the bladder, or there may be retention from the swelling of the gland. The patient experiences an exacerbation of pain on motion, and sitting is uncomfortable or may be impossible. The perineum is found sensitive on pressure, and the introduction of the finger into the rectum causes a spasm of the sphincter which is irritated by the adjacent inflammation. The prostate is found to be enlarged, hard, hot, and very painful on pressure. In this class of cases there is always more or less fever, with the attending constitutional disturbance. If pus forms, there may be chills. Every degree of intensity is met with; in the milder varieties the symptoms are much less pronounced. Fluctuation may often be detected by rectal palpation after suppuration has occurred.

In the subacute cases there may be but few symptoms. Such a course may be observed in cases of pyemia. Socin found an abscess in the right lobe of the prostate as large as a pigeon's egg in a man who died of pyemia from a phlegmon of the right foot.

Usually an abscess of one lobe discharges spontaneously through the urethra. If, however, the intercellular substance is affected, the whole gland may break down rapidly, with the development of pronounced constitutional symptoms; a diffuse phlegmon is apt to occur if the periprostatic tissue becomes involved. These larger abscesses are apt to discharge into the rectum. If the pus is not evacuated, either naturally or by incision, it may ascend and penetrate the peritoneal cavity, causing a rapidly fatal septic peritonitis, or it may burrow subperitoneally, or, being guided by the levatores, may escape through the ischiatic foramen and appear on the buttock or thigh.

Usually on evacuation there are rapid shrinking and cicatrization of the abscess-cavity, ending in complete cure. In other cases septicemia or pyemia may cause a fatal termination. Occasionally long-standing fistulæ remain. The fistulæ may be urethro-rectal, prostato-rectal, or urethro-perineal, depending upon the direction in which the abscess ruptured spontaneously or was opened by the surgeon.

Diagnosis.—The diagnosis of acute prostatitis is ordinarily not attended with difficulty. In the presence of a specific urethritis, or, following one of the various causes mentioned, if the patient experiences a constant and deep-seated pain, throbbing in character, which may or may not be referred to the rectum, and if, in addition, there is frequent and painful micturition and acute pain is felt during defecation, it is more than probable that the prostate gland is the seat of acute inflammation. This will be confirmed if the gland is found to be enlarged and extremely tender on rectal examination. If there

is retention of urine and it becomes necessary to introduce a catheter, extreme pain will be experienced as the instrument reaches the prostatic urethra.

Acute prostatitis must be differentiated from inflammation of the neck of the bladder (which to a certain extent probably always coexists). This will be done by remembering the much greater prominence of the urinary symptoms, and the absence of complaints connected with the perineum or rectum, in the vesical inflammation.

In the condition known as Cowperitis, which may give rise to symptoms more or less closely simulating those of prostatitis, there will be found a deep, circumscribed, very tender perineal tumor on one side of the middle line, and the rectal symptoms common to the last-named condition will be absent.

It will occasionally be necessary to distinguish between retention of urine from stricture and enlargement of the prostate from that due to prostatitis. If, however, the history be borne in mind and the usual urethral and rectal examinations be made, a mistake will not be apt to occur. As strictures of the prostatic urethra are unknown, obstruction from a urethral coarctation would be found anterior to this point.

In all of the conditions mentioned the rectal examination would be conclusive. The presence of a moderately enlarged, exquisitely tender prostate gland would be characteristic of inflammation. In hypertrophy of the gland, although there would be enlargement, there would be little tenderness on pressure. In addition to the symptoms mentioned in the inflammatory affections there would be more or less fever, depending upon the kind and degree of the inflammation.

Treatment.—The treatment of acute prostatitis, like that of other inflammatory processes, demands at the outset as nearly absolute rest as it is possible to secure. It is desirable, therefore, that the patient should go to bed and that the hips should be raised on pillows higher than the body. The treatment should be antiphlogistic, both local and general. A number of leeches may be applied to the perineum and around the margin of the anus at intervals of a few hours. Repeated short, hot sitz-baths (100° to 105° F.) act beneficially by causing an acute hyperemia of the skin, not only of the part included in the bath, but of the general surface of the body, which relieves to a marked degree the congestion of the internal parts. If there is pronounced vesical irritation, a mixture containing sodium bromide, boric acid, and belladonna will be found to give great relief. If there is much fever, a diaphoretic mixture containing moderate doses of potassium citrate, sweet spirit of nitre, and aconite will be beneficial. If the pain is severe, a small quantity of morphine may be added to this mixture or opium may be given in suppositories. The use of hot-water clysters will also be beneficial. Saline or other laxatives should be given regularly. The patient should be cautioned against straining either during micturition or defecation. If there is retention, the urine should be drawn at proper intervals with a Nélaton catheter (14 to 16 of the French scale).

During the acute stage of the attack the diet should consist largely of milk; alcoholic and other stimulants should be interdicted; water should be taken freely.

If the case should go on to suppuration, the symptoms will be found to ameliorate considerably, and fluctuation may be detected by digital, rectal examination. (See Abscess of the Prostate.)

A fistula may persist for some time, but usually closes spontaneously. If during convalescence the patient attempts to get about too soon, a relapse may be caused and the course of the disease much prolonged.

Periprostatitis and Periprostatic Abscess.—Suppurative prostatitis may extend to the cellular spaces between the rectum and the prostate or the deep perineal spaces, giving rise to periprostatic abscesses, which are usually caused by infection through the lymphatics from the deep urethra or through a phlebitis of the prostatic plexus.

The symptoms of these abscesses (both prostatic and periprostatic) are alike: there may be retention of urine, and swelling and fluctuation are always detected either in the anterior wall of the rectum or in the perineum. The constitutional disturbances are even more marked than in suppuration of the gland proper. The swelling is, however, usually more diffuse in periprostatic abscess, and is apt to point in the posterior or anal perineum and to invade the ischio-rectal space, inasmuch as its origin is behind the middle perineal fascia.

Unless these abscesses are promptly treated the prognosis is bad, both as to life and as to the damage to the surrounding tissues.

Treatment.—The pus must be evacuated by early and free incisions through the perineum. Pointing should never be awaited; any delay permits the almost certain occurrence of extensive sloughing of the cellular tissue of the perineum, the probable occurrence of rectal fistula, and the possible loss of life.

Chronic Prostatitis.—Chronic prostatitis is relatively of much more frequent occurrence than is the acute form of the disease, but is much less understood.

Etiology.—It occurs as a sequel of acute inflammation, and also in its simple or uncomplicated form develops primarily as a chronic process. The latter variety has been ascribed to irritating injections long continued, to excessive coitus, to masturbation, to hemorrhoids, and to constipation, all of which act by keeping up a chronic congestion of the prostate and surrounding structures. In one variety it is the result of a chronic pyogenic infection, in which but small quantities of the poison gain access to the gland at one time, so that the tissues are able at least partly to resist the invasion. This condition would therefore commonly be met with in patients suffering from chronic gonorrhoea, strictures, etc. It not infrequently complicates senile hypertrophy.

In addition to the causes mentioned, the long-continued exposure to cold and damp, the presence of either vesical or prostatic calculus, and mechanical injury should be mentioned.

Morbid Anatomy.—A prostate gland the subject of chronic inflammation may be found larger or even smaller than the normal size; the consistence, if any difference exists, is less firm; the texture is more open and spongy. The color of the cut surfaces has a dusky hue, sometimes with a redder tint. More fluid than is natural is found in the gland-tissue and it freely issues on exerting pressure. This fluid is of a dirty hue, and if firm pressure be made appears to be stained slightly red. In advanced cases deposits of pus are found, varying from the size of a grain of sago to that of a pea. They are, however, few in number, being in strong contrast, therefore, with the appearance in acute prostatitis in the later stages. The mucous membrane may be thinner and more vascular than normal, with the duct-orifices large. In other places it may be coated with organized lymph, giving it a roughened and opaque appearance, or its own structures may be thickened, not reddened as in acute inflammation, but presenting after death a dull gray or even slaty hue, the last-named marking long persistence of the unhealthy action. In such cases pus is often found filling the sinus pocularis and the gland-ducts

around. Sometimes a cavity filled with pus communicating with the urethra marks the site of a chronic abscess. It is not uncommon to find an abscess or abscesses surrounding the gland—in other words, periprostatic abscesses depending on a previous disease of the prostate itself (Thompson).

Symptoms.—The principal symptom is the occasional discharge of a larger or smaller quantity of a clear, viscid fluid constituting the so-called prostaticorrhea. Occasionally the fluid may be milky. It varies in amount from a few drops to 5 or 10 grams in twenty-four hours. This discharge, especially when in considerable amount, may be preceded by spasm of the perineal muscles. The greatest flow is apt to attend an action of the bowels, especially if the movement is constipated. The patient may also note a little troublesome tickling sensation in the urethra, some undue frequency of urination, occasional dull pains in the perineum, which are apt to be increased by exercise, and pains in the thighs or sacral region. There is apt to be pain at the end of micturition, which is, however, not nearly of so severe a type as occurs in cases of vesical calculus. There may be slight tenderness in the perineum, which makes sitting uncomfortable, and increased sensitiveness of the prostate on rectal examination. There may or may not be slight enlargement. The introduction of a catheter causes more pain than usual as the instrument traverses the prostatic urethra. The urine is apt to show a little cloudiness, which is found on examination to be mainly due to shreds of tenacious muco-purulent matter and masses of epithelium which have their origin in the prostatic urethra, as may be demonstrated by requesting the patient to pass urine into two glass vessels, the first ounce or so in one and the remainder in the other. All the turbid matter will be found in the first portion. This test would exclude bladder and renal troubles.

Other symptoms which are more or less constant are frequent and painful erections, or there may be imperfect erections and premature ejaculations, lascivious dreams, etc. A characteristic symptom is the profound mental depression exhibited by many of these patients. In pronounced cases it may result in melancholia. The importance of the various symptoms is apt to be greatly magnified by the patient. He is particularly worried about the discharge, which he invariably believes to be spermatic fluid; it is needless to say that this idea is erroneous.

In addition to the similarity that some of these cases present to vesical calculus, the condition must be differentiated from inflammation of the seminal vesicles, or seminal vesiculitis, as it is called.

The following symptoms of subacute and chronic seminal vesiculitis, the varieties most likely to be confounded with chronic prostatitis, are condensed from the description by Fuller:¹ Pain is felt in the sacral region, over the pubes, or in the bladder, or more rarely in the rectum or perineum. It is intensified by sexual excitement or emotion, which may cause sharp paroxysms lasting for some days. The pain is also intensified to a greater or less degree by constipation or diarrhea, especially if accompanied by tenesmus, and active exercise. As a rule, there is no tenderness on firm abdominal palpation. Rarely tenderness to pressure in the perineum is a pronounced feature. Sexual desire varies in different cases; it may be increased or diminished, and may vary from time to time in the same case. Abnormalities relating to the seminal emissions are usually observed; they may take any variation from the normal. Inflammation of the seminal vesicles may be the sole cause of persistent urethral discharges. In addition, a great number of reflex symptoms are described. They are, of course, in no way

¹ *Disorders of the Male Sexual Organs*, 1895.

characteristic and may occur in very many conditions. Altogether, there seems to be nothing distinctive in the symptomatology of these varieties of vesiculitis. Many of the complaints mentioned would be suggestive, but the presence or absence of the condition must be determined by examination of the patient.

A valuable aid in the diagnosis of chronic prostatitis has recently been proposed by Posner of Berlin. The method has been worked up by v. Schlen and by Krotazyner and Spencer.¹ It consists in having the patient urinate in two glass vessels, the first ounce or two in one, and a similar or greater quantity in the other, *a portion of urine still being retained in the bladder*. The prostate is now thoroughly expressed by massage with the finger in the rectum or by the instrument devised by Feleki, and the patient requested to pass the last portion of urine. In cases of chronic prostatitis this last portion was found to be cloudy; microscopic examination showed pus-corpuscles, threads, and gonococci. The writers referred to believe that the presence of gonococci in the prostatic glands is always a source of danger, and that no patient who has suffered from chronic posterior urethritis can be pronounced cured without an examination of the prostatic secretion. The only treatment of any avail in chronic gonorrhoeal infection of the prostate is systematic massage.

In this examination care must be observed not to express the contents of the seminal vesicles as well as of the prostate, otherwise disease of the former may be mistaken for prostatic trouble.

Treatment.—The first indication in the treatment of chronic prostatitis is to remove, if possible, the cause. Therefore if stricture, phimosis, or a contracted meatus exists, such condition should first receive attention. Erotic excitement should be strenuously avoided, as should everything else that tends to induce a congestion of the affected part. For this reason constipation is to be carefully guarded against. Many of the cases could doubtless be cured by hygiene alone if all disturbing factors could be removed. Ungratified sexual excitement and sexual excess are harmful, but moderate, unemotional intercourse need not be interdicted.

The prolonged use of counter-irritation to the perineum is of undoubted value. This may be obtained by the application of equal parts of tincture of iodine and tincture of belladonna once daily until the skin becomes sensitive, or cantharidal collodion may be applied and the resulting vesicated surface dressed with some antiseptic ointment; the blistering to be repeated after the skin has healed. A continuous effect may be obtained by applying the blistering fluid on one side of the raphé at a time, the application being made to the opposite side in three or four days, and so on alternately. The daily use of a jet of cold water from a bidet is of unquestioned value in many cases. Both the low temperature of the water and the force of the stream are efficient agents in exciting a reflex contraction of the blood-vessels, with consequent relief to the engorged organ. In other cases hot hip-baths for a few moments at a time are serviceable. They effect a dilatation and engorgement of the superficial vessels, which depletes deep-seated congestion.

In most instances the application of a solution of silver nitrate to the prostatic urethra will be followed by benefit. The application should be made by means of a syringe of hard rubber especially designed for the purpose. In the beginning not more than a few drops of a 1 per cent. solution should be deposited. By making the early applications unduly strong a high degree of inflammation will be induced, and considerable annoyance, or even

¹ *Journal of the American Medical Association*, July 21, 1894.

suffering, unnecessarily inflicted upon the patient. The solution should be accurately placed in the prostatic urethra. This may be accomplished by introducing a catheter and marking the point at which urine first begins to flow. Knowing the length of the urethra, there will be no difficulty in determining the distance that the syringe should be introduced in making the applications of silver. The treatments should be repeated in from three days to a week or more, depending upon the strength of the solution used and upon the amount of reaction that follows, allowing the longer interval to elapse between the stronger applications. The strength of the solution is to be increased gradually to 2, 3, 4, and 5 per cent. as the toleration of the urethra becomes established. Some authors recommend much stronger applications, as, for example, a 10 per cent. solution of silver or even the mitigated or pure stick of silver. The latter is unjustifiable; it does more harm than good. The stronger solutions of silver nitrate may be demanded in rare cases, but they should always be used in very small quantity, with the greatest care, and only after having tried the weaker solutions first. They should be given while the bladder is full, so that any excessive action of the silver may be neutralized by prompt urination. If marked inflammatory action should follow any of these applications, it must be controlled by rest and appropriate remedies. (See Acute Prostatitis.)

As many of the patients will be found to be more or less depressed physically, the general condition of the health should be looked after. This will include the question of diet, the condition of the digestive organs, the amount and kind of exercise, bathing, etc. As regards diet, anything which would have an irritating effect upon the urinary organs should be avoided. Such articles are cayenne pepper, mustard, sauces, vinegar, and pickles generally. Tomatoes and other highly acid vegetables and fruit are also objectionable in many cases. Any derangement of digestion should be overcome by increased care in diet and suitable medication. Moderate exercise is beneficial, but excessive exertion is to be avoided. The patient should bathe frequently, and attend to the various details of personal hygiene with the view of improving the general health and vigor. It will be necessary in many instances to reassure the patient in order to prevent him from becoming morbid in regard to his condition.

Dr. Hugo Feleki¹ considers that, theoretically, massage is the ideal rational therapy for chronic affections of the prostate and seminal vesicles. It clears out the ducts thoroughly, helps to decrease congestion, leads to the absorption of chronic inflammatory material, and finally gives tone to the muscular structures and enables nature to accomplish once more what, for the time being, massage does artificially.

Massage with the finger, as usually practised, is unpleasant to both the surgeon and patient, and besides, it is impossible always to reach the parts with the finger, as they are situated farther from the anus than is usually stated. The average distance of the upper part of the prostate from the anus is given as 7 to 7½ cm. In a series of measurements in 32 bodies at from twenty-one to sixty-four years of age, where the prostate seemed normal, the average distance of the lower edge of the prostate from the anus was 6.3 cm., and the upper margin 9.2 cm., the seminal vesicles being on an average about 13 cm. from the anus.

Feleki has devised an instrument (see p. 296) with which the patient can thoroughly massage the parts himself. The procedure lasts, according to the

¹ *Centralblatt für die Krankheiten der Harn- und Sexual-organe*, Band 6, Heft 10, Dec. 14, 1895.

sensitiveness of the patient, from three to ten minutes, and may be practised two to three times a week. Very rarely does the patient complain of much pain. The author has obtained much better results with this method than with digital massage.

Imperative urination usually ceases after four or five séances, and in most cases the feeling of fullness in the rectum and the uncomfortable or even painful sensations in the prostate disappear.

In a colleague, premature ejaculation that had existed for years, and for which everything had been tried, ceased after six treatments, and has not recurred. A number of similar cases have been successfully treated. Frequent emissions and spermatorrhea due to chronic prostatic trouble nearly always disappear after massage for some weeks. In all of these cases the author says that the usual remedies must not be neglected. The passage of sounds, as an internal massage, he especially commends, and the use of Winternitz's psychrophor he has found useful.

Swinburne¹ has devised a modification of Feleki's instrument (see p. 296) for applying massage to the prostate, and finds it very useful in many cases, although he employs the finger by preference in most instances.

Massage is also highly recommended by Güterbock and Ebermann. The latter² directs that the patient be placed on the back or in the knee-elbow position. The operator introduces a finger into the rectum and rubs the gland from left to right, and *vice versa*, pressing toward the symphysis. The séance may last five to ten minutes or even longer, and may be repeated every day or second day. Pathological products are thus driven into the veins and lymph-currents.

Abscess of the Prostate.—Acute inflammation of the prostate may be followed by chronic prostatitis, as has been mentioned, or it may result in the formation of an abscess. The latter will be more apt to occur in neglected cases and in those in which the health is below par. Suppuration may take place early in the course of the disease or as a late result. There may be a single abscess or several, which later coalesce, forming one large cavity.

Symptoms.—The occurrence of suppuration in the course of an acute prostatitis may be suspected when the symptoms have not ameliorated at the end of about a week, if the temperature does not subside, if there is a throbbing sensation at the seat of the trouble, and especially if rigors occur. The diagnosis will be confirmed if it is possible to detect fluctuation by rectal examination.

These abscesses open spontaneously into the urethra in the majority of cases. Occasionally the collection is evacuated during the act of passing a catheter to relieve retention. In other cases the pus is discharged into the rectum. The latter is rather an unfavorable termination, inasmuch as a urethro-rectal fistula may remain. Evacuation by the urethra is usually followed by rapid shrinking of the abscess-cavity and cure; this is considered a favorable termination. In rare instances the obliteration of the sac may fail to take place. In such cases a focus of chronic suppuration remains.

Treatment.—As soon as the presence of a prostatic abscess can be detected it should be evacuated through the perineum. The proper method consists in introducing the left fore finger into the rectum and locating carefully the fluctuating point; then without removing the finger a long, straight, and narrow bistoury, the cutting edge of which is upward, should be thrust into the raphé about $\frac{3}{4}$ of an inch anterior to the anus until the abscess is

¹ *American Medico-surg. Bulletin*, Mar. 28, 1896.

² *Intern. Centrabl. f. d. Physiol. u. Pathol. d. Harn. u. Sex-org.*, Leipzig, 1891-92, iii.

reached, the point of the knife being guided by the finger in the rectum. The incision should be enlarged upward sufficiently to give free exit to the pus. The depth of the incision will probably be $1\frac{1}{2}$ to 2 inches. It is obvious, of course, that the surgeon should be satisfied as to the presence of pus before proceeding to carry out this operation. The urethra should be avoided in making the incision.

In completing the operation the cavity should be thoroughly explored with the finger, all partitions broken up, and the wound well irrigated with an antiseptic solution. Occasionally, profuse hemorrhage may be encountered, but this can be controlled by packing iodoform gauze directly into the bottom of the wound. Incision through the wall of the rectum should be performed only in those cases in which the abscess appears in this situation just beneath the mucous membrane.

Prostatic Gout.—As Reginald Harrison has pointed out, there are certain affections of the region about the neck of the bladder that we cannot do better at present than designate “prostatic irritation,” and of these the most common is found in gouty patients, where the irritation is so intense as to amount almost to an inflammation. Many cases that are described as neuralgia of the prostate are simply illustrations of this affection.

Symptoms.—Like gout affecting the great toe, the paroxysm comes on usually at night. It is referred to the neck of the bladder. Urination is irresistible, although painful, and spasmodic, sympathetic pain often attacks one or both testicles. The patient is sensitive to rectal examination. The urine is highly acid, deposits urates, and contains an excess of mucus. During the day the symptoms are generally in abeyance, but they recur at night with unabated force.

After such a paroxysm the prostate is unusually sensitive for a considerable time. As a consequence the patient dreads to exercise pressure upon the gland by completely emptying his bladder. Retention of urine under these circumstances is not only a fruitful cause of cystitis, but also predisposes to vesical calculus.

The **diagnosis** of prostatic gout can be made easily by the exclusion of inflammatory lesions and by the history of gout. It usually merges into a chronic form of irritation unless actively treated.

In the **treatment** of this form of “irritable prostate,” both in the acute and in the chronic variety, reliance must be placed chiefly upon the correction of the state of the urine and the use of remedies which usually relieve the manifestations of gout. Patients who habitually suffer from this trouble are often greatly benefited by periodical visits to saline springs.

Prostatorrhœa.—The discharge of a colorless or milky, viscid, mucoid fluid from the meatus, appearing sometimes after the spasmodic contractions at the end of urination or during the act of defecation, constitutes the condition known as prostatorrhœa. Authorities differ as to whether this should be considered as a disease *per se* or as a symptom of chronic inflammation of the prostate. In some cases the discharge of the characteristic fluid is the only symptom present, but there is reason to believe that the condition depends at least upon a chronic congestion, if not inflammation, of the gland. This subject has therefore been considered under the heading of Chronic Prostatitis, to which the reader is referred.

Hypertrophy of the Prostate.—The term “hypertrophy” seems rather more appropriate than “enlargement” as applied to the condition under consideration, inasmuch as it expresses the pathological condition present. It is contended by some, among whom are Socin, and it may be

admitted, that in certain cases the condition is more like a tumor-formation; but the new tissue is the same as that normally found in the prostate. Accepting this distinction, a circumscribed overgrowth would be termed a "hyperplasia," and a uniform increase in size an "hypertrophy." The latter term may be used, however, to include both conditions.

In a certain proportion of men the prostate shows an inclination to increase in size after the fiftieth year of life. It doubtless begins earlier in some instances, but more frequently at a later period. Belfield¹ refers to the following instances of enlargement of the prostate occurring before the fifty-sixth year, the earliest period at which Thompson had observed the affection: "McGill removed a prostatic collar 'the size of a large walnut' from a man aged fifty-three; M. Schmidt a large middle lobe from a man aged fifty-two; Belfield a prostatic growth from a patient aged forty-nine; Iverson described a case at thirty-six, which Güterbock says is no rarity; H. G. Mudd exhibited an extreme example of prostatic hypertrophy from a negro aged twenty-seven (the prostate and its outgrowths literally filled the true pelvis; on microscopical examination the growth was found to be a true fibro-myoma with no suspicion of malignancy); and Dr. Mudd referred to a case of true prostatic hypertrophy in a child five years old."

Varieties.—The following forms of enlargement can be recognized: (a) a uniform increase of the glandular and stromal elements, constituting a true hypertrophy. In these cases the gland is uniformly enlarged, but does not reach a great size, and seldom causes symptoms of importance. (b) Overgrowth of the stroma, the fibrous connective tissue being chiefly involved, without much change in the muscular elements. This form may attain a large size, and is that most commonly met with. (c) In a third class the overgrowth of glandular tissue predominates over the stromal. This form of enlargement is rarely permanent. Usually the glandular hyperplasia disappears sooner or later, and is replaced by fibrous tissue of greater density. (d) A localized overgrowth. This form is commonly met with. These small tumors are found in almost every case of hypertrophy of the prostate, and seem to be confined to no one particular portion. According to some authorities, they are merely areas of marked local hypertrophy, enlarging more rapidly than the surrounding tissue. The enlargement is always confined within the capsule of the gland, although certain portions, enlarging more rapidly than others (*e. g.* the small tumors just mentioned), may extend a considerable distance from the gland, pushing the capsule ahead of them, and remain connected with the prostate only by a thin band of glandular and fibrous tissue.

Changes in the Prostate noted in Hypertrophy.—The earliest change observed is that the prostate as determined by digital exploration through the rectum is thicker and more rounded than is natural. The margins of the organ are more easily defined; usually the gland is firmer in consistence, and seems to be composed of one mass rather than of the two-lobed formation which is normally felt. According to Thompson, a prostate weighing 7 drams must be considered enlarged. He has examined those weighing less than 6 drams that afforded unmistakable evidence of the existence of hypertrophy. In this stage the only increase of dimension may be in the thickness, the length and the transverse diameter not being much altered.

Every degree of enlargement is to be noted, from that just mentioned to the size of a closed fist, an orange, or a cocoanut. The hypertrophy may be general, affecting the whole organ symmetrically, or there may be a general enlargement, in which, however, one portion participates in the

¹ *Am. Jour. Med. Sci.*, n. s., vol. c, 1890.

change to a greater extent than others, and an irregular tumor results. Occasionally one lateral lobe is chiefly affected, but it is common for the other to be involved to some extent. Adami¹ believes that the reason for circumscribed enlargement of the prostate lies in the fact that the gland arises as a series of acini, each of which is surrounded by a coat of plain muscular tissue, while at a later date groups of these acini become surrounded

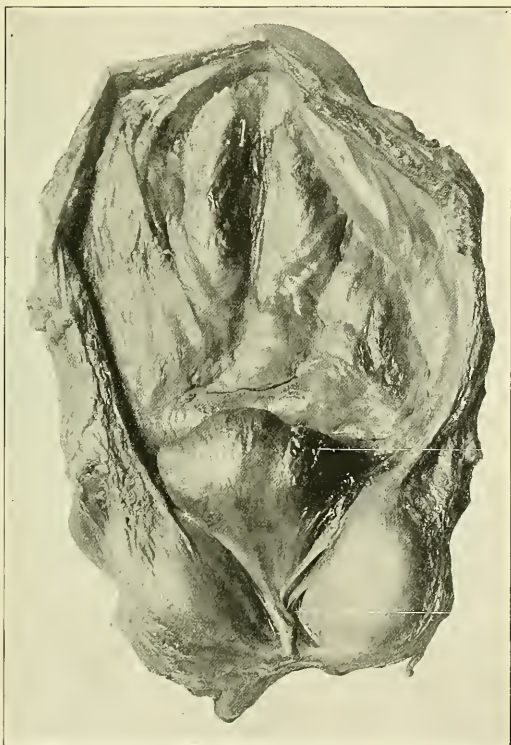


FIG. 73.—General enlargement of the prostate. The divided surfaces of the supra-urethral portion and the large median lobe show well. Catheterization was possible in this case only with a metal prostatic catheter, the point of which invariably turned to the patient's left on entering the bladder; profuse bleeding always followed the introduction of the instrument. *A*, point in middle lobe against which the catheter impinged and from which the hemorrhage came; *B*, verumontanum.

by a common sheath of muscular or fibro-muscular tissue. These acini being at least partly independent, certain ones may take on enlargement. Adami could not determine whether the ducts of the acini became occluded or not. Sometimes the enlarged gland will present independent tumors arising from some portion of the surface. In other instances the median portion becomes

¹ *Montreal M. J.*, 1892-93, xxi. 647.

enlarged greatly out of proportion to the change in the other parts of the organ. It has been asserted that an increase of one-half centimeter (three-sixteenths of an inch) in the length of the prostatic urethra is indicative of hypertrophy.

Regarding the frequency with which the different portions of the prostate

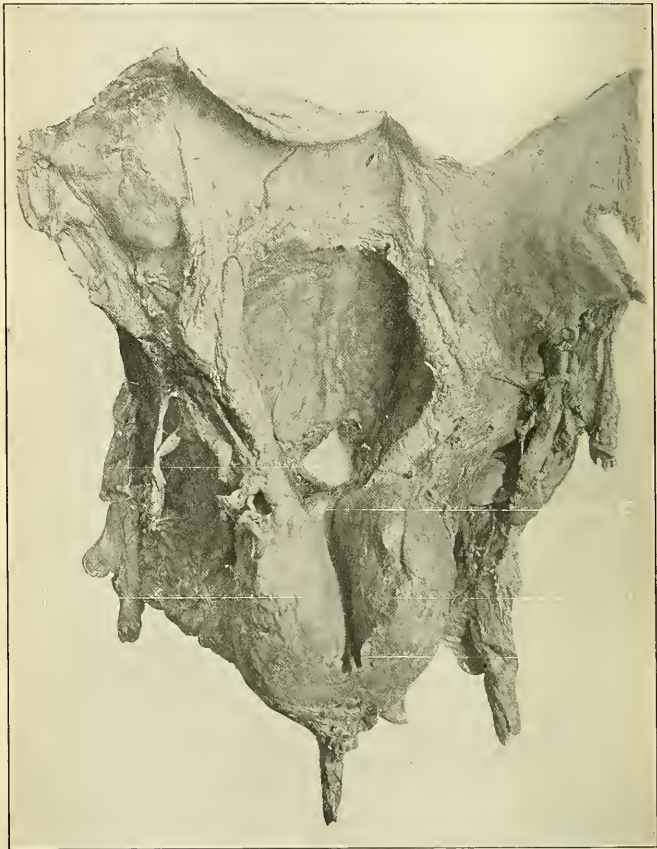


FIG. 74.—Moderate enlargement of the lateral lobes of the prostate. This case was complicated with a vesical calculus. *A*, perforation through the *bas fond* of the bladder, due to pressure-necrosis from the stone, which remained fixed in one position; *B* and *D*, the cut surfaces of the supra-urethral portion of the prostate; *C*, floor of urethra; *E*, very slight enlargement of the median lobe.

are involved we have now considerable evidence. Thompson examined carefully 123 specimens with the following result: Of the common forms of the affection he found—(1) general enlargement of the prostate—that is, both lateral lobes and the median lobe were pretty equally enlarged in 74 cases

(about 60 per cent.); (2) general enlargement of the prostate, in which the median portion was hypertrophied to a greater extent than the remainder in 19 cases (about 15 per cent.); (3) general enlargement, but with the right lobe very decidedly larger than the left in 8 cases (about 6 per cent.); (4) general enlargement in which the left lobe predominated distinctly over the right in size, 11 cases (about 9 per cent.). Among the uncommon forms of enlargement he found (5) the lateral lobes only affected in 5 preparations (about 4 per cent.); (6) the anterior commissure only or chiefly enlarged in 3

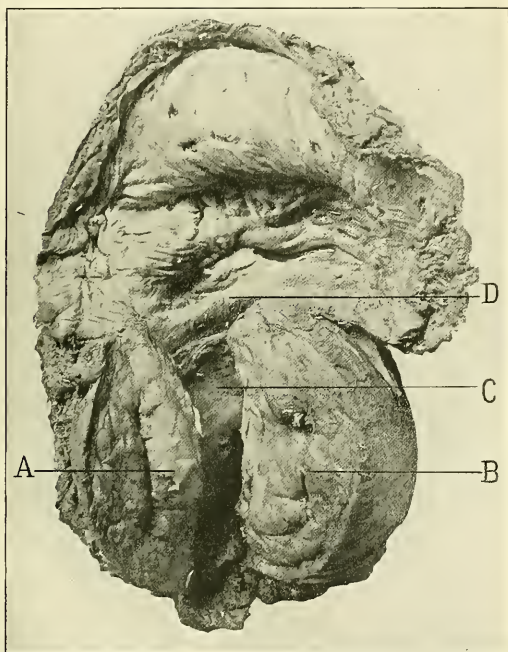


FIG. 75.—Enlargement of the lateral lobes of the prostate, most pronounced on the left side: *A* and *B*, incision through prostate from urethra; *C*, floor of prostatic urethra, very much broader than normal; *D*, very slight enlargement of median lobe. The size of the prostate will be appreciated by comparing it with the bladder, which is here shown entire.

preparations (about 2 per cent.); (7) the lateral lobes and anterior commissure enlarged, but not the median portion, in 33 instances (about 2 per cent.). These results correspond approximately with those arrived at by Messer, Vignard,¹ Watson,² and others; an analysis of the cases quoted shows that—(a) The lateral lobes and the median portion are equally liable, or nearly so, to be affected with hypertrophy; (b) that the posterior commissure is generally involved with the preceding enlargements, and in proportion to the

¹ *De la Prostatomie et de la Prostatectomie*, Paris, 1890.

² *Operative Treatment of the Hypertrophied Prostate*.

extent which they manifest ; (c) that the anterior commissure is not frequently affected, but nevertheless is so in rare instances ; (d) lastly, the enlargement takes place at about an equal rate in each of the three principal divisions, in some cases the lateral lobes appearing to enlarge more rapidly than the median portion ; in others the contrary is found, and perhaps in a rather larger number of cases than in the preceding.

According to the studies already referred to, about 300 grains may be considered the weight of the normal prostate. When the gland has increased to 400 grains, or about 7 drams, it is considered pathological. In 20 examples of hypertrophy of the prostate dissected by Thompson the weight ranged from 6 drams and 20 grains to 18 drams, the average being about 9 drams and 15 grains. Dr. Messer's dissections included 35 specimens, which ranged in weight from 6 drams and 15 grains to 48 drams, the average being 15 drams. The largest recorded example weighed about 75 drams and in size approached that of an ordinary cocoanut.

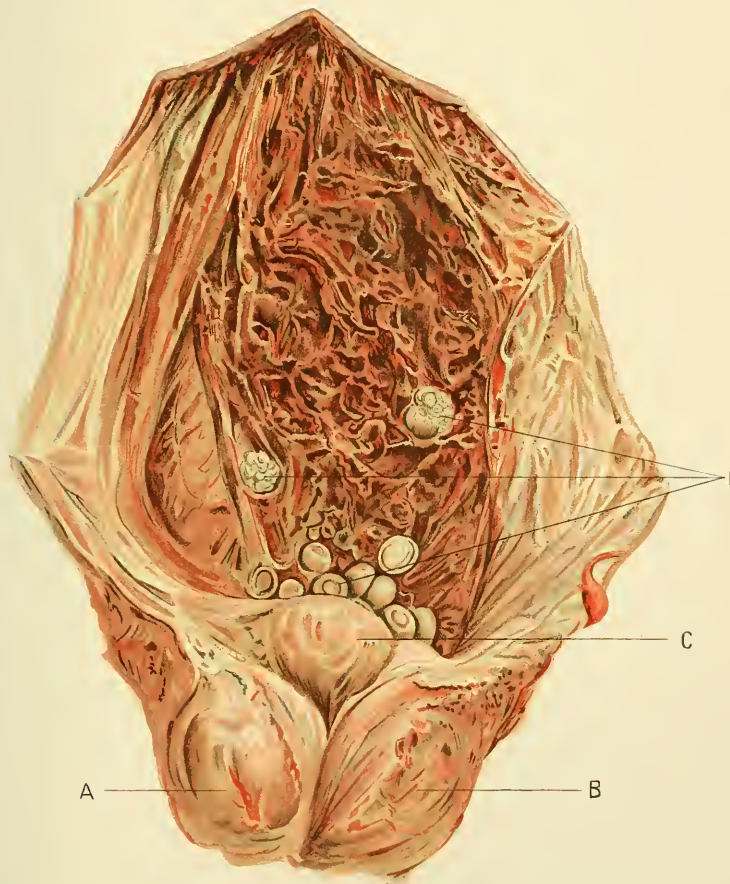
Changes in the Urethra and Neck of the Bladder.—The internal sphincter may be considered an integral part of the prostate, hence any alteration in the structure of the latter would be followed by interference with the function of the former. In addition, as the prostate is limited in front and below by dense fascia, it tends to grow upward and backward as it hypertrophies, elongating and narrowing or deflecting the urethra according to whether the enlargement be symmetrical or irregular, and always raising the vesical outlet to a higher level than normal. As the base of the bladder remains stationary, while the neck rises in proportion to the degree of prostatic enlargement, a pouch is formed behind the prostate, which makes complete evacuation of the bladder difficult or impossible. The urine thus remaining after each act of micturition is called "residual" urine. The amount gradually increases as the obstruction becomes more marked and the power of the muscular coat of the bladder diminishes. The increased frequency of urination and the greater force necessary to overcome the obstruction lead to dilatation of the bladder with overstretching of the muscle, and atony results. In some cases the bladder-wall becomes much thinned from the extreme distention ; in other cases the muscular trabeculæ become enormously hypertrophied, the inner layers of which form pronounced ridges beneath the mucous membrane. These by their powerful contraction exert considerable pressure upon the vesical contents, which leads to dilatation and sacculation in such parts of the bladder as are not supported by these strong muscular bands. The hypertrophy and sacculation are further increased by the vesical irritability incident to venous congestion at the neck of the bladder.

Hypertrophy of the prostate strongly predisposes to the formation of vesical calculi, especially if residual urine also be present. Plate 3 illustrates a bladder containing numerous calculi. The specimen also shows well the hypertrophied trabeculæ and the sacculation that are so frequently met with. The mucous membrane was very deeply injected. Death in this case was due to ascending pyonephritis.

The size of the bladder varies greatly. In the cases in which the obstruction has not been marked and the bladder has been frequently emptied it may be so contracted as not to hold more than two to four ounces ; in other instances, in which there has been marked obstruction and chronic retention, the capacity may be as much as four pints.

An early effect of prostatic hypertrophy is congestion, and later inflammation of that portion of the mucous membrane of the bladder in contact with the tumor. The inflammation spreads in time, being aggravated by the

PLATE 3.



General enlargement of the prostate; sacculation of the bladder-wall; numerous calculi. The bladder has been opened in front, and the prostate divided from the roof of the urethra directly upward. *A* and *B* represent the cut surfaces of the prostate, widely separated, showing the tension that existed; between these is the floor of the urethra; *C*, enlarged median lobe; *D*, numerous vesical calculi; behind the middle lobe a nest of these is seen.

sluggish venous return. In this condition the mucous membrane offers but slight resistance to microbial invasion. The presence of pathogenic microbes in the bladder frequently depends upon the introduction of instruments that have not been surgically clean, or the germs may have been carried in by failing to cleanse the anterior urethra before the instrument was introduced. Cystitis develops, however, independently of these causes. The infection may be conveyed by way of the urethral mucous membrane apart from instrumentation, or may gain access, as claimed by some authors, through

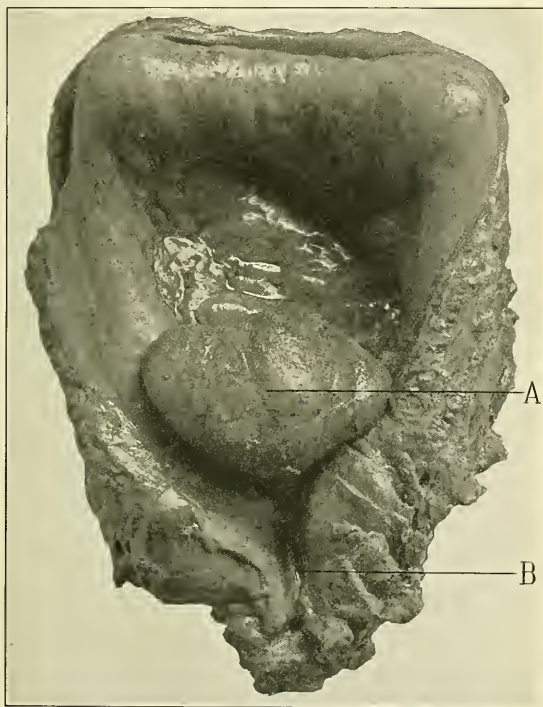


FIG. 76.—A, very large median lobe; B, floor of urethra (verumontanum). No enlargement of the lateral masses. (Original.)

the kidneys, or, as shown by others, directly through the walls of the rectum and bladder. According to the researches of Clado and Albarran, septic cystitis almost invariably depends upon the bacterium pyogenes. This is said to be identical with the bacillus coli communis. As a result of the irritating properties of the germs themselves or their ptomaines an intense inflammation of the vesical mucous membrane is caused. The urea is decomposed and ammonia is set free, which acts as a further irritant.

The important change produced in the bladder from the standpoint of the

surgeon is the loss of power to evacuate its contents even when the mechanical obstruction is relieved. This may be due to over-distention, sacculation, or more commonly to crippling of the detrusor muscles as a result of the chronic obstruction.

In the early stages of hypertrophy of the prostate there are an increase in the antero-posterior diameter of the prostatic urethra and a diminution in the lateral or transverse diameter, whereas in the healthy state both dimensions would be equal. The narrowing of the canal is due to the encroachment of the lateral lobes. The length of the prostatic urethra is always increased. Its normal length is about one and a quarter inches. Thompson records having observed cases in which the prostatic urethra has measured three inches, and White observed a case in which this measurement was three and a half inches. In addition to the increase in length, the prostatic urethra becomes more curved than in its normal condition; in some instances a distinct angle is formed. If the enlargement affects one lateral lobe more than the other, the urethra will be deviated to the opposite side. Whether the hypertrophy affects either one or both lateral lobes, the median lobe is generally found enlarged also, but not invariably, as is well shown in Fig. 75. In Fig. 76, the vesical end of the urethra being divided by the large median outgrowth, a passage is left on either side of it, giving to the canal the form of the letter Y. The vesico-urethral orifice becomes distorted, depending upon the degree and nature of the enlargement.

In rare cases the result of enlargement of the prostate is the reverse of obstruction. There is then a genuine incontinence in contradistinction to the incontinence of retention that is commonly observed.

Morbid Anatomy.—When a section is made through a prostate the sub-

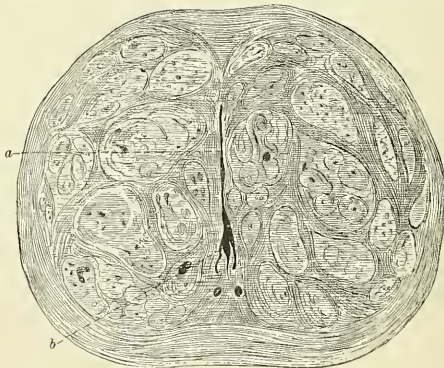


FIG. 77.—Section of hypertrophied prostate of a man aged 74 years; natural size (Socin): a, urethra; b, colliculus seminalis.

ject of marked hypertrophy, the cut surface protrudes more than the normal gland, and is moreover irregular, showing the tendency that exists for certain centers to develop more than others, as has already been mentioned. The cut surface displays an irregular coloring due to trabeculae of a grayish-white or grayish-red color, which surround yellowish-white foci, varying in size from that of a millet seed to that of a pea. This irregular coloring is much

more pronounced than in the case of the normal organ. Microscopic examination does not reveal any new elements. The enlargement consists entirely of an increase in the structures normally present.

The Occurrence of Tumors in Connection with Prostatic Hypertrophy.—Although benign tumors are found in what appears to be otherwise a normal prostate in rare instances, their presence is much more common in connection with hypertrophy of the organ. Thus in three-fourths of the hypertrophied specimens examined by Thompson tumors were present. Messer reports having observed isolated tumors in 27 of a series of 35 hypertrophied prostates which he examined. These tumors are of two varieties—namely, those which are imbedded in the substance of the prostate, but which are isolated from the surrounding structures; and those which, although continuous with the part of the gland from which they spring, manifest a tendency to become isolated and pedunculated.

When the tumors appear in the substance of the prostate they are apt to be encapsulated. Their consistence is rather firmer than that of the normal prostatic tissue.

Any part of the prostate may become the seat of a well-defined, more or less pedunculated growth. The median portion is, however, the most frequently affected. The shape of the growth is apt to be pyriform. These growths vary in size from that of a pea to that of a pear. The anatomical location of these tumors tends to interfere greatly with the function of micturition. Enlargement of the median portion occurs usually in connection with more or less general hypertrophy of the organ.

The analogy between these tumors and uterine fibroids was first pointed out by Velpeau. This view was later elaborated by Sir James Paget and others.

Etiology.—Many theories have been advanced in explanation of the occurrence of enlargement of the prostate gland. It is known, of course, to belong to the period beyond middle life, but why only a certain portion of individuals should be affected has not been satisfactorily explained.

Sir Everard Home,¹ who devoted a good deal of study to this subject, believed that the chief predisposing cause was “the slow return of the blood from the neck of the bladder, arising from the disadvantageous situation of the veins respecting the heart.” It is known that the veins of the prostatic plexus become dilated, and that the valves shrink or disappear or the coats of the vessels undergo calcareous degeneration. The result of all this would be an habitual congestion of the part. Sir Astley Cooper considered the enlarged prostate the consequence of age, and not of disease. Velpeau was of the opinion that hypertrophy of the prostate depended on the presence of tumors. Sir Benjamin Brodie regarded hypertrophy of the prostate as a part of a general senile change. He says: “When the hair becomes gray and scanty, when the specks of earthy matter begin to be deposited in the tunics of the arteries, and when a white zone is formed at the margin of the cornea, at this same period the prostate gland usually—I might, perhaps, say invariably—becomes increased in size.”² Mercier regards as predisposing causes “all those which favor stagnation of the blood.” He believes “there is a certain relation between a weakness of the inferior veins and hypertrophy of the prostate.” Inflammatory action, as pointed out by Thompson, would be antagonistic to, rather than favorable to, hypertrophy, because nutrition would be impeded as a result, not encouraged.

¹ *Practical Observations on the Treatment of the Prostate Gland*, vol. ii., Lond., 1818.

² *Lectures on the Urinary Organs*, 4th ed.

Among the more recent views that have been offered may be mentioned (a) that of Guyon, which regards hypertrophy of the prostate as a part of a general condition peculiar to advanced years, characterized by widespread degenerative changes and by the over-production of fibrous tissue; in other words, a disseminated arterial sclerosis or general atheroma, not limited to the vessels of the genito-urinary system, but when occurring in them producing both the prostatic hypertrophy and the rigid or feeble bladder, with their resulting symptoms.

(b) Harrison believes that the primary change takes place in the bladder itself, and the depression of the posterior wall, which is said to occur as the bladder sinks into the pelvis with advancing years, precedes prostatic obstruction, and is compensated for by the development of a muscular buttress between the orifices of the ureters, tending toward the obliteration of what would otherwise prove to be an inconvenient pouch.

(c) The theory suggested by Velpeau, and which seems to us to more nearly correspond with the facts than any of the others mentioned, considers the growth or growths which make up the enlargement in prostatic hypertrophy as analogous to the fibro-myomata so frequently found in the uterus.

In support of the first of these it is claimed that general atheroma and hypertrophy of the prostate occur at the same period of life and are commonly found in the same individual. As has been already pointed out,¹ atheroma is to be found associated with other diseases which appear by preference after middle life, as, for example, carcinoma; but no one would think of constructing from this a theory of causation. This theory is further negated by the fact that the common result of arterial sclerosis is atrophy; that recent investigations show that the beginning of prostatic enlargement occurs earlier in life than was formerly supposed (Griffiths and others); and that the original growth is glandular, which would not likely result from atheromatous disease. Additional evidence in opposition to this view is added by the observations of Bier, who has performed ligation of the internal iliac arteries in 5 instances, and Meyer, who has operated in 3 cases for hypertrophy of the prostate. In none of these cases was arterio-sclerosis observed. The vessel-walls in every instance were soft and normal.

The work of Casper is very significant in this connection. Casper² examined microscopically the prostate glands of 28 old men. He found hypertrophy present in 24 instances, and arterio-sclerosis without hypertrophy in the remaining 4 cases. In the 24 cases in which hypertrophy was found evidence of arterio-sclerosis was observed in the aorta in all, in the kidneys 8 times, in the vesical arteries 8 times, in the vesical arterioles 9 times, and in the prostatic and periprostatic vessels 4 times.

The bladder and prostate were affected in 2 cases, the kidneys and prostate in 3 cases, and the kidneys and bladder in 3 cases. The nearest approach to a general arterio-sclerosis of the urinary tract was observed in 2 cases, in which the kidneys, the bladder, and the prostate were affected. These results clearly disprove the theory of Guyon and the French school.

The second view presupposes that the prostate is primarily a urinary organ. If this theory be correct, the hypertrophy of the prostate must be considered compensatory in nature, and due to the changes in the tonicity and in the position of the bladder itself, as well as to the more frequent demands made upon it in adult life to retain for a long time considerable quantities of urine. As soon as a little pouching of the trigone takes place residual urine

¹ White: *Annals of Surgery*, Aug., 1893.

² *Centralblatt für Chirurgie*, No. 13, 1894.

remains. The efforts to expel this cause the development of the interureteral bar, and later of general prostatic overgrowth.

It is now known beyond a question of doubt that the prostate is a sexual organ, and is not related to the urinary tract except by accidental position. This is shown conclusively by its embryology and by its comparative anatomy and physiology. While the prostatic urethra arises with the bladder from the allantois, the prostate is entirely distinct from the rest of the urinary passages, and remains so in some instances of hermaphroditism in man, and invariably in the monotremata the prostate itself originates as regards its glandular portion from the mucous surface of the urogenital sinus, and as regards its stroma from the genital cord surrounding the Wolffian ducts behind the allantois and quite distinct from the bladder.

The function of the gland is chiefly sexual, its secretion serving to surround and protect the spermatozoa, or, as Finger supposes, to vivify them, and the muscular portion to secure the discharge of this secretion into the urethra. The gland, like the testicles, remains small until puberty, when both undergo rapid evolution and soon attain full size. Furthermore, the prostate is well developed in many animals in which the horizontal posture precludes the idea that it is functionally merely a continuation of the circular fibers of the bladder. Hypertrophy has also been observed in dogs and other animals. The view held by Harrison is further contradicted by the facts to be presented in connection with the explanation of prostatic hypertrophy next to be considered—namely, that the growth or growths which make up the enlargement in prostatic hypertrophy are analogous to those fibromyomata so frequently found in the uterus. It must be admitted at the outset that it is possible to offer certain objections to this theory, and even if true it could scarcely be said to be a full explanation of their occurrence; but it is certainly the only theory that has thus far given any plausible working basis in regard to the etiology, and consequently the treatment, of this common affection.

The arguments in favor of this view, as formulated by Thompson, are as follows: The prostatic vesicle is the analogue of the sinus genitalis in the female—the uterine and vaginal cavities; the structure of the prostate and of the uterus is strikingly similar, and would be almost identical if the tubular glands found in the inner walls of the uterus were prolonged into its substance; the histology of the growths themselves is equally similar, differing chiefly in the predominance of the glandular element in prostatic tumors; the varieties of the growths, from small and encapsulated tumors easily shelled out or polypoid growths intimately connected with the uterus or prostate, up to the enormous tumors which far exceed the original bulk of the organ itself, are identical; or there may be in either case a general hypertrophic enlargement affecting the whole organ; lastly, these disturbances occur at about the same time in the sexual life of the two sexes—that is, during the latter half of the reproductive period. This ends sooner in the female than in the male, and accordingly we find the growths appearing in the former at a somewhat earlier age.

This series of striking analogies, long ago suggested by Velpeau, we have adopted as being more rational than any so far brought forward. No other view has been advanced which at all explains either the cause of these growths, their spontaneous disappearance (or failure to appear) at a certain time of life, or their cure by castration. Among other recent writers Kummel adopts this theory.

Impressed with the analogy above described, Dr. White laid before the

profession, in a paper read before the American Surgical Association at Buffalo, June, 1893, the theoretical and experimental reasons for believing that castration might have the same effect upon prostatic hypertrophy that oöphorectomy has upon uterine fibro-myomata.¹ The author's only experience at that time had been with dogs having normal prostates, but the results bore out this theory in the most striking manner. Following this paper, cases of castration were reported in which the results were so uniformly successful in relieving the patients that it was apparent that an addition of some definite value had been made to the treatment of the condition in question.

With this evidence an effort was next made to explain the etiology of these prostatic overgrowths and the effect which had been found to follow castration. The following views were embodied in a paper read before the American Surgical Association in June, 1895:² The testicles, whose highest and most specialized function is to produce spermatozoa for the propagation of the species, seem, like the thyroid, to exert a widespread influence over general nutrition and development. This is also true of the ovaries. "In man, as in the rest of the vertebrate animals, the male and female organs in the original state of the germ are entirely the same, and the differences of the two sexes only gradually arise in the course of embryonic development (in man in the ninth week of embryonic life) by one and the same gland developing in the female as the ovary and in the male as the testicle. Every change of the female ovary, therefore, has a no less important reaction upon the whole female organism than every change of the testicle has upon the male organs."³ The removal of either testicles or ovaries in early life usually changes profoundly all the characteristics, physical and mental, of the individual. There is, however, abundant evidence⁴ to show that the testicles may lose or may never have had the sperm-producing power, and still possess the quality which enables them to hold the organism in its normal groove and to invest it with the full attributes of masculinity.

When both testes fail in their descent they are incapable of producing spermatozoa, and in consequence the person is sterile. This has been shown by Hunter, Astley Cooper, Curling, Griffiths, and others, and is undoubtedly the rule, although there are occasional exceptions. In spite, however, of the imperfection of the organs, such a person acquires all the external bodily characteristics of the male, and is in all respects, except in the power of procreating, like an ordinary man.⁵ It is not known whether this influence is exerted through a chemical product or not, but the fact that some indubitable effects are produced on the whole system by the injection of watery extracts of the testicles would seem to favor this idea.

"The function of the testes is therefore clearly twofold—viz. (1) to control and determine the development of the characteristics of the male sex; and (2) to produce spermatozoa for the reproduction of the species. These two functions are usually exercised together, but that the former may be active when the latter fails seems to indicate that the production of spermatozoa is the more specialized property and attained with more difficulty. The manner in which this sexual effect of the testes is produced, whether through the nervous system as an ordinary reflex or through the medium of some substance produced by the seminal cells (whether they form spermatozoa or not) and absorbed into the system, which by influencing the nerve-centers

¹ *Annals of Surgery*, Aug., 1893.

² J. William White: *Annals of Surgery*, July, 1895.

³ Haeckel: *The History of Creation*, vol. i. p. 244.

⁵ Griffiths: *The Lancet*, Lond., March 30, 1895.

⁴ Curling, 4th ed., p. 14.

or in some other way controls growth and nutrition, is not known. . . . During the last few years a watery extract of the thyroid gland has been administered with signal success in myxedema, in which disease the thyroid gland atrophies and ultimately disappears. The disease myxedema arises from the want of the influence of some unknown substance, which the thyroid gland, as is supposed, elaborates upon the nutrition-centers of the central nervous system. It may be that the testis in like manner elaborates, irrespectively of its spermatic secretion, some chemical substance which by a similar influence not only controls the growth and development of the body at puberty, but maintains the manly characters then acquired throughout life." ¹

Whatever its mode of action, however, it is probable that the need for this occult property of the sexual glands would begin to disappear after their essential purposes have been subserved—*i. e.* after full adult life has been reached and the individual cast in the mould intended by Nature. This need abrogated, there would yet remain the function common to both sexes, that of producing cells endowed with the property of perpetuating the species. The testicle and the prostate would thus at this time have a closer physiological resemblance to the ovaries and uterus than at any other period of life. Both ovary and testicle would still possess the power of propagation, and with it a marked effect upon all the accessory sexual organs, while at the same time the necessity for a certain controlling influence would have been removed, and larger opportunity afforded for aberration in the growth and structure of the tissues involved. This may specially be the case, as with the cessation of the necessity for the exercise of this function (or for the evolution of the hypothetical product in question) the activity of the testicle does not cease. The organ (that it may be able to perform the other half of its work, the generation of spermatozoa) is still preserved from atrophy. Nothing in the little we know of the origin of the so-called benign growths in the body contradicts the theory that overgrowth of normal structures may be favored or hindered by changes in the nervous and vascular supply of the region. The disappearance of the necessity for a given product without the coincident disappearance of the vital energy which was expended in producing it might conceivably result in hypertrophy of organs intimately associated with those which were the source of supply. Griffiths says ² the whole genital system is an apparatus the potentiality of which mainly depends upon the integrity of the testicles, one or both; they control the extent to which the remainder of the sexual apparatus grows, the growth of the vas deferens no less than that of the prostate and other accessory sexual glands. Such a modification of the natural ovarian and testicular functions as has been suggested would, so far as the development of uterine and prostatic overgrowths was concerned, be equivalent to a failure of the *general restraining force* which Williams ³ believes regulates the growth and development of the tissues and organs in relation to each other and to the organism as a whole. The persistence of what might be called unexpended energy during the ovule- and sperm-producing life of the ovaries and testicles respectively, might thus offer a reasonable explanation of the overgrowths in question, while the final atrophy of these organs would similarly be accompanied in many cases by such a withdrawal of nervous and vascular supply as to prevent the occurrence of hypertrophies, or even to cause their disappearance if they had already formed.

Symptoms.—The symptoms of hypertrophy of the prostate are not

¹ Griffiths: *Loc. cit.*

² *Op. cit.*

³ *Diseases of the Breast*, p. 138.

referable to the gland itself, but to adjacent organs, the function of which is interfered with by the changed relations due to the enlargement. A certain—perhaps fairly large—number of patients with but moderate hypertrophy are never aware of any symptoms that would lead them to suspect the presence of this condition. There may have been some increased frequency of urination, noticed at night particularly, more or less difficulty in starting the stream, which lacked its usual force, absence of the normal parabolic curve, and incomplete stoppage, resulting in some dribbling at the end of the act. Most patients ascribe these symptoms to the natural weakness of advancing years, and it is only when symptoms arise that become distinctly annoying that the surgeon is consulted.

In the more pronounced cases the symptoms mentioned are more marked. The desire to urinate becomes more and more frequent. In some advanced cases the patient is obliged to attempt to empty the bladder every hour, half hour, or even oftener day and night. The difficulty in starting the stream gradually increases, so that a few minutes of fruitless efforts are sometimes passed before the act is finally accomplished. The stream is expelled slowly and with much more delay than normal. In severe cases the act is attended with pronounced burning sensations that not infrequently amount to agony. The diurnal frequency of urination varies from twice to many times the normal, depending upon the stage of the disease. The increased frequency of micturition in the early stages is probably due to a congestion, or even a mild chronic inflammation, of the mucous membrane of the prostatic urethra and neck of the bladder—a urethro-cystitis or prostato-cystitis. After the bladder has developed a post-prostatic pouch the capacity is reduced by the amount of residual urine present, so that the normal capacity for the individual bladder is reached correspondingly more quickly than if it had been completely emptied at each act of urination. The presence of residual urine is never suspected by the patient. The greater frequency of urination at night is a symptom which calls for explanation. It is contrary to what one would expect, as an irritated organ is usually much more quiescent during repose. It is in strong contrast with what is observed in cases of vesical calculus. This symptom has been denied by some writers, who believe that it is apparent only. During the day the attention of the individual is absorbed in his regular duties, and the conveniences are such that the successive acts of micturition are not noted. This is not true, however, at night, when the person is disturbed from sleep by the desire to pass urine. The consensus of opinion, however, is certainly in favor of a greater nocturnal frequency. The symptom is probably due to the fact that the vesical sphincter has become weakened by the prostatic overgrowth, and the urethral orifice, being not infrequently somewhat expanded, permits a few drops of urine to ooze into the sensitive prostatic urethra during sleep when voluntary control is lost, and these few drops of urine are sufficient to stimulate the desire to urinate. It is not due to any change in the quantity or quality of the urine, nor does it depend upon the position of the patient, as is shown by the fact that urination is not more frequent during the daytime when the patient remains recumbent. It may also be that during the first sleep of the night the patient passes a longer period without voiding the urine than through the day, which would distend the bladder more than usual and perhaps add to its already hypersensitive condition. Such, at any rate, would be a reasonable inference from the history of many of these patients. The first sleep after retiring may extend over some hours, but after being once awakened to empty the bladder the desire is repeated at short intervals until morning.

This does not of course apply to the aggravated and advanced cases, when there is but little rest for the patient day or night.

The amount of residual urine depends largely upon the form of the hypertrophy that is present. It appears sooner or later in all cases, but is found much earlier in those in which the middle lobe principally is enlarged. In these the vesical orifice of the urethra is elevated above the *bas fond*, which, remaining stationary, forms the so-called post-prostatic pouch which the bladder is not able to empty completely. The quantity of residual urine becomes greater and greater as the pouch increases in size, the bladder-walls become dilated, and the power of contraction feeble owing to the great strain made at each act of micturition to overcome the constantly increasing resistance offered by the steady encroachment of the prostatic overgrowth. As the obstruction increases and the strength of the bladder-wall diminishes, the quantity of urine voided at each act becomes smaller and the quantity of residual urine correspondingly greater, until finally, although the individual may be passing urine every hour or two, and, as he believes, emptying the bladder, he may really be carrying as much as from two to four pints. This condition may go on for months if the urine remains sterile. It not infrequently happens that these patients consult the surgeon on account of a supposed abdominal tumor which is found to be the distended bladder: as the patient has been passing urine regularly, he asserts on questioning, and really believes, that there is no trouble of any kind connected with the urinary organs. That which is being passed is, however, merely the overflow—the excess above the capacity of his bladder.

The case is quite different if infection of the urine takes place. The bladder then becomes acutely sensitive to small quantities of urine, which is expelled at frequent intervals, and the result is a contracted bladder. It is for this reason that in the retention due to urethral stricture this chronic form of distention is less frequently observed. In some cases there is acute retention, even going on to rupture of the bladder if unrelieved within a reasonable period, but this is different from the slowly-forming dilatation of the bladder from prostatic obstruction.

Complete retention may be one of the first symptoms to call the attention of the patient to his condition, but more usually this occurs late in the affection. In the former case, with a moderate degree of enlargement, but not sufficient to interfere distinctly with the function of the bladder, the individual is exposed to cold, over-distention from neglecting to urinate at the proper time, sexual excitement, or excess of some kind which tends to increase the amount of blood in the pelvic organs and to induce congestion and swelling of the neck of the bladder sufficiently to obstruct the flow of urine. In the later stages it is due to the obstruction of the urethral outlet by the prostatic overgrowth; it is, however, not complete as a rule, and is gradual in its onset. In the rare cases in which the enlargement of the middle lobe takes the form of a pedunculated growth the tumor may completely obstruct the vesical orifice.

Incontinence of urine is sometimes observed, and may be due to two widely distinct causes. In the first instance, on account of the peculiarity of the prostatic hypertrophy, the vesical sphincter may be so interfered with as no longer to offer any resistance to the escape of urine. In these cases the bladder remains empty or nearly so. This condition is of very rare occurrence, but the possibility should be borne in mind.

Much more frequently the incontinence met with in enlargement of the prostate is the result of over-distention of the bladder, and when the tension

becomes great enough to overcome the sphincter, the urine begins to escape, and flows as fast as it comes into the bladder from the kidneys. The amount of distention is, however, not relieved; it is only the excess over and above the vesical capacity that is discharged. This condition, which should be spoken of as "retention with overflow," in contradistinction to true "incontinence," invariably misleads the patient, and occasionally the physician, who, without the knowledge of the facts described, would consider the constant dribbling as evidence of an empty bladder.

Pain is an inconstant symptom. In the milder cases it is usually absent, or there may be indefinite pains in the groins, testicles, and thighs, or a sense of fulness may be felt in the rectum or perineum. In the later stages more or less distressing pain arises from the inflamed condition of the bladder. Either a distended bladder or cystitis will cause a constant distress behind the pubes, which becomes very trying to the endurance of the patient. There may be a soreness or smarting felt in the urethra, and shooting pains may extend to the glans similar to those felt in cases of vesical calculus. The severe straining efforts to pass water and the irritation of the rectum due to the presence of the enlarged gland cause tenesmus, prolapsus ani, or hemorrhoidal swellings more or less frequently. During the efforts to evacuate the bladder the contents of the bowel frequently escape from the inability of the patient to control the anal sphincter during micturition.

The periodical appearance of hematuria is common in the later stages of prostatic hypertrophy. If not too profuse, it relieves congestion, and thus to a certain extent lessens the distress of the patient. It is apt to occur after exposure or other influences which cause congestion of the pelvic organs. It may also result from efforts to catheterize the bladder, in which case it is sometimes exceedingly profuse. If the bladder becomes infected, as is apt to occur particularly in the cases that require frequent catheterization, the symptoms described have superadded to them those of severe cystitis. The patient is tormented with almost constant desire to urinate, which, however, does not relieve the distress, or at most for a brief period, the act itself being accompanied with great pain and tenesmus, or, if there is complete obstruction, the catheter will have to be passed at short intervals, and the introduction of the instrument is attended with acute suffering.

The constitution sooner or later shows the debilitating effect of pain and loss of rest. The patient loses weight, the strength fails, his appetite is impaired; he becomes cachectic and ages rapidly. There is apt to be some febrile movement; the tongue is coated and the pulse rapid. Slight exposure or other irregularities are apt to produce marked exaggeration of the symptoms, during which retention is threatened or actually occurs. The long-continued intravesical tension sooner or later results in dilatation of the ureters and backward pressure upon the kidneys, which become greatly embarrassed in their function. If the urine has been infected, the kidneys will become similarly involved, still further crippling their secreting power. As a consequence, many of these patients are in a condition of greater or less uremic intoxication, and succumb if the slightest additional strain is added. It is this fact that makes the surgeon hesitate to perform any operation upon these patients, the mildest operative attack, or even the mere administration of ether, is so apt entirely to disable the already greatly crippled kidneys.

So long as the urine remains uninfected there are no decided changes in its composition. The specific gravity is perhaps a little below the normal average, and is due to a corresponding increase in the amount. This probably results from the fibroid condition of the kidneys common to advanced years,

but intensified by the passive hyperemia brought about by reflex irritation from the neck of the bladder. Tube-casts are absent unless the kidneys were previously diseased or unless an infectious inflammation of the kidneys developed subsequent to cystitis. When the latter disease becomes established the urine is intensely foul from decomposition—is loaded with pus and mucus, and possibly with blood. The mucous membrane becomes intensely injected, and may be ulcerated in places.

The condition of the urine just described is favorable to the formation of vesical calculi, especially of the phosphatic variety, and, in fact, stone in the bladder is a not infrequent accompaniment of prostatic hypertrophy. The presence of stone may be suspected if there is frequently a sudden stoppage in the flow of urine, or if there is great pain at the neck of the bladder or in the glans penis at the end of urination, and if the blood and pus are pretty constantly present and are greater than the degree of the prostatic disease would seem to account for. In any case in which it was suspected it would be proper to relieve any doubt by the careful use of the vesical sound.

The irritation of the enlarged prostate in some cases is attended with more or less erethism, or perhaps even erections or priapism. In other cases a painful orchitis develops. If the prostate has been injured by the introduction of instruments, an abscess may form, and this may be followed by septicemia or pyemia.

If the prostatic enlargement is pronounced, the patient will complain of symptoms referable to the rectum. In addition to a feeling of fulness or a sensation as though a foreign body was present, there may be some obstruction to the discharge of feces, and such patients may be obliged to take laxatives habitually in order to keep the contents of the bowels in a soluble condition to facilitate the movement.

Dr. A. Guépin¹ of Paris calls attention to two sources of orchitis in these cases—first: the use of the catheter; second: the lessened resistance of the senile prostatic tissue with the infectious material so near at hand—in the distended bladder usually the seat of inflammation.

When true orchitis does not develop in such cases, there often exists an abnormal tenderness of the testicle. This increases whenever the general health runs down or when the venous congestion and prostatic irritation due to constipation are allowed to go on for any length of time. Sometimes the progress of the chronic infection along the cord can be noted in the progressive advance of the tenderness and swelling. These reach the epididymis and testicle, affecting both structures about equally in from two to four days. An effusion of serum into the tunica vaginalis may follow, and this may even become purulent. The whole process is characterized by the slow and progressive course of the swelling, by the usually moderate pain, and occasionally by localized suppuration.

Diagnosis.—There should be no difficulty in arriving at a diagnosis in the majority of cases. The symptoms already detailed are fairly characteristic, and when they are observed in a patient in or beyond the fiftieth year we should at least think of prostatic hypertrophy as the condition most likely to be present. The final conclusion will rest, however, upon the evidence obtained by the urethral and rectal examinations. The condition must be distinguished from other forms of obstruction and from atony and paralysis of the bladder.

Stricture of the urethra gives rise to symptoms somewhat similar to those

¹ *La Tribune médicale*, Feb. 26, 1896.

of prostatic enlargement, and will more frequently have to be differentiated from the latter than any other condition. There would be increased frequency of urination, attended with more or less difficulty, and there might be a small amount of residual urine or even overflow. A correct conclusion would result from a consideration of the following points: If stricture was present, there would be a history of a previous urethritis or rupture of the urethra from some violent force being received on the perineum. The frequency of urination would be diminished during repose, and increased effort would usually aid, and not retard, the stream, as it frequently does in prostatic hypertrophy. Finally, an examination of the urethra with bulbous bougies will remove any doubt. If an instrument of proper size for the given urethra meets with an obstruction within the first six inches from the meatus, the presence of stricture is certain.

A vesical calculus may give rise to conditions simulating those of enlarged prostate. The distinctive features of the presence of a calculus, as far as such may be stated, are—severe pain felt in the glans penis, especially at the end of micturition; the exacerbation of the symptoms, especially of pain and of bleeding after vigorous exercise, and the amelioration of the symptoms and the distinct diminution in the frequency of urination brought about by rest. Some of the symptoms might belong equally well to either condition, and the occasional association of the two in the same case must not be forgotten. The use of the sound will almost invariably remove any doubt.

The presence of vesical tumors or tuberculosis is more difficult to determine. The cystoscope will help us in many cases. In others the constant and profuse hematuria, the more marked pain, and the more rapid course would lead us to expect tumor or tuberculosis. In the case of villous tumors fragments may sometimes be detected in the urine. Although primary tuberculosis of the genito-urinary tract may occasionally occur, it is much more frequently found associated with tubercular disease of some other organ.

Atony of the bladder may follow a single or repeated voluntary prolonged retention. It occasionally happens that no opportunity is offered for voiding urine for a long period. The condition which results is not unlike that produced by retention from enlarged prostate, and requires the use of the catheter at least immediately and perhaps for some days. The history of the attack and the absence of symptoms will lead the surgeon to the correct interpretation of the case. It will be observed in atony of the bladder that the urine flows from the catheter without any force, and voluntary effort has little or no effect on the stream.

Paralysis of the bladder results from disease or injury of the spinal cord, and is constantly associated with a similar condition in the lower extremities or other parts. The term "paralysis" should not be applied to conditions causing obstruction at the neck of the bladder or to over-stretching of the vesical muscle (atony).

The existence of cystitis will depend upon the presence of some other condition, which must be sought for. It is caused by strictures, posterior urethritis, certain drugs, traumatism, vesical calculus, tumors, tuberculosis, etc.

The recognition of prostatic hypertrophy depends, as has already been stated, upon the careful instrumental examination of the urethra and digital examination through the rectum. The examination of the urethra should be conducted somewhat as follows: A full-sized metal catheter, properly sterilized and lubricated, is passed gently into the urethra, which may previously have been irrigated in order to avoid carrying into the bladder any

germs that may be present. If the catheter passes without obstruction, and particularly if urine begins to flow when the eye is from seven to seven and a half inches from the external meatus, we may be sure that marked enlargement does not exist. On the other hand, if the catheter does not withdraw urine until eight, nine, or even more inches have been passed, and if, in addition, it is necessary to depress the shaft of the instrument more than usual between the patient's thighs, the presence of prostatic hypertrophy may very properly be suspected. In some cases after passing the silver catheter to its full length it would still fail to draw urine. In such an

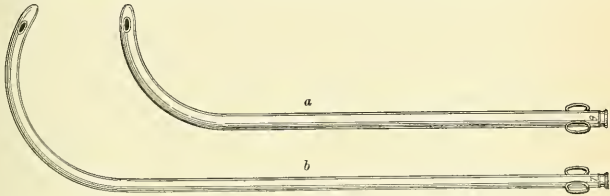


FIG. 78.—Metal catheters: a, usual form; b, prostatic catheter.

event it is proper to next try what is known as the "prostatic catheter," which has a longer and larger curve and a longer shaft. The larger curve is for the purpose of riding over the prominence of the floor of the prostatic urethra caused by the overgrowth, and the increased length of the shaft is to meet the lengthened urethra that occurs in hypertrophy of the prostate. If this instrument passes readily, we can ascertain the length of the urethra and the direction of its prostatic portion. In some cases as the beak traverses this part of the urethra the handle will be deflected to the right or left, which indicates either a greater degree of enlargement of one lateral

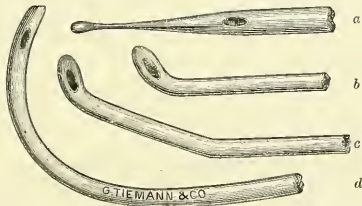


FIG. 79.—a, French olivary catheter; b, Mercier's elbowed catheter; c, Mercier's double-elbowed catheter; d, curved woven catheter.

lobe than of the other or marked hypertrophy of the median portion. If a soft-rubber catheter is used, we may measure the length of the urethra by carefully marking on the catheter the position of the external meatus at the moment urine begins to flow. The distance from this point to the middle of the eye of the catheter will indicate the length of the urethra. In cases in which there is considerable upward projection none of the instruments mentioned can be passed, and it will be necessary to employ the elbowed catheter of Mercier, the double-elbowed catheter, or one with a very large curve, according to the character of the obstruction in the individual case. It is desirable to use a fairly large-sized instrument whenever possible.

Considerable information is to be obtained by rectal examination. As in the preceding manipulations, the patient should lie upon his back. It is most convenient to employ the middle finger of the left hand for this examination. After having filled the spaces around and beneath the nail with soap, the finger is oiled and introduced into the rectum. By sweeping the finger from side to side over the gland and from before backward, it is possible to determine in the first instance whether the gland is enlarged, and if so the extent of the increase in size and whether it is partial or general. During the examination the right hand may be used to forcibly depress the hypogastrium. We may also determine the degree of tenderness present. If a solid instrument be allowed to remain in the urethra during this examination, the examining finger is enabled to determine more accurately the precise size and conditions of the prostate, especially its thickness from the urethra to the rectal wall. It will be remembered that the normal gland is but slightly larger than a horse chestnut. The enlargement, as felt by the rectum, may be moderate or very great, in some cases resembling in size an orange or even a coconut. We should also at this examination endeavor to determine (1) the predominant character of the growth, whether soft, indicating excess of glandular and muscular elements, or hard, showing advanced fibroid change; (2) the seat of the growth, which is of interest in relation to the change in the bladder. It may be said that when the enlargement affects the lateral lobes chiefly, the urethra is narrowed and compressed. In such a case the difficulty in urination depends on purely obstructive causes which are quite outside of the bladder. This organ undergoes in consequence the usual hypertrophy and thickening of its muscular walls, with diminution of the size of its cavity. There is little residual urine. If the growth is median, projecting backward into and beneath the neck of the bladder, or if the lateral lobes are elongated in the same direction, a dam is formed behind which residual urine is retained. The muscular tissue at the base of the bladder, which is prevented from contracting normally, atrophies and becomes thin; the post-prostatic pouch gradually increases in size. As a rule, vesical atony supervenes, and the expulsive power becomes very feeble or is completely lost, so that in neglected cases the urine which escapes from the bladder is simply the "overflow." (3) The presence of general sclerosis with rigid vessels, arcus senilis, polyuria, hyaline casts, etc., and with rigidity of the bladder-walls, will usually be associated with a dense fibroid condition of the prostate. (4) Infection of the bladder with pyogenic organisms materially modifies the case both in regard to the prognosis and the treatment.

It is desirable in every case to estimate the amount of residual urine. This is done by introducing a catheter after the patient has emptied his bladder to the best of his ability. In the presence of over-distention but a portion of the urine should be removed at one time. Failure to observe this precaution may result in considerable shock to the patient, which may be followed by suppression of urine, uremia, and death. The sudden withdrawal of the pre-existing intravesical tension so weakens the mucous membrane that it is very susceptible to microbial infection, and fatal cases of cystitis have frequently followed in this way. The strength of the muscular coat can best be determined by watching the force with which the urine escapes from the catheter. The character of the urine should also be taken into account. If it is alkaline and offensive, with a heavy deposit of pus, mucus, and phosphates, it is evidence of a very severe infection of the bladder-wall. The condition of the kidneys should also be determined as accurately as possible.

In some of these cases the cystoscope may be employed to advantage in determining the exact size and position of the enlargement. Usually, however, but little information can be obtained with this instrument. It is almost useless in cases in which hemorrhage is easily excited, because the fluid so soon becomes opaque that the field of vision is entirely obscured.

Treatment.—The treatment of prostatic hypertrophy may be (1) expectant, (2) hygienic, (3) medicinal, (4) palliative, and (5) operative.

(1) The purely expectant plan is applicable only to those cases in which enlargement has produced no symptoms and catheterism is easy and shows no residual urine. Such cases will include those in which the prostatic condition is recognized during an examination instituted for other reasons. They are not infrequently met with in practice, and have been observed before the fortieth year of life. An antecedent history of posterior urethritis should of course suggest a possibility of chronic prostatitis, which may be recognized by the symptoms mentioned under this heading.

(2) The hygienic treatment of this condition is likewise applicable to but the mildest forms of the affection. It is of the first importance to maintain all of the functions in a healthy condition, as any irregularity may bring about increased irritability of the bladder and more pronounced obstruction. In the matter of diet the patient should confine himself to what would be included under "plain but nutritious" food. Idiosyncrasies must be respected. In general, broiled steaks and chops, poultry, game and fish, well-cooked vegetables, or fruits (excluding the very acid varieties), stale bread, fresh milk, eggs, farinaceous foods, etc., are allowable. Pork, salted and dried meats, highly-seasoned dishes, rich soups, pastry, cheese, and the richer kinds of dessert, strong tea or coffee, pickles, mustard, condiments generally, all unripe and many uncooked fruits and vegetables, are to be rigorously avoided. The question of alcoholic beverages is to a certain extent an individual one. Any excess is certainly deleterious. In cases of more or less pronounced debility a dry sherry or claret or small quantities of whiskey or brandy may be used to advantage. It is needless to say that if cystitis should supervene these should be withdrawn for a time at least. Constipation should be carefully avoided by care in diet, by exercise in moderation, by regularity in the habits, and by gentle laxatives when necessary, the particular kind of which may be varied from time to time with advantage. The clothing should be such as to protect the surface from sudden changes of temperature. An entire suit of woollen underwear is desirable. Any chill of the surface is apt to be felt at once in the increased frequency and difficulty of urination. Dampness is to be carefully avoided. Considerable protection and comfort is afforded by wearing a heavy woollen bandage around the loins. Regular tepid baths are to be advised to promote the healthy function of the skin.

It is important for the patient to take regular exercise in moderation. No form is more useful than walking. Riding may be injurious. Driving over good roads is unobjectionable. Fatigue should be avoided. Some form of mental occupation is desirable to keep the patient from dwelling unnecessarily upon his condition and believing himself a confirmed invalid.

Moderation in all things should be the watchword. Sexual excitement is harmful, and it may be necessary in certain cases to advise against intercourse.

(3) The medicinal treatment of prostatic hypertrophy, so far, has been disappointing. The only drug that seems to have a direct influence upon the enlargement is ergot, which is administered on the theory that the prostatic overgrowth is analogous to the fibro-myomata of the uterus, and would be

influenced in the same way by this drug. To be of benefit it must be exhibited for a long period. In some instances it seems to disagree with the stomach, which will make necessary the reduction in the dose or even its complete discontinuance. It will be most beneficial in the cases in which the hypertrophy of the muscular and glandular elements predominates, as evidenced by the softness of the gland. It must always be combined with other measures, either general or special, according to the indications of the particular case. If the urine is unhealthy, the administration of salol or boric acid will be useful; for vesical irritation small doses of belladonna and the bromides will be of service. For loss of tone of the muscular wall of the bladder strychnine or nux vomica will be useful. If the urine is distinctly alkaline, the administration of boric acid or of benzoic acid is indicated. On the other hand, excess of acidity should be met by care in the diet, by suitable laxatives, and by the administration of piperazin, of which five grains may be given three times a day. If these fail, one of the salts of lithium or potassium may be administered. For catarrh of the mucous membrane of the urinary tract sandalwood oil or oil of eucalyptus may be administered with benefit. The further exhibition of drugs would be to meet the special complications present, and they would be given on the general principles governing the treatment of such affections from whatever cause.

(4) Palliative treatment consists in the use of steel sounds of full size or other instruments to maintain the patency of the prostatic urethra, and the systematic use of the catheter. Dilatation will be beneficial chiefly in those cases of incipient hypertrophy in which urination is not of great frequency and the amount of residual urine is small, and if in addition the enlargement as felt through the rectum is of moderate density and offers but slight resistance to the introduction of an ordinary catheter. It is a good custom to pass the

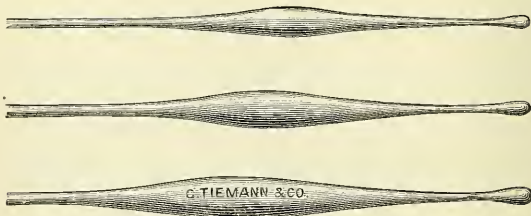


FIG. 80.—Harrison's prostatic dilators.

largest steel sound that the membranous urethra will comfortably accommodate every fifth to seventh day, allowing the instrument to remain from five to fifteen minutes. In this way the caliber of the urethra is maintained; whether the simple stretching causes a slight resorption of the parts immediately surrounding the canal or a dissipation of local congestion and tumefaction, the discharge of urine is facilitated, and consequently the vesical irritability and the quantity of residual urine are both diminished. It is necessary to observe the most rigid asepsis in order to guard against the occurrence of cystitis. This method has been strongly advocated by Harrison,¹ who uses flexible instruments with an enlargement near the vesical end (Fig. 80). Intelligent patients learn to pass these instruments for themselves, and if sufficiently impressed with the necessity for gentleness and clean-

¹ *Brit. Med. Journ.*, 1882.

liness, no harm will likely result. It is not to be supposed that this treatment will have any curative power or that it will arrest the progressive enlargement of the gland, but it delays the consequences of the hypertrophy for a considerable time at least.

If the quantity of residual urine amounts to two ounces or more, it is desirable to institute systematic catheterization. Some form of soft instrument of medium size will be found to be most suitable. The choice will be made by learning which particular form can be passed most easily and with the least discomfort to the patient. As a general rule, the catheter should be passed once daily if the residual urine amounts to between two and four ounces, twice daily for six ounces, and once more for every additional two ounces. A proper appreciation of the dangers attending the withdrawal of the residual urine will go far toward obviating their occurrence. The danger of causing cystitis is an ever-present one, and will be surely avoided only by the most careful asepsis. The sudden withdrawal of a large quantity of retained urine may be followed by immediate syncope or later by "catheter fever." The latter is usually announced at the first act of micturition after the instrumentation by a chill, when the patient is found to have fever, a rapid pulse, and considerable prostration. In marked cases the fever rises very high, sometimes reaching 106° , and subsides by crisis, which is accompanied by a profuse sweat; the typhoid condition may be observed early in the course of the case. In its milder forms the symptoms are all moderate and pass off with the first crisis or during the next two or three days. The condition is always serious if the patient's kidneys have become affected by the long-standing bladder trouble. Syncope will be avoided by withdrawing but a portion of the urine when there is a large quantity present, and the danger of catheter fever will most likely be obviated by observing the strictest cleanliness. While the etiology of the latter is not known, the condition is probably caused by a more or less pronounced sapremia or septicemia resulting from the slight traumatism of the urinary canal caused by the instrumentation.

If cystitis is present, the bladder should be irrigated with warm solution of boric acid 1 : 50, bichloride of mercury 1 : 20,000, silver nitrate 1 : 5000, or potassium permanganate 1 : 5000, each time that the catheter is introduced, or one to four times daily, depending upon the case. In the milder forms of the disease the boric-acid solution is preferable. In the presence of marked infection with purulent and ammoniacal urine the stronger antiseptics will be more serviceable. In the cases complicated by marked cystitis Guyon and Michon¹ have employed the retained catheter in a large number of cases. At the time of undergoing the treatment the patients were suffering from an acute attack superadded to a chronic cystitis. In 38 of the 49 cases reported (77 per cent.) a cure is said to have been obtained without any complication. In 11 cases the symptoms persisted. In the former defervescence was observed from the first to the sixth day, most often on the third day. The retained catheter was also employed in cases of hemorrhage following the use of instruments, and always with the greatest benefit. For the success of this treatment it is essential that the catheter should be introduced exactly the proper distance and accurately retained in this position. The underlying principle is that of drainage and physiological rest, and to secure these ends the urine must flow from the catheter as fast as it enters the bladder from the kidneys. If the pain and fever continue, it will probably be found that the catheter is too far within the bladder.

¹ *Ann. des Mal. des Org. Gén.-urin.*, May, 1895.

If these measures are properly carried out, the patient with hypertrophy of the prostate and with more or less retention may pass through a number of years in comparative comfort.

It has been urged that the regular use of the catheter will conduce to vesical atony, and this must be borne in mind when the practice is instituted, but it is not a valid argument against its use in proper cases.

If a patient suffers from complete retention from the effect of exposure or other cause, he should be put to bed, covered warmly with blankets, and should be surrounded by hot-water bottles, especially about the pelvis and the lower extremities. If convenient, a hot sitz-bath may be given. The lower bowel should be emptied by an enema, and, if required to relieve pain or spasm, a suppository of opium may be administered. If these measures fail to re-establish the flow, it will become necessary to withdraw the urine by means of a catheter. The soft instruments are preferable if they can be made to enter the bladder; if not, a full-sized silver prostatic catheter must be employed. The utmost gentleness must be observed in their introduction, and the remarks already made in regard to asepsis and the dangers of drawing off all of the urine at once must be borne in mind.

In his desire to relieve a patient suffering from retention the physician may be led to employ more force than is proper when using metal instruments, and produce a false passage, which adds greatly to the gravity of the condition. Patience will invariably accomplish more with less risk than will force. In case it is impossible to pass any instrument into the bladder, it will become necessary to perform suprapubic aspiration of the bladder, the puncture being made about an inch above the symphysis pubis. In the course of a few hours it may be possible to introduce the catheter, when the usual precaution against withdrawing too much at one sitting must be observed. In case it is impossible to introduce any form of catheter by the second day, one of the operations to be mentioned later should be performed rather than continue the repeated aspirations.

Unfortunately, in spite of the most intelligent and careful treatment of these cases, a time will come in many cases when instrumentation is so difficult and painful that some further relief becomes imperative, and the degree of cystitis present may also call for some more radical method of treatment.

(5) *Operative Treatment.*—It too frequently happens that when the patients come under the observation of the surgeon the golden opportunity for permanent relief has passed by. This will certainly be the case if cystitis and infection of the kidneys have occurred. It seems proper, however, to give the patient the benefit of the chance for possible relief from what frequently is agonizing suffering.

Among the means that have been advised for the advanced stages of enlargement of the prostate are—(1) electricity, (2) massage, (3) overstretching the prostatic urethra, (4) perineal drainage, (5) suprapubic drainage, (6) prostatotomy, (7) prostatectomy, of which there are several forms, (8) castration, (9) excision of the vas deferens, (10) ligation of the vascular constituents of the cord, (11) ligation or section of the entire cord.

Electricity.—A number of writers have employed electro-puncture, introducing the needle attached to the negative pole into the prostate through the rectum. Among these may be mentioned Biedert,¹ Casper,² and Roux.³ Biedert noted marked improvement in 1 case out of 5. Casper reported that of 4 patients treated in this manner 2 were cured, but in 1 a rectal

¹ *Deut. med. Woch.*, 1888.

² *Berl. klin. Woch.*, 1888.

³ *Société vaudoise de Médecine*, 1888.

fistula remained. In 4 of Roux's patients the gland was said to have diminished in size.

Bottini¹ advised the use of the galvano-cautery for the purpose of removing the prostatic obstruction. The electrode, which has a short beak placed at an angle to the shaft, resembling in shape a Mercier catheter, is introduced into the bladder, the point turned downward, and the instrument



FIG. 81.—Bottini's galvanic prostatomè.

withdrawn until it comes into contact with the obstruction. The current is then turned on, while some pressure is made against the obstruction. If there is any doubt about the location of the point of the instrument, a rectal examination should be made. During the time that the current is on a stream of water circulates through the catheter in order to prevent it from becoming overheated. The instrument is to be pushed in the bladder and allowed to cool before being withdrawn. Bottini has operated on 77 cases in this way: 52 are said to have been completely cured; in 11 there was some improvement; in 12 no result was obtained; 2 died, both of these being among the first so treated. Bruce Clark² recommends the use of the galvano-cautery by Bottini's method. Of 4 cases so treated, 3 were said to be absolutely cured three to six months after the treatment. Newman³ also advocates the application of the galvano-cautery to the prostatic urethra. Watson has also devised an instrument to be used in the same manner.

The methods here described do not seem to have been used to any extent. The electro-puncture, like the parenchymatous injections of various chemicals, is attended with many disadvantages. Although in some instances temporary reduction in the size of the prostate has been noted, there is a probability that the treatment will increase the congestion and swelling of the prostate,

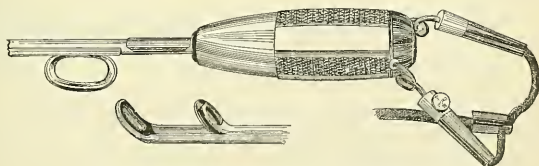


FIG. 82.—Watson's galvano-cautery prostatocetatomè.

and may lead even to the formation of abscesses. The procedure recommended by Bottini is rather more rational, but is performed entirely in the dark; it would be suitable only for cases in which there is a projection in the floor of the urethra. In the present state of our knowledge the method is not to be recommended. The same remark might be applied to the other methods of applying electricity which have been advocated.

¹ *Centralb. f. Chir.*, 1885.

³ *British Med. Journ.*, 1887.

² *Lancet*, London, 1892.

Massage.—Ebermann¹ recommends the use of massage in the following manner: The patient is placed on the back or in the knee-elbow position. The masseur introduces the finger into the rectum and rubs the gland from left to right and *vice versa*, making pressure in the direction of the symphysis. A bougie may be introduced into the urethra. The séances, which should last from five to ten minutes or more, may be repeated every day or every

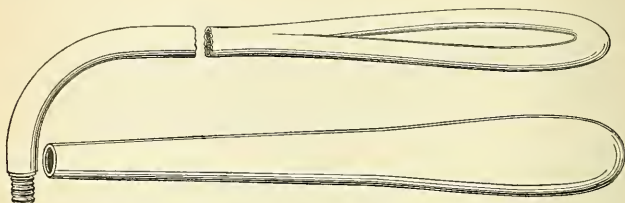


FIG. 83.—Instrument for massage of the prostate (Feleki).

second day. At the same time hot sitz-baths and a suppository of three to five grains of the iodide or bromide of potassium are recommended. It is claimed that in this way the pathological products are removed through the veins and lymph-channels. Güterboek recommends massage in the softer forms of hypertrophy when the whole gland is of the same consistence. He says that the hard myomatous growths could scarcely be influenced, although no harm would follow the procedure. Enlargement of the middle lobe is not susceptible to this method of treatment, as it grows upward into the bladder and beyond the reach of the finger.

Feleki² describes an instrument which he has had made for the purpose of applying massage to the prostate in cases of chronic inflammation. The instrument is made with a handle 20 cm. long, attached at the extremity to a



FIG. 84.—Swinburne's instrument for massage of the prostate.

pear-shaped body 13 cm. long and 6 cm. in circumference. Swinburne³ has modified the instrument devised by Feleki (see Fig. 84).

Overstretching the Prostatic Urethra.—Early in the present century Physick suggested the use of hydraulic compression, for which he invented a special instrument, and Sir Henry Thompson devised what he called a hydrostatic dilator some forty years ago. No one seems to have adopted the method suggested by Physick, and Thompson later discarded the use of his dilator. Upon this subject he remarks that no one of experience would now venture to use instruments large enough to produce any diminution of the gland or any dilatation of the canal which passes through it by the agency of

¹ *Intern. Centralt. f. d. Physiol. u. Path. d. Harn. u. Sex.-org.*, Leipzig, 1891-92.

² *Centralt. f. d. Krankh. d. Harn. u. Sex.-org.*, 1895, Nos. 9 and 10.

³ *American Medico-Surgical Bulletin*, March 28, 1896.

compression, on account of the probability of exciting prostatico-cystitis; and he does not believe that any beneficial effect on the gland is possible by this agency. Thompson's estimate of this operation was formed before the anti-septic methods were known, and it is quite possible that the risk of prostatico-cystitis would be very much less if the procedure was carried out with rigid asepsis. Overstretching could scarcely be beneficial in the cases in which the enlargement affects chiefly the "middle lobe" or the vesical neck. In the cases of lateral hypertrophy in which the urethra is compressed between the two enlarged lobes, or is rendered tortuous by irregular hypertrophy, the method might be found beneficial. To secure the best effects the procedure should be carried out under general anesthesia, and the stretching should be pushed as far as the safety of the patient will admit.

The effect of stricture of the urethra in causing atrophy of the prostate is explained by Thompson as a result of pressure. In further confirmation of these observations may be cited the experience with the use of the steel sounds in the milder forms of enlargement of the prostate to which reference has been made, and which has given in many cases the greatest satisfaction. Belfield has suggested dilatation of the prostatic urethra through a perineal incision, but the operation has not been employed in a sufficient number of cases to justify an opinion regarding its value. Bangs suggested digital dilatation by means of a suprapubic opening, and employed it frequently, but recontraction speedily followed.

The theoretical advantage of a hydrostatic dilator would be the uniform pressure exerted on the whole circumference of the prostatic urethra and vesical neck, with less risk of dangerous laceration of the mucous membrane than by using the metal dilators.

The method may be proposed, tentatively or experimentally, in the cases of hypertrophy of the lateral lobes in which the palliative treatment has failed to give relief and more radical measures are declined.

Perineal Drainage.—In cases of enlarged prostate complicated by the presence of a high degree of cystitis, demanding the introduction of the catheter every hour or even more frequently, the introduction of which is attended with great difficulty and with intense pain, some form of relief by a more radical method becomes imperative. Heretofore, this has been drainage of the bladder, either alone or combined with one of the forms of prostaticectomy. The operation of castration is likely to supplant that of simple drainage of the bladder in the vast majority of cases, but the latter will be described for those cases that refuse the former procedure, and the now comparatively few cases in which for other reasons it may be especially indicated.

The perineal route is by all odds the simplest way of establishing permanent drainage of the bladder if it cannot be secured by a catheter introduced through the urethra. Thompson recommends a median incision after the introduction of a grooved staff. The urethra is opened immediately in advance of the prostate, and a catheter introduced into the bladder. The catheter is removed after some days, depending upon the degree of relief which has been obtained.

Annandale¹ has modified the foregoing procedure by establishing permanent drainage. A large-sized india-rubber tube is secured in the wound by means of silk threads; to this may be attached another piece of tubing of convenient length, which may be closed by a pinch-cock, the latter being removed when it is desired to empty the bladder.

Whitehead² also favors a permanent perineal opening for those cases that

¹ *Edin. Med. Journ.*, vol. xxxiii.

² *Proceedings of the Royal Med. Society*, vol. xii.

have reached the stage when all prospect of their ever again being able to pass urine in the natural manner has been abandoned as hopeless.

In 1881, Harrison punctured the bladder from the perineum in the case of a man aged eighty-four years who was much reduced by advanced prostatic disease. The operation, which he calls "tunnelling the prostate," is performed as follows: A suitable trocar and cannula (Fig. 85) is selected,

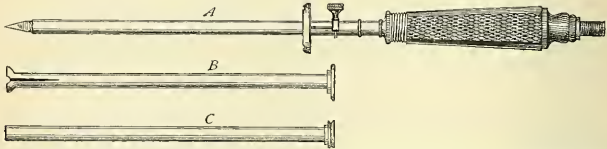


FIG. 85.—A, trocar with cannula complete; a piece of india-rubber tubing is to be attached below the collar of the cannula on withdrawal of the trocar, to convey the urine into a receptacle; B, silver cannula, which is introduced in tube of A to form a probe-end, and for retaining it; C, a plain silver tube with which to clear B in case of its becoming blocked up (R. Harrison).

and entered in the middle line of the perineum one inch in front of the anus and in a direction toward the umbilicus. The instrument is so constructed that urine flows as soon as the bladder is entered, when the trocar is withdrawn, the cannula being allowed to remain. The patient referred to was up in twenty-four hours. In about six weeks urine began to pass by the urethra and the cannula was removed. Two years later the prostate could not be felt. The man died at the age of ninety without having had any recurrence of the

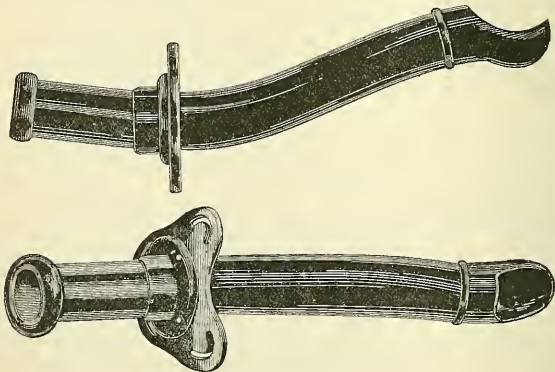


FIG. 86.—Perineal drainage-tubes (Watson).

disease.¹ Similar shrinkage and improvement have been observed after cystotomy for stone or other cause when the enlarged prostate has been divided.

Tunnelling the prostate is not as safe a procedure as the method by incision, and is not to be recommended. Where the sole object is to secure thorough drainage of the bladder with the least risk to the patient, a median perineal cystotomy will be the operation of choice.

¹ *Surgical Disorders of the Urinary Organs*, 3d ed.²

Suprapubic Drainage.—Suprapubic cystotomy for the purpose of securing permanent drainage in cases of prostatic hypertrophy was first performed by Thompson in 1869. In this country Hunter McGuire has suggested the formation of a permanent artificial urethra above the pubes. He performs the usual operation, and after the wound heals sufficiently introduces a catheter of special design with a stopper, which is worn permanently by the patient.

This operation permits of digital or even ocular exploration of the interior of the bladder, and in rare instances one is able to deal with pedunculated growths without adding much to the danger already incurred. Calculi, if present, may be removed. Morris¹ has modified this operation by transplanting flaps of skin from the sides of the abdominal incision so as to form the new urethra. He attempted in this way to overcome the tendency to contraction that otherwise follows healing.

The operation of suprapubic cystotomy is one that requires considerable time; it may be attended with difficulty if the bladder is contracted and a rather prolonged anesthesia is necessary; all of which are very objectionable, and frequently positively contraindicated in the very patients who are most in need of relief. The danger of opening the peritoneum in these cases is by no means fanciful.

As was mentioned under the previous heading, castration or one of its substitutes is likely to restrict very much the indications for the suprapubic operation.

Prostatotomy.—The division of the bar at the neck of the bladder, either by cutting instruments (Mercier) or by the use of the cautery (Bottini) introduced through the urethra, is mentioned only for the purpose of condemning it. This procedure was adopted with the view that the obstruction is always a bar at the neck of the bladder. Not only is this conception incorrect, but if it were not these procedures are so clumsy and uncertain that their employment could not be recommended. If in rare cases there is any distinct indi-

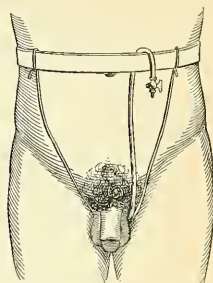


FIG. 87.—Apparatus for drainage of bladder (R. Harrison).



FIG. 88.—Mercier's prostatome.

cation for such a procedure, the operation could be better accomplished through a perineal incision.

Perineal prostatotomy in its simplest form consists in opening the urethra at the apex of the prostate by a median incision, and dividing the obstructing portion of the gland by means of a probe-pointed bistoury cutting from within outward. The channel may be further enlarged by divulsion by the finger.

At the meeting of the International Medical Congress in Copenhagen in 1884, Harrison described a method of dealing with the retention of urine from enlargement of the prostate,² which is as follows: The membranous urethra is opened on a grooved median staff, when one of the following pro-

¹ *N. Y. Med. Journ.*, July, 1890.

² *Brit. Med. Journ.*, 1893, i. p. 512.

cedures is carried out: (1) The prostatic bar is divided on the floor of the gland; (2) some portion of the prostatic ring or outgrowth is removed or enucleated; (3) the prostatic ring or outgrowth is forcibly stretched by the finger or a suitable sound. The introduction and retention of a suitable drainage-tube should invariably follow, irrespective of which method is adopted. Of 36 cases of advanced prostatic obstruction in persons over sixty years of age so treated, the floor of the prostate was divided or a portion of the gland removed in 18 cases, whilst in the remaining 18 simple drainage was secured. Harrison was able to satisfy himself that in 10 of these the function of urination had been restored.

This operation will be indicated in certain cases that refuse castration in which there is marked diminution of expulsive force, cystitis, and evidences of widespread degenerative changes or of distinct renal disease, accompanied by toxemia and general feebleness. It will also be appropriate in some cases in which the bladder is rigid and contracted, holding but a few ounces of urine, or if the atony is nearly absolute and does not tend to improve under careful treatment, although renal and constitutional symptoms are absent.

The beneficial results are probably due to a combination of mechanical dilatation of the channel and cicatricial contraction of the substance of the gland, reducing its bulk in the immediate vicinity of the urethra and consequently diminishing its obstructive power.

Gouley¹ adopted Mercier's procedure through a perineal incision. The



FIG. 89.—Gouley's prostatome.

instrument resembles a lithotrite, and consists of a male and female blade, one sliding in the other. It is made to cut or punch out segments of the overgrowth. In this way extensive portions may be removed.

Norton² has devised an instrument closely resembling Gouley's, which is used in the same manner.

It is evident that these procedures would be suitable only for cases of



FIG. 90.—Norton's prostatome.



FIG. 91.—Maisonneuve's sécateur.

involvement of the middle lobe or of a bar at the neck of the bladder. They would not be suitable for hypertrophy of the lateral bodies.

Prostatectomy.—Extirpation of a portion or all of a prostate the seat of hypertrophy would naturally seem to be a rational means of securing relief from the obstruction to the discharge of the urine.

In operating for the removal of portions of the enlarged prostate gland may be approached through a perineal incision, or through the bladder after performing the usual suprapubic cystotomy, or, as has been recommended by Belfield and others, by a combination of these two. Opinions are divided regarding the relative value of these procedures. Woolsey³ has

¹ *Amer. Surg. Ass'n*, 1885.

² *Med. Press and Circ.*, Jan., 1892.

³ *Journ. of Cut. and Gen.-urin. Dis.*, July, 1895.

recently made an exhaustive study of the choice of operation in these cases. The difference in the views of the various writers on this subject is due to the particular conception of the underlying conditions upon which depends the urinary obstruction in enlargement of the prostate. McGill, for example, whose efforts succeeded in placing prominently before the profession the suprapubic operation, believed (1) that prostatic enlargements which give rise to urinary symptoms are intravesical and not rectal, and (2) that retention is caused by a valve-like action of the intravesical prostate, the urethral

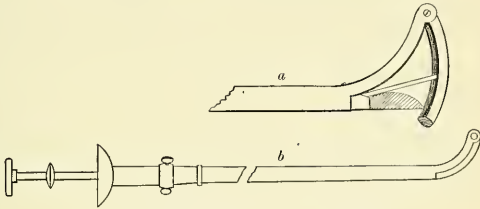


FIG. 92.—Civiale's kiotome: a, open; b, closed.

orifice being closed more or less completely by the contraction of the bladder on its contents.¹ It is clear that if these propositions were true of every case, the suprapubic route should always be selected. Watson² found among 30 specimens 28 in which the principal hindrance was an outgrowth at the vesical outlet, and in 10 cases this was the sole source of obstruction.

On the other hand, von Dittel claims that hypertrophy of the middle lobe is usually accompanied by a more or less considerable enlargement of

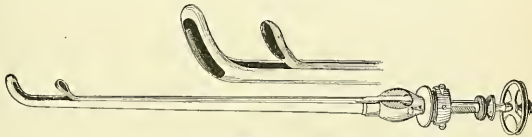


FIG. 93.—Mercier's exciseur.

the lateral masses.³ Many others hold the same views. Eigenbrodt states that the median portion only is prominently enlarged in but 19 per cent. of the cases.⁴ Desnos⁵ found the median portion enlarged 12 times in 47 cases. Vignard⁶ found manifest hypertrophy at the level of the neck of the bladder in 12 cases among 28 specimens in the Musée Civiale. Fenwick⁷ makes the statement that 90 per cent. of the prostatic obstructions are due to enlargement of the middle lobe. Browne claims that the intravesical form of growth is the chief source of difficulty in micturition.⁸ This view is endorsed by Hutchison, who believes that it is the projecting and valve-like vesical lobe which alone constitutes the impediment.⁹ This opinion is also shared by Kümmel,¹⁰ who thinks this tumor-like middle lobe is more common than is

¹ *Brit. Med. Journ.*, Oct. 19, 1889.

² *Wiener klin. Woch.*, 1890, No. 18.

³ *Traité élém. de Mal. des Voies urin.*, Paris, 1890.

⁴ *Ann. de Mal. des Org. Génito-urin.*, Paris, 1890, viii.

⁵ *Ibid.*, 1893, vol. i.

⁶ *Festschr. zum 70te Feiertag Fr. v. Esmarch*, 1893.

⁷ *Annals of Surgery*, 1889.

⁸ *Beitr. z. klin. Chir.*, 91-92, viii.

⁹ *Lancet*, Lond., Jan. 16, 1892.

¹⁰ *Archiv. Surg.*, London, 1892-93.

usually supposed. Tobin¹ states that a study of specimens of enlarged prostate shows that it is in the cases in which the median lobe is movable, and therefore removable, that retention is most complete.

Belfield has collected 63 cases of prostatic obstruction operated upon, of which tumors involving the middle lobe occurred 37 times, lateral tumors 9 times, median and lateral tumors 5 times, collar-like enlargements 7 times, horseshoe enlargements 3 times, and diffuse enlargement in 2 cases.²

As showing the importance of the lateral bodies in causing obstruction a case of M. Schmidt's³ is of interest. After removing the enlarged middle lobe through a suprapubic incision, he was obliged subsequently to make a median perineal section, to remove the urethral obstruction piecemeal, dilate the urethra, and use a *sonde à demeure*⁴ on account of the failure of the first operation. Spontaneous urination was secured only after further dilatation of the prostatic urethra.

Von Dittel's experiments are very instructive in this connection. He found that a wax bougie left for twenty-four hours in the prostatic urethra in cases of hypertrophy was compressed laterally. He also studied, post-mortem, the outflow of water introduced into the bladder with the organs in position and after their removal from the body. He found—(1) with the normal prostate the water flowed away completely in a short time. (2) When bilateral hypertrophy existed the water flowed away only partly when the bladder was filled under strong hydrostatic pressure, about 30 per cent. of residual water remaining. Residual water remained after a vertical median prostatotomy was done, but all the fluid flowed away promptly when the lateral lobes were resected from the exterior. (3) In a case of general hypertrophy of the prostate the median portion was cut out as a wedge-shaped piece, but a slow and incomplete emptying of the bladder resulted until a wedge-shaped portion was removed from both lateral lobes. The bladder then promptly emptied itself.⁵

There is no doubt that a more important rôle is played by the lateral lobes than has heretofore been accorded them. McGill has felt it necessary to remove a considerable amount of the extravescical portion. Keyes⁶ reports having removed the lateral lobes as far as one-half of the length of the gland downward and forward. Further, Küster has performed lateral prostatectomy in 3 cases with results so successful that we are compelled to admit the influence of the extravescical portion of the lateral lobes as a factor in prostatic obstruction.

As a result of his studies, Woolsey considers the following conclusions justifiable: (1) that intravesical prostatic growth is not always, though perhaps most often, the cause of obstruction requiring operative relief; (2) that in such cases the median portion plays a most important part by forming a valve in the majority of cases; (3) that the lateral lobes are often important factors both intra- and extravescically, but especially in the latter manner.

The specimens reproduced on pages 273-277, all of which have been obtained during the preparation of this paper, add conclusive evidence to this subject. Fig. 76 illustrates a specimen in which the middle lobe was enormously hypertrophied without any enlargement of the lateral lobes. Fig. 75 shows a case in which the lateral lobes are very greatly increased in size (the left much

¹ *Dub. Journ. Med. Sci.*, 1891, xcii.

² *Am. Journ. Med. Sci.*, Nov., 1890.

³ Quoted by v. Dittel: *Wiener klin. Woch.*, 1890, No. 18.

⁴ The name given by the French to a catheter introduced into the bladder and retained for continuous drainage.

⁵ *Wiener klin. Woch.*, 1890, No. 18.

⁶ *Journ. Cutan. and Gen.-urin. Dis.*, 1892.

more than the right), while the middle portion is barely perceptible. In the fresh condition the vesical neck was funnel-shaped, the apex of the funnel being almost at the apex of the prostate, and the prostatic urethra did not appear encroached upon at any point, and yet the retention was just as absolute in the latter as in the former. In the case illustrated by Fig. 76 there was but little residual urine. It is clear, therefore, that we are not yet in a position to dogmatize in this matter. Each case will require careful study, and the treatment determined upon accordingly.

In choosing one or other form of operation the following considerations will aid in reaching a decision: Obstruction due to intravesical growths could be most satisfactorily, and in some cases only, reached through the suprapubic incision, while those depending on enlargement of the lateral lobes could best be dealt with from the perineum. It will often be difficult, however, to come to a conclusion in these cases, because, as has been shown, the obstruction seems to depend on something more than the mere extent of the enlargement, inasmuch as in some cases with a great degree of overgrowth there is but slight obstruction present, while, on the other hand, in some cases of apparently quite moderate hypertrophy the urinary symptoms are pronounced.

Suprapubic Prostatectomy.—McGill, who has been a strong advocate of this operation, claims for it (1) perfect drainage of the bladder, and (2) the opportunity permanently to remove the cause of the obstruction. He also claims that it is more generally applicable, that it can be performed with greater precision and completed with greater certainty, and that it is as safe as the perineal operation.¹

These claims are, however, not universally conceded. Woolsey does not accept the statement that the suprapubic incision provides efficient drainage. He claims that the pocket left as the result of the prostatectomy will not be well drained in this way, but that perineal drainage is much more efficient. In this view he is in accord with Chance,² May,³ and others.

The forms of intravesical outgrowths described by McGill are—(1) projecting middle lobe (pedunculated or sessile); (2) median and lateral lobes, forming three distinct projections; (3) lateral lobes; (4) pedunculated growths from the lateral lobe; and (5) uniform circular or collar-like projections surrounding the internal urethral orifice.

Operation.—The field of operation should be shaved and cleansed in the manner habitually employed in advance of operations at the present time, and the patient should have received the usual preparatory treatment.

The following instruments will be required: scalpel, blunt-pointed bistoury, scissors (straight and curved), sharp hook, blunt hooks, dissecting, artery, and hemostatic forceps, broad rectangular retractors, rectal bag, syringe, large drainage-tube, needles, sutures, ligatures. The retractor devised by Watson may be employed with advantage.

For operation the patient is placed upon the back; the shoulders may be raised upon a pillow. Occasionally, it may be desirable to operate in the Trendelenburg position; some operators habitually employ this posture. The surgeon stands on the patient's right side. The empty rectal bag is oiled with vaseline and introduced into the rectum well above the internal sphincter. The filling of the bag may properly be delayed until a later period. A soft-rubber catheter is then introduced into the urethra, or, if this will not pass, any other form that will enter the bladder is employed to draw off the urine,

¹ *Brit. Med. Journ.*, Oct. 19, 1889.

² *Med. Press and Circ.*, Lond., 1894, N. S. lviii. 3.

³ *Brit. Med. Journ.*, Oct. 19, 1889.

after which the bladder is irrigated with warm boric-acid solution until the fluid returns clear. The bladder is then moderately distended with the solution, which is allowed to remain, the catheter being withdrawn. The quantity that can be used will vary greatly with different cases. It is not always possible to employ a given amount, as can be done in performing cystotomy

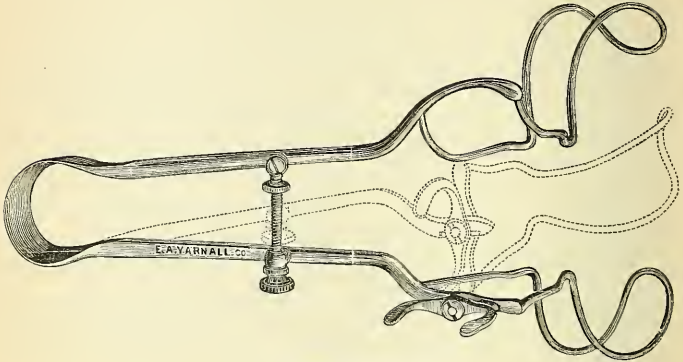


FIG. 94.—Watson's speculum (open).

upon the healthy bladder, the walls of which have not been altered by disease. It is desirable, when possible, to distend the bladder until it can be detected above the pubes. The rectal bag is next filled with warm water,

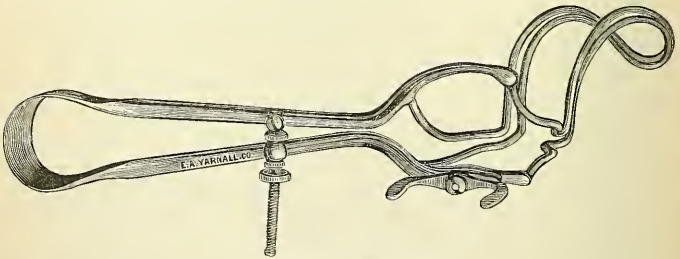


FIG. 95.—Watson's speculum (shut).

six to ten ounces being employed. Some operators prefer not to distend the rectal bag until the bladder has been reached; others prefer to distend the rectal bag before injecting the bladder, as by this order of procedure the projection forward of the bladder is rather more pronounced.

McGill of Leeds, after whom this operation is sometimes called, emphasizes the following points in the technique of the operation:

(1) The quantity of water injected into the rectal bag, especially in cases where the prostate is abnormally hard, should be smaller than the quantity usually recommended. Each case must be decided upon its merits, but six to ten ounces are usually sufficient.

(2) The bladder should be irrigated till the antiseptic solution used is perfectly clear. The quantity left in the bladder varies from ten to twenty ounces or more. [In our opinion it will rarely be proper to exceed ten fluid-ounces, and frequently it is not safe to introduce more than six or eight.] The hand placed on the hypogastrium during the filling of the bladder will show when the distention is sufficient.

(3) In cases where the bladder is contracted with thick, non-distensible walls it will usually be inadvisable to perform this operation.

(4) It is better to leave a catheter in the bladder till its cavity is opened, as it is a guide that expedites the operation. Care must be taken not to hook the peritoneal fold (superior false ligament) into the wound with the point of the instrument.

(5) The linea alba is best divided by incising it immediately above the symphysis, and then dividing upward on a director.

(6) Care must be taken to secure the bladder before proceeding to remove the prostate. This is best done by inserting two sutures through each lip of the wound, and fastening it securely to the deeper part of the abdominal wall. When the operation is completed a third suture passed through the lower angle of the wound is an additional security against urinary extravasation into the retropubic space.

(7) A pedunculated middle lobe can be removed with ease, its pedicle being divided with curved scissors. A sessile middle lobe can be removed

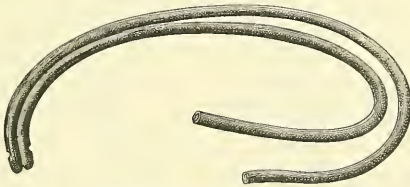


FIG. 96.—Guyon's double drainage-tube.

in the same way, helping the scissors by tearing with forceps. The collar enlargement is removed with greater difficulty. It is advisable to divide it longitudinally by inserting one blade of the scissors into the urethral opening and dividing the portion above, and then passing the other blade into the same opening and dividing the portion below. That part of the gland which projects into the bladder is now divided into two lateral halves; these can be removed separately by scissors curved on the flat or enucleated with the tip of the fore finger. Care must be taken not to leave any portion of the projecting valve untouched.

The prostate should be removed as far as possible by enucleation with the finger, and not by cutting. The mucous membrane over the projecting portion having been snipped through, the rest of the operation is completed with finger and forceps. In this way excessive hemorrhage is prevented. Hemorrhage is best arrested by irrigation with water so hot as to be unpleasant to the hand.

When the operation is complete, whichever form of growth has been removed, it is advisable to see that the urethra is patent, and to pass the fore finger as far as the first joint into its canal.

(8) A large tube should be inserted into the bladder, and the wound

united above the tube by a deep and superficial row of sutures. The tube is to be removed in forty-eight hours.

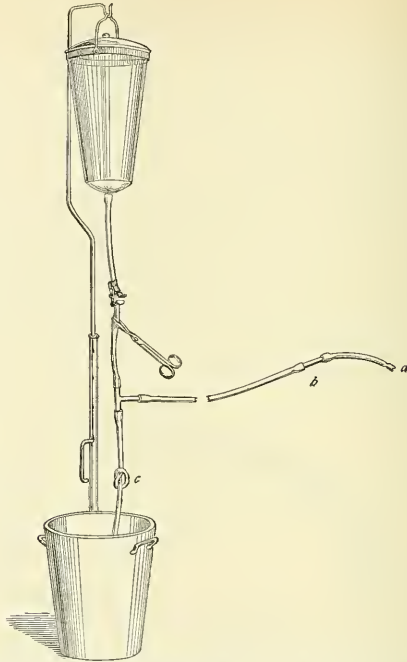


FIG. 97.—Apparatus for draining bladder after suprapubic cystotomy: *a*, end of rubber tube to be placed in *bas fond* of bladder; *b*, glass tube; *c*, trap (Dawbarn).

(9) The after-treatment consists in keeping the parts clean and washing the bladder and the wound with boric-acid solution.¹

Browne² advises that the bladder be opened on a staff: since the body

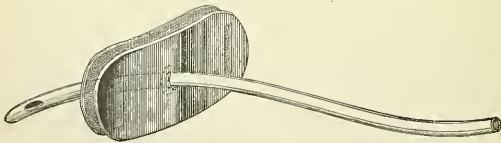


FIG. 98.—Plate to secure catheter in suprapubic drainage.

of the prostate is in some instances very large, it is apt to be incised instead of the bladder when the surgeon thinks he is puncturing the latter organ

¹ *Lancet*, Lond., Feb. 4, 1888.

² *Brit. Med. Journ.*, March 11, 1893.

with the knife. He recommends also that the projecting portion of the prostate be removed with forceps, twisting it off in one piece if small, and piecemeal if large. The torsion greatly diminishes the amount of hemorrhage.

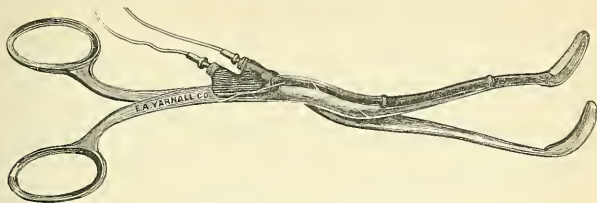


FIG. 99.—Watson's scissors-cautery.

Some authors prefer the transverse incision above the pubes, dividing the recti muscles, as advised by Trendelenburg.¹ Kümme² sutured the bladder and drained through the perineum with a Nélaton catheter. For

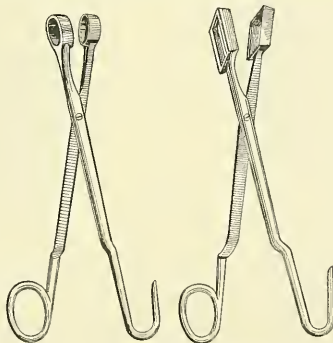


FIG. 100.—Prostate-scissors (Jessop).

the cases in which the obstruction at the neck of the bladder is dense, Keyes³ accomplishes its thorough removal by means of the rongeur, thus solving



FIG. 101.—Forceps for twisting away bladder-growths, etc. (R. Harrison).

this hitherto unsettled question. For those in which the enlargement of the middle lobe takes the form of a distinct projection Weir⁴ recommends

¹ *Brit. Med. Journ.*, Oct. 19, 1889.

³ *Med. Rec.*, New York, Oct. 31, 1891.

² *Dent. med. Week.*, April 8, 1889.

⁴ *N. Y. Med. Journ.*, May 30, 1891.

the use of the amygdalotome in effecting its removal. One may also employ Watson's scissors-cautery (Fig. 99), Jessop's scissors (Fig. 100), or Harrison's forceps (Fig. 101), the choice of the particular instrument being determined by the form of the median enlargement.

For the control of the excessive hemorrhage that sometimes occurs in removing sessile growths Keyes¹ adopted the use of a tampon composed of bichloride gauze made as follows: A square of four thicknesses of gauze is cut, the length of each side being about 6 inches. Upon this are placed eight thicknesses of gauze cut square, each side measuring 4 inches, and upon this eight other thicknesses, also square, the sides measuring 3 inches. Centrally, upon the 3-inch pad a small white shirt-button is tied by stout silk ligatures transfixing the pad and tied upon the 6-inch square surface. This central button also has a piece of silk attached to it running out freely in the direction away from the 3-inch surface. This is to facilitate extraction. Each of the corners of the 6-inch pad is stoutly tied with a piece of silk, and the silk from each of these four corners is knotted at its end into a double knot, while the silk running out backward from the button is tied with a single knot for the purpose of distinguishing which is which when

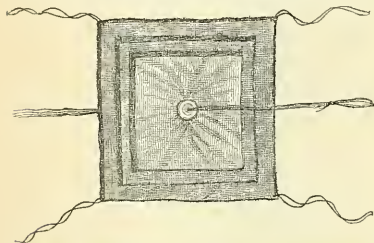


FIG. 102.—Keyes's pad for controlling hemorrhage after prostatectomy.

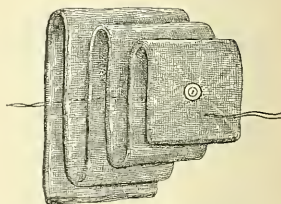


FIG. 103.—Cabot's pad for controlling hemorrhage after prostatectomy.

making the extraction, although, practically, it will be found that they must all be made taut and pulled upon all together in order to effect removal with the greatest care and facility.

The pad is applied by introducing a catheter through the urethra into the bladder, attaching the silk threads from the center of the 6-inch surface, and withdrawing the catheter. The threads are then tied over a roll of gauze at the meatus in order to keep the pad firmly in place. If a perineal opening has been made, the threads are brought out of this incision and similarly tied over a piece of gauze. On account of the difficulty experienced in removing this tampon Cabot² suggested the following modification: A long strip of gauze, of appropriate width, the edges of which should be rolled in and stitched so that there should be no loose, frayed edges, should be folded back and forth upon itself to form a pad of the proper size. The folds are made shorter each time, so as to produce a pad somewhat cone-shaped. For the same reason the strips of gauze should be broader at one end than at the other by 2 inches. A silk thread, attached to a button, is passed through the center of all the layers of the pad from the surface having the smaller to that having the larger diameter, so that the button is at the extremity of the gauze strip representing the last fold. The thread is to be carried through the perineal opening or through the urethra and secured, in

¹ *Med. Rec.*, New York, Sept. 17, 1892.

² *Ibid.*

order to make the necessary traction as described in connection with Keyes's pad. The pad should have another thread attached to the upper extremity of the strip to remove it by. This pad could be drawn into the neck of the bladder as firmly, Cabot thinks, as any compress; but on loosening the thread which passes through the perineum or urethra, and then drawing on the upper thread, the gauze would unfold and come out in a long strip, much as the packing which one applies to a bleeding uterus does.

The following procedure has been recommended by Tobin:¹ A small suprapubic cystotomy is performed, and the condition of the enlarged prostate estimated by means of the finger introduced through the wound. A wire of sufficient length is then doubled, and the loop passed through the urethra into the bladder. By means of two fingers in the suprapubic opening the loop of wire is made to encircle the prostatic outgrowth. A special metal catheter with the vesical end open is then passed over the wire until the point comes in contact with the obstruction. The wires are then drawn upon, and, being contained within the catheter, act as an *éraseur*, the two fingers in the bladder guiding the wire loop in the proper direction as it makes its way through the prostatic growth. Tobin claims the following advantages for his method: (1) As much of the gland as interferes with the escape of the urine is removed and no more; (2) such portion is removed in a satisfactory manner, for the wire cuts up to the portion where the instrument has been stopped by the obstruction; (3) a smooth surface sloping into the urethra is left, instead of the more or less rough one that must result from taking away the gland piecemeal by means of forceps; (4) there is very little hemorrhage. It is obvious, however, that this method would be applicable only to the cases in which there was a distinctly localized growth of the median portion.

Perineal Prostatectomy.—The patient, having had the necessary preliminary preparation, should be placed in the lithotomy position, and a staff introduced as in the operation of median perineal cystotomy. The surgeon inserts the left index finger into the rectum and steadies the staff with the point of the finger, which is pressed against it at the apex of the prostate. A narrow, double-edged bistoury is then thrust into the median raphé of the perineum half an inch in front of the anus. It is introduced horizontally, with the longer cutting edge directed upward. The groove in the staff is "hit" at the point where it is steadied by the finger in the rectum, and by continuing to thrust the knife deeper the apex of the prostate is incised and the prostatic urethra is opened, the superficial wound being enlarged upward as the knife is withdrawn. By this method small median tumors may often be caught by forceps and removed. Portions of the lateral lobes have also been removed by scissors or forceps or by being torn away with the finger or sharp spoon. Watson² states that in two-thirds of the cases of enlarged prostate needing treatment the intravesical growth could be successfully reached and partially or wholly removed through a perineal incision.

Wishard³ favors this operation in cases in which the deep urethra is not so much lengthened by the prostatic hypertrophy as to prevent the finger introduced through the perineal wound from reaching beyond the growth. He states that catheter measurements of the prostatic urethra, together with the rectal examination, are usually sufficient to determine the operator in making the choice as to the method of operation.

¹ *Med. Press and Circ.*, Lond., 1892, N. S., vol. ii.

² *Operative Treatment of the Hypertrophied Prostate*, 1888.

³ *Indiana Med. Journ.*, Oct., 1892.

Several other methods of approaching the prostate from the perineum have been recommended. Von Dittel¹ recommends cuneiform resection of each lateral lobe of the enlarged prostate, to which operation he applies the term "lateral prostatectomy." The steps of the operation are as follows: (1) Introduce a catheter [or sound] into the bladder through the urethra, and tie so that the urethra may be easily appreciated during the operation, and thus avoided; (2) pack the rectum with gauze, that it also may be recognized and avoided; (3) the patient is placed prone on a table with the legs hanging down over the end: the incision begins at the tip of the coccyx, and is continued down the middle line to about the middle of the sphincter ani, and thence around the anus nearly to the raphé; (4) dissect away the rectum and expose the prostate; (5) arrest hemorrhage and render the wound aseptic; (6) cut away as much as possible of each lateral enlargement, leaving only a small amount of substance to protect the urethra; (7) arrest hemorrhage, pack lightly, and drain.

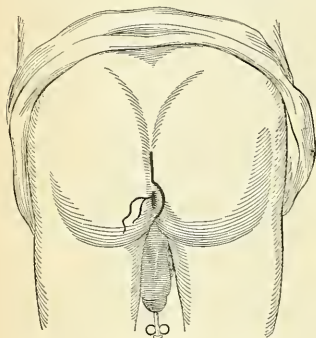


FIG. 104.—Dittel's operation for prostatectomy.

Warholm² has modified von Dittel's method by making the incision from one ischial tuberosity to the other. A sound is passed into the urethra and the rectum tamponed with iodoform gauze. On dividing the venous plexus on the posterior surface of the prostate considerable hemorrhage may be encountered, and is to be arrested by tampons or ligatures. When hemostasis is obtained cuneiform resection of both lateral lobes is performed. The wound is drained and closed.

Von Dittel's operation has been carried out by Küster³ in 3 cases, a portion of the gland only being removed in each. Von Dittel reports a successful case in which he removed the whole gland by his external method,⁴ and Pyle⁵ reports a successful case operated upon by a similar method.

L. Bolton Bangs⁶ relates a very interesting case in which overstretching of the prostatic urethra incident to a perineal lithotripsy proved to be of distinct benefit in relieving prostatic symptoms which had existed previous to the stone-formation. Woolsey⁷ records that in a personal communication Dr. Bangs had stated that the effect in this case was only temporary, indicating that the lateral hypertrophy requires a more active treatment than simple stretching.

Woolsey⁸ gives the details of a case upon which he performed von Dittel's operation of lateral prostatectomy. The man was sixty-two years of age. He came to the hospital on account of retention of urine. He had had two suprapubic operations performed by other surgeons. The suprapubic opening was enlarged, and drainage thus obtained; a catheter was introduced into the urethra and retained. The suprapubic fistula remained; there was no diminution in the size of the prostate, and spontaneous urination did not take place.

¹ *Wiener klin. Woch.*, 1890, No. 18.

³ *Münch. med. Woch.*, April 14, 1891.

⁴ *Intern. klin. Rundschau*, Vienna, June 18, 1893.

⁵ *Med. Rec.*, New York, Aug. 6, 1892.

⁷ *Journ. Cutan. and Gen.-urin. Dis.*, Aug., 1895, p. 314.

² *Gaz. heb. de Méd. et de Chir.*, Jan. 2, 1896.

⁶ *Annals of Surgery*, April, 1893.

⁸ *Op. cit.*, August, 1895.

The operation was performed, as described by von Dittel, by making a median incision from the coccyx to and around the left margin of the anus and extended one inch anteriorly. After division of the skin and fascia the upper part of the ischio-rectal fossa was reached by blunt dissection without hemorrhage, after ligation of only one or two vessels. The levator ani muscle was divided antero-posteriorly on the left side of the prostate, exposing the latter, which was freed by the finger on all sides. Although the prostatic plexus looked large, but little bleeding occurred on removing a large boat-shaped piece from either side. But little was left of the prostate and the urethra was not injured. The catheter was tied in the urethra and the wound packed; recovery was uneventful. He was able to pass urine much more freely than before, though the suprapubic fistula remained. The patient died, however, three or four months later, it is supposed from a cancer.

Woolsey states that, so far as it is justifiable to reach any conclusion from so limited an experience, he should say that the operation is feasible, easy, and safe.

Pyle¹ advocates the following method of removing the prostate: A semi-circular incision is made around the anus anteriorly, midway between the tuber ischii, entering between the bulb of the urethra and the rectum. There is no hemorrhage to speak of, and the access to the gland is easily accomplished. After dividing the integument and tough fascia the loose tissue is to be separated with the handle of the scalpel, working between the rectum and urethra until the fascia covering the levator ani is reached, the division of which exposes the prostate. The gland may be grasped with a volsellum forceps and enucleated with the finger. It will usually be desirable to insert a bougie into the urethra to act as a guide and to prevent injuring this structure.

Combined Suprapubic and Perineal Prostatectomy.—On account of the fact that neither the suprapubic nor the perineal operation permits of dealing radically with the prostate in every case, a number of surgeons have advised the combination of the two. Belfield² states that the addition of the boutonniere increases but slightly the injury to tissue and the time of anesthesia, while it affords an access to the entire prostate which may convert an utter failure into a complete success. He believes the combined operation should be the rule rather than the exception.

Nicoll,³ in order to obviate lacerations and tears of the mucous membrane of the vesical neck and deep urethra, recommends the following procedure in removal of the prostate: A suprapubic cut is made, the bladder opened, and the sides of the vesical incision sutured to the corresponding margin of the abdominal wound. A median perineal incision is next performed, and the capsule of the prostate opened without incising the urethra. With one hand in the suprapubic wound he presses down the prostatic growth, so that it is steadied and brought into reach of the fore finger of the other hand introduced through the median cut. By this means the perineal finger gradually shells out the growth. If the growth is too fine and fibrous to be removed by the finger, then an instrument much like a periosteum-scraper does the work. In case the median incision does not give room enough in the region of the prostate, lateral incisions can be made much as in von Dittel's procedure. The hand in the bladder can detect when all the obstruction has been removed.

Desnös,⁴ who has performed 22 resections of the prostate for hypertrophy

¹ *Med. Rec.*, New York, 1892, vol. xlii.

² *Sys. Genito-urin. Dis., Syphilology, and Dermatology*, vol. i.

³ *Lancet*, Lond., April 14, 1894.

⁴ *Annales des Mal. des Org. Gen.-urin.*, Dec., 1895.

during the past seven years, summarizes his results as follows: 2 deaths, 1 aggravation of urinary symptoms, 4 not improved, and 15 improved or cured. One death, which occurred on the fifth day, was from previous infection, which the cystotomy did not relieve; the other, on the eighth day, suddenly followed an effort of the patient to raise himself up in bed. In the case in which aggravation of the symptoms was noted there was a certain degree of incontinence which did not exist before.

The "improvement" consisted in a diminution of the amount of urine retained (in 6 of the cases retention completely disappeared); urination had become less frequent and but slightly painful. In cases in which infection of the bladder had occurred the urine had become almost, if not quite, clear. Four of the patients, whose general health had been seriously disturbed, rapidly recovered, the appetite and strength returning in a few weeks.

As to recurrence, the first two patients operated on, now sixty-six and seventy-one respectively, have rather frequent micturition, but there is no retention, and they have not had to recur to the catheter. The others are still occasionally subject to cystic infection when antiseptic irrigations are required; the inflammation yields to this treatment. In one case, after a period of amelioration, the pains returned so severely that a cystotomy was necessary. Some of the others have had a slight increase of residual urine after a temporary improvement due to the operation.

As to age, only in the relatively young is the operation a success. Over sixty-five years of age only once was relief given. In the others retention was not lessened and the bladder rapidly lost its contractility.

Castration.—In the autumn of 1892 one of the writers was asked to prepare a paper on "The Present Position of the Surgery of the Hypertrophied Prostate." In thinking over the subject, the apparent analogy between prostatic growths and uterine fibro-myomata seemed to him to demand investigation, and it was determined, if possible, to ascertain whether castration would have the same effect upon the hypertrophied prostate that oöphorectomy does upon similar growths in the uterus. Experiments were at once instituted upon a large number of dogs, which showed that castration invariably caused a rapid and pronounced diminution in the size of the normal gland. Microscopic sections showed that the decrease in size was a true atrophy. Upon the result of these experiments "castration" was suggested for hypertrophy of the prostate.¹

Since this time the operation has been performed a great number of times in all parts of the civilized world, with better average results than have been obtained by any other form of treatment hitherto employed. Castration may be said to have passed the experimental stage, and to have established for itself a place among legitimate operative procedures.

The following reports illustrate the results of castration in properly selected cases:

CASE 1.—The first patient subjected to castration for hypertrophy of the prostate in this country was operated upon by Dr. Francis L. Haynes of Los Angeles, Cal., Dec. 12, 1893. Dr. Haynes was led to carry out this procedure by the experimental evidence placed before the profession in the paper before alluded to.² The patient was an old man with chronic cystitis, frequent urination—passing water from four to eight times during the night; the residual urine measured half a pint. He had not urinated with ease for two years. The prostate was moderately hypertrophied. The catheter had to be used from one to three times daily. The operation was followed by relief of the urinary symptoms, shrinkage of the prostate, and disappearance of the cystitis. At the

¹ Paper read before the American Surgical Association, June, 1893: *Annals of Surgery*, August, 1893.

² White: *Ibid.*

end of three months the patient considered himself entirely cured. He urinated with ease, there was no cystitis; he used the catheter once in four days to estimate the amount of residual urine, which was about three drams. A letter from Dr. Haynes, dated Aug. 5, 1895 (one year and eight months after the operation), states that the patient remains perfectly well. He rises once at night, passes water about five times during the day, and is able to retain his urine for nine hours at a time. The urine is normal; the prostate has nearly disappeared. His mind is in excellent condition and his general health perfect.

CASE 2.—The following case, which Dr. White saw with Dr. F. Fremont Smith of St. Augustine, Florida, during the Christmas holidays of 1893, was a most remarkable one:¹ "On October 25, 1893, a patient was admitted to St. Alicia Hospital, St. Augustine, who had suffered for a year with mild symptoms of prostatic hypertrophy. During the month previous to his admission increasing symptoms of obstruction had set in. During the seven and a half weeks after admission he suffered with irregular fever; urination was painful and frequent, especially at night, and the urine was loaded with the products of decomposition and pus. Attacks of retention were frequent, and the smallest amount of residual urine was six ounces.

"From Oct. 25th to January 17th the usual and approved internal treatment and bladder-douches were carefully carried out by Drs. Fremont Smith, Alexander, and Anderson. During this period the patient steadily declined. The depression of repeated acute inflammatory attacks, each recurrence accompanied by excess of pus and septic fever, the harassing constancy of the desire to urinate, and the necessary loss of appetite and sleep, with the other effects of the local disease, reduced his weight during these seven and a half weeks from 165 to 135 pounds. His weakness was alarming; all unfavorable symptoms were increasing."

The patient's condition now appeared most hopeless. It really seemed that from the amount of cystitis and septic intoxication he could not survive more than a few days. Any form of prostatectomy was evidently out of the question. He seemed too ill even for formal cystotomy. It did not seem reasonable to hope that castration would be of any avail at such a late period in the disease, but it was advised under the circumstances, inasmuch as it could be done with less ether and hemorrhage, and consequently with less shock, than any of the other operations usually recommended.

The operation was performed on January 17, 1894. "During the week following the patient was catheterized twice daily. At the end of that period he attempted and successfully voided his urine, and the catheter was used twice a week, alone for the purpose of determining the quantity of residual urine. No local treatment was employed subsequent to the operation. March 1st, six weeks after operation, the patient was discharged. His general conditions were changed, in that he had subsequent to castration no fever from any source, his appetite returned, his weight increased from 135 to 163 pounds, his mental state, previously weak and melancholic, made decided improvement. His local conditions were changed, in that, instead of retention or residual urine of not less than six ounces, he had no retention, attack, or return of acute cystitis, and the residual quantity steadily diminished and during the final week varied between three drams and one and one-half drams. The nocturnal desire to urinate was reduced from twelve and fifteen to four and six times. The urine now presented a sediment only on standing for hours, which contained under the microscope a moderate number of pus-cells."

A recent letter states that the patient has no difficulty whatever in voiding his urine, and no pain at all from that source.

CASE 3.—As another example, one may be mentioned from the practice of Dr. White: A man aged seventy-nine years had had symptoms of obstruction to urination for eight years. He had marked cystitis and six ounces of residual urine. He was obliged to use the catheter four to six times daily. The prostate was about the size of a small orange. On January 26, 1895, castration was performed. Three days later the retention was replaced by incontinence. The latter had disappeared by the 1st of April, at which time the patient voided urine about five times daily; the prostate was greatly reduced in size. The patient was seen on the 2d of May. He had remained entirely well. The urine was perfectly clear, his cystitis having disappeared.

CASE 4.—The following additional case may be quoted:² A shoemaker, sixty-eight years of age, had first noted undue frequency of urination fifteen years before coming under observation. The frequent micturition gradually became painful; at times the suffering was intense. Finally, he noticed incontinence and loss in the force of the stream. He was obliged to rise as many as twenty times during the night. Later, he had complete retention; catheterization became very difficult and caused a great deal of pain. The patient failed in strength and became delirious; the urine, which had been ammoniacal

¹ *Annals of Surgery*, July, 1894.

² *University Medical Magazine*, May, 1896.

and offensive for years, became more foul; the quantity was markedly diminished, and all of the symptoms suggested a rapidly fatal termination. The temperature was 101; pulse 110 and weak. November 9, 1894, both testicles were removed. The condition of the patient at once began to improve; he gradually came out of his uremic state; spontaneous urination gradually returned; he was able to do away with the catheter; the pain disappeared, and also the frequent desire to urinate. The cystitis was entirely relieved, and the condition of the urine normal. There was no residual urine. The prostate diminished from the half-orange-like projection to a flattened, scarcely perceptible mass. March 10, 1895, sixteen months after the operation, the patient was shown before the Surgical Section of the College of Physicians of Philadelphia. He had been, in the interim, entirely free from urinary troubles, and stated that he urinated as freely as when a boy. He was obliged to rise but once or twice during the night, and passed urine which was normal and free from pus six times during the day.

It is understood, of course, that every case subjected to this operation has not been as successful as those quoted, and death has followed the operation in some instances. The object has been, however, to demonstrate the possibilities of castration in a large proportion of cases of enlargement of the prostate, and to use the facts thus brought out in discussing certain problems in connection with this subject.

The Status of the Operation.—In the first tabulation of the results of castration for prostatic hypertrophy,¹ it was shown that in approximately 87.2 per cent. of the cases there was a rapid atrophy of the prostate, that a long-standing cystitis disappeared or was much improved in 52 per cent., that vesical contractility returned in 66 per cent., that there was amelioration of the most troublesome symptoms in 83 per cent., and a return of local conditions not very far removed from normal in 46.4 per cent. Strikingly similar are the observations of P. Bruns,² who has analyzed 148 cases. Among 93 of these cases, in which accurate notes were made, the prostate decreased in size 77 times (83 per cent.). Cabot³ has collected 99 cases not included in Dr. White's table. His analysis of these shows: "failures, 9.8 per cent.; moderate improvement, 6.6 per cent.; substantial or very great improvement, 83.6 per cent." Bruns⁴ states that microscopic examination of the prostates of two patients who died subsequent to castration showed that the decrease in size was due to a true atrophy (first of the glandular elements and then of the stroma). This is in accord with the observations of Griffiths⁵ and of White.⁶ Cabot⁷ reports examining microscopic sections of the prostate of a man who died seven days after castration. He failed to find any difference from the hypertrophied prostate of a non-castrated patient. In a second case, examined for Dr. Post, practically the same conclusion is reached. Moullin⁸ records a similar observation.

These facts appear to show that just as some patients are not benefited by castration, so also will the prostate fail to show any change after the operation in a certain proportion of cases. That atrophy does occur in many instances has been fully established by microscopic examination.

The observation of Albarran⁹ that "he has seen similar conditions to those pictured by Griffiths in cases that had never been castrated" (Cabot) is without weight as evidence that castration does not cause such changes. It has been already pointed out that at a certain age the prostate undergoes atrophy spontaneously.

¹ J. William White: *Annals of Surgery*, July, 1895.

² *Separatdruck der Mittheilungen aus den Grenzgebieten der Medizin und der Chirurgie*, verlag von Gustav Fischer, in Jena.

³ *Annals of Surgery*, September, 1896.

⁴ *Ibid.*

⁵ *Brit. Med. Journ.*, March 16, 1895.

⁶ *Loc. cit.*

⁷ *Loc. cit.*

⁸ *Lancet*, London, Nov. 30, 1895.

⁹ *Ann. des Mal. des Org. Genito-urinaires*, Dec., 1895.

That castration is followed by atrophy of the normal prostate has been conclusively shown as an invariable result in the dog. In man it has been found that castration is followed by a true atrophy of the hypertrophied prostate in many cases, but not in all, and a much broader experience is necessary before we can predict with certainty those cases that will be benefited and those that will not.

Are the results due to rest in bed, hygiene, and other palliative measures? A study of the reported cases will show that in a large number of instances the patients have had the benefit of rest in bed, carefully regulated hygienic conditions, regular catheterization, irrigations of the bladder, and appropriate internal treatment with little or no relief. In fact, any one who has seen many of these cases must have observed that sometimes, in spite of the most intelligent palliative treatment, the condition of the patient gradually grows worse. It not infrequently happens that during this treatment catheterization is required more and more often and is attended with greater and greater difficulty, or it may even become impossible. Prostatic hypertrophy has been well known, and has been the subject of considerable study since Home wrote upon the subject in 1806. The palliative treatment, so far as it is understood at the present time, is well known to the profession. It is preposterous to accuse surgeons all over the world of such infidelity to their trust as to intimate that they have removed the testicles of their unfortunate patients at the first intimation of prostatic enlargement, without having first exhausted the ordinary measures at hand. There is nothing more certain than that the rank and file of the profession are conscientious in the discharge of their duties to their patients, and that they employ the best judgment at their command in dealing with the various accidents of disease and injury to which the human family is subject. Nor is it reasonable to suppose that all of the patients who have submitted to this operation have done so at the first intimation of urinary obstruction, without having ascertained that relief was not obtainable by simpler means.

The Factors that Bring about Decrease in the Size of the Prostate.—It has been asserted that the disappearance of symptoms following castration has been due to relief of congestion and edema of the prostate. This is probably true to a certain extent, but not, as some have supposed, on account of rest and other factors which would ordinarily obtain during confinement to bed.

The intimate relation existing between the testicles and the prostate has been thoroughly established both by the experiments already alluded to and by previous observations. The prostate being a sexual organ, the function of which is to secrete a fluid to dilute the semen, its activity would naturally continue during the functional life of the testes. Congestion doubtless is an important factor in the enlargement in the softer forms of prostatic hypertrophy. The removal of the testicles relieves this congestion by abolishing the source of the stimulus that excites the function of the prostate. This accounts for the very prompt and in some cases remarkable relief after operation. The later and final results, however, are due to a real atrophy of the gland, as has been shown by clinical experience, by post-mortem observations, and by numerous experiments on dogs.

Griffiths¹ and White² have shown that after castration it is the glandular tissue which first atrophies and disappears, and that this atrophy begins within a few days. The median lobe is particularly rich in glandular tissue, and as this is commonly the chief cause of the urinary obstruction, the early relief is thus accounted for. A very little diminution in the size of certain of these

¹ *Brit. Med. Journ.*, March 16, 1895.

² *Annals of Surgery*, August, 1893.

growths would suffice to bring about great relief of the obstructive symptoms. These factors also explain the ability to urinate soon after operation and the improvement in the symptoms that have been noted.

The Disappearance of the Hyperplasia.—The disappearance of the hyperplasia after castration has been remarkable. It is entirely rational to expect a diminution of the congestion after this operation, but that the newly formed muscle should disappear as well as the glandular elements is so surprising as to have led some writers to doubt its occurrence. It must be remembered, however, that the sole function of the muscular fibers of the prostate is to exert compression on the glandular tubules, the effect of which is to empty the contents of the latter into the urethra. The muscle fibers are entirely subservient in function to the glandular elements. The stroma of the prostate is as purely sexual as are the glands which it contains.

The number of observers who have witnessed reduction in the size of the prostate from that of a small orange to the normal dimensions or less is quite sufficient to establish its accuracy. Additional evidence is afforded by the microscopic examinations of the prostate of patients who have died after castration.

There can be no doubt that fibro-myomata of the uterus undergo atrophy after removal of the ovaries, and a consideration of the analogy between this operation and that of castration in hypertrophy of the prostate renders a similar result in the latter case quite comprehensible.

The Estimation of the Size of the Prostate Before and After Operation.—It would be desirable, for the sake of accuracy, to be able definitely to measure the prostate before and after operation, but this is of course impossible. To the average individual the comparison in size to that of a "walnut," a "billiard ball," an "orange," or a "fist," or the expressions "reduced to the normal size," "smaller than normal," "scarcely to be felt," etc., convey fairly intelligent ideas and for purposes of description answer at least for the practical surgeon.

The decrease in size can also be estimated by measuring the distance it is necessary to pass the catheter before urine flows both before and subsequent to the operation. This observation has not been made as frequently as it should have been, but in every instance in which the measurements have been taken a decrease in the length of the urethra has been noted. As the value of the operation is measured not by the amount of decrease in the size of the prostate, but by the relief afforded the patient, this question is one of minor importance, and is only discussed to meet the theoretical objections that have been offered by one or two writers.

The Relief of Cystitis.—Not the least interesting phenomenon in these cases is the disappearance of the intractable cystitis that is so often present. In the 111 cases reported by White¹ this occurred in 52 per cent. In his study of 148 cases Bruns² states that the aggravated cystitis so often met with is improved in many instances and often entirely cured. This result is explained by the fact that an important factor in the complications of prostatic enlargements is the pronounced congestion of the gland and vesical neck. From the prolonged backward pressure and passive hyperemia the veins become much distended and congestion or even inflammation of the mucous membrane of the bladder follows. The prostatic plexus of veins receives most of the return blood from the bladder, hence the relief of congestion in the former would be followed by a like result in the latter. It has been shown by the researches of a number of writers, prominent among whom

¹ *Loc. cit.*

² *Loc. cit.*

are Guyon and Albarran, that in a healthy condition the mucous membrane of the bladder is able to resist the irritant effects of pyogenic bacteria in the urine. If, however, the resistance of the mucosa is lessened by the presence of congestion and by distention of the walls of the bladder, the same influence is apt to establish cystitis. The infectious microbes are carried into the bladder by instruments that have not been properly sterilized, or they are transferred from the anterior urethra at the time of catheterism. The micro-organism commonly found is the bacillus coli communis. Cystitis also develops independently of the use of instruments, but in one way or another is very apt to occur sooner or later in these cases. The decomposition of the mucus and other organic matters in the urine results in the breaking up of the urea and the formation of ammonium carbonate, which acts as a powerful irritant to the mucous membrane, but, as indicated, it is the result and not the cause of cystitis.

We know that the tendency of healthy tissues is to resist the invasion of micro-organisms and their poisons, or to throw them off if they have already gained access. The most rational method of relieving an infected bladder, therefore, is to place it in as healthy a condition as possible. If the engorged vessels have an opportunity to empty themselves and the bladder to evacuate its contents regularly and completely, it is reasonable to suppose that the morbid process would be arrested, the mucous membrane would be restored to a healthy state, there would be no residual urine to undergo decomposition, and a cure would thus be effected. Fels and Ritter were able to produce cystitis in dogs by inoculating their bladders, but only on condition of ligating the urethra; upon loosening this ligature the bladder promptly resumed its condition of health.¹ The shrinkage of the prostate that follows castration seems to be the "loosening of the ligature" in the majority of these cases.

Diminution in the Length of the Urethra.—This is not brought about, as some suppose, by relieving an over-distended bladder. Finger's observations² show that the urethra is shortened when the bladder is overfull. In the cases in which the length of the urethra has been recorded the measurements before operation were usually taken with the bladder full, and after operation when it was comparatively empty, so that the decrease was actually greater than the measurements indicated.

Return of Vesical Contractility.—The return of power in the bladder is noted in 66 per cent. of the 111 cases first tabulated. The cases do not afford any information in regard to the particular class in which this may be expected. It occurred in some instances after several years of catheter life. Of 28 cases analyzed by Bruns,³ in which the catheter was used for from some months to two years, natural, voluntary micturition was restored in 22. The improvement was usually observed in the first week. Of 20 cases in which the catheter life had lasted from two to twenty years, 8 have been enabled by the operation to discard the catheter entirely, spontaneous micturition having been restored.

Vesical Calculus as a Complication of Hypertrophy.—Among the classical contraindications to litholapaxy are a high degree of cystitis and enlargement of the prostate sufficient to interfere with the introduction of the necessary instruments. As the crushing operation is coming more and more into favor with the surgeons who have had most experience with it, a distinct advance has been made if we are enabled to remove the obstacles just mentioned. In one case recently under Dr. White's care castration was

¹ Keyes: *Am. Journ. Med. Sci.*, June, 1894. ² *Gonorrhœa and its Complications*, 1894.

³ *Loc. cit.*

performed with a view of reducing the size of the prostate and of relieving the cystitis preparatory to litholapaxy, which was done soon after, with the greatest satisfaction to the operator and to the patient. The patient was advanced in years and somewhat feeble. He was kept in bed but a few days after each operation instead of some weeks, which would have been necessary if cystotomy had been performed, and in addition it is quite probable that he will be more comfortable the remainder of his life by reason of having been relieved from the enlargement of the prostate to a greater degree than would have followed cystotomy. This experience was so successful that it was repeated in other cases, and will be resorted to in all appropriate cases in the future until a more satisfactory method of treatment shall have been described.

Permanency of the Results.—The successful cases among those tabulated in the *Annals of Surgery*, July, 1895, were grouped as to the time of report into three classes: (1) Those reported immediately after operation—that is, within the first two or three weeks, and from which nothing further has been heard; these comprised but 8.7 per cent. (2) Those in which from a month to three months elapsed before the patient passed from observation, and in which the prostatic changes and the improvement in symptoms were carefully noted; these amounted to 20 per cent. (3) Those observed after three months, and in which the local changes seemed to have reached their culmination and the health of the patient appeared to be permanently re-established; a total of 71.3 per cent. These figures, taken in conjunction with the knowledge of the manner in which the relief had been brought about, seemed very satisfactory. It is not reasonable to suppose that an organ which has once undergone atrophy would again rapidly enlarge. If it was a question of simply the relief of congestion, one could imagine a return, but it has been shown that castration is followed by a true involution of the prostate. We have, however, more recent evidence. Dr. Francis L. Haynes of Los Angeles, Cal., who performed the first castration for enlarged prostate in this country, reports that his patient remains well now more than two years after the operation. The condition of several cases has been reported between one and two years after operation. In this connection Dr. Cabot¹ has given important evidence. He says: "In the effort to obtain data upon this point I have written to the operators mentioned in Dr. White's table, whose cases were reported but a short time after operation. I received answers from twenty-seven out of forty-one addressed, and most of the reports were favorable."

Mortality.—In discussing this subject it will be necessary to take into account the feeble condition of these patients, the damaged kidneys which are so frequently associated due to the prolonged backward pressure, and the resulting infection. In the 111 cases referred to, which include nearly all of those operated upon up to the time of the report, counting all the cases that died after operation, the mortality is 18 per cent.; excluding 10 cases that clearly did not die from the operation, the legitimate mortality is 7 per cent. Even in most of the fatal cases a distinct amelioration of the urinary troubles was noted before death. It seems more fair to say that the operation failed to save life than that it was the cause of death. Barring the influence of the ether, castration *per se* should have an exceedingly small death-rate, but if the operation is performed on patients already in an advanced state of uremia or toxemia, with kidneys barely able to discharge the duty they have to perform, and entirely incompetent to withstand any additional strain whatever, a certain mortality must always be expected.

¹ *Loc. cit.*

This proper revision of statistics has been objected to, but it is evident from the reports, and it is a matter of personal knowledge to the writers, that a number of these patients were castrated when on the verge of the grave, simply because the operation was so trifling and could be done in a few moments, with little or no ether, while any other operative procedure would not have been considered. For this reason it was and is proper to exclude from the estimates of mortality *due to the operation* many cases that were manifestly practically moribund when the testicles were removed.

Cabot says, following this line of thought, "It may be urged that the simplicity and ease of the operation have led some men to castrate patients so desperately ill that a more severe operation would not have been thought of. This is doubtless true; but we must remember that in the earlier days of prostatotomy and prostatectomy these also were looked upon as operations to which one must be driven by the extremest needs; and the first cases were therefore very unfavorable." But this is again an unfair comparison. It can scarcely be doubted that many cases have been subjected to castration that even in the earliest days of the other operations would have been considered too ill for operative interference.

This cannot be too strongly insisted upon if it is desired to obtain a fair comparison of castration with the various forms of prostatectomy.

The justice of this will be still more apparent when we consider the after-effects of the two operations. In the vast majority of cases of castration the patient may be allowed out of bed in from three days to a week, and the wounds will be healed in from seven to ten days. The patient would therefore be said to be "well" as far as the operation was concerned, and death due to accident or other causes after this time cannot be said to be due to the operation.

On the other hand, after prostatectomy the patient is obliged to remain in bed several weeks. Every surgeon is familiar with the various complications and the general break-down that frequently occurs in old patients from long confinement to bed, and an operation that requires this detention in such a class of cases will necessarily have a correspondingly greater mortality.

In Dr. Cabot's table of 99 cases 20 are recorded as having died (about 20 per cent.).

Among the fatal cases that have been charged to castration are:¹ "death due to uremia one year after operation." Another in which death occurred on the fifth day, "not as the result of the operation, but of the condition of the patient, which was very bad;" this was manifestly not a proper case for operation. One patient, aged eighty years, appears to have died of the changes inseparable from senility. He had frequently been "out of his head" before the operation, and was plainly not a case of which much could be expected from any form of treatment. In another case the surgeon operated against his own judgment at the urgent demands of the patient. Another patient, aged seventy-seven, is said to have developed senile dementia about a month after operation and died at the end of another month. The autopsy in one case revealed a right kidney three times the normal size and the left kidney the size of a hen's egg; the left ureter was occluded. Another is said to have died some days after operation of "chronic uremia," and was presumably uremic at the time of operation. In one instance a distinguished surgeon had advised against the operation. One patient died of perforation of the bladder and general suppurative peritonitis. This result could scarcely be attributed to castration by the greatest stretch of the imagination. One developed acute

¹ Cabot: *Annals of Surgery*, Sept., 1896.

mania thirty-six days after operation. There were evidences of pyelitis in addition to great enlargement of the prostate and chronic cystitis. Another died of gangrene of the right leg "from occlusion of the popliteal," which could not have been due to the castration.

In endeavoring to arrive at the true mortality of castration in properly selected cases, in contradistinction to that of the operation in cases that are too far advanced to admit of any other form of treatment, or who are *in extremis*, most or all of the cases mentioned may be legitimately deducted from those who died as a result of the operation. Deducting those cited, the mortality in Dr. Cabot's table would be 10 per cent. instead of 20 per cent.

We have collected 107 cases of castration, not included in the tables of White or Cabot. The number of deaths were 12 (11 per cent.). They were as follows: exhaustion 3; 1 became septic from his pyuria and died, but was improved by the operation; 1 died on the twenty-second day of pyelonephritis; 1 died of surgical kidneys—the reporter says the patient "should not have been operated upon;" 1 died on the fourth day of suppression of urine; 1 had a perineal section for drainage three weeks after castration—the cause of death could not be determined; 1 died of cerebral hemorrhage; 1 of fatty degeneration of the heart; 1 died five or six weeks after operation—there were infection of the wounds and secondary deposits; the autopsy showed pyelonephritis; 1 was subjected to suprapubic lithotomy one week after castration, and died eight days later.

It is clear that in estimating the mortality of this operation several of these cases must be thrown out—the 2 cases subjected to a second serious surgical attack and the patient who died of cerebral hemorrhage. This reduces the mortality to 8.5 per cent. If the cases had been *carefully selected*, the figure would be below 5 per cent. We desire to emphasize this point. Before operating for carcinoma, for example, every aspect of the case is considered. If it is thought that the patient will not survive the operation, the surgeon very properly declines to interfere. Mark the difference in many cases of hypertrophied prostate. The patient has absolute retention, catheterization is very difficult, and is followed by profuse hemorrhage; the patient is nearly exhausted from suffering, loss of sleep, etc.; he is probably septic, he begs for relief; the surgeon advises castration, as it is a minor operation. The patient does not recover; the mortality is raised. This is not a proper basis from which to judge any surgical procedure.

In a few cases some form of nervous disturbance is reported to have followed castration. Surgeons have long been familiar with a form of mania which, for want of a better term, may be called "post-operative," that sometimes develops after any form of operation. In our personal experience we have not observed any permanent mental change after castration. We are inclined to accept the view of Hughes¹ that "the causes that made the operation necessary of themselves lead to degenerative changes in the nervous system, and of course the psychological effect of the surgical procedure must be considered." He states that the chief causes of these disturbances at this time seem to be "constitutional neuropathic decadence and hereditary neural instability."

It is true the question of "mania" or other mental disturbance as a remote result of the removal of the testicles must be considered. It seems, however, that those who see in mania after castration the relation of cause and effect have not made out their case. Some of these patients are said

¹ *Kansas City Med. Index*, xiv. 1893.

to have been "out of their heads," "subject to such spells," "mental condition feeble," "patient in a peculiar mental state for a long time," etc., before the operation. This is doubtless due in most cases to degenerative changes in the coats of the arteries—an arterio-sclerosis—which results in softening of the brain, renal insufficiency, and degeneration of the viscera generally. One patient is said to have developed "acute hysteria," one became melancholic, another unconscious on the eighth day and died on the fourteenth day. One patient was excessively nervous and begged for the operation. After operation he "remains nervous and despondent." The mental condition noted in some of these and in other cases was due, in all probability, to the previous condition of the patient, to suppuration of the wounds and the accompanying fever or septic absorption, or to uremia. Certainly none of the cases so far described show conclusively that there is a liability to any peculiar change of the mental condition after castration. Besides, the following facts negative this idea: Castration in earlier life, when the individual is still in good health, has not been observed to cause any change in the patient; oöphorectomy is not followed by mental deterioration except in the rarest instances, nor is castration in animals.

In a discussion on "The Relation of Nervous Disorders in Women to Pelvic Disease," Weir Mitchell says:¹ "Both Goodell and I have long suspected that insanity after operations is sometimes due to the anesthetic, since twice we saw it follow operations of quite a trivial nature."

Albarran,² who has carefully studied the effects of castration in enlargement of the prostate, discusses the results of the operation from the double point of view of the size of the gland and the contractility of the bladder:

I. *Effect of Castration on the Volume of the Prostate.*—There is in most cases a true atrophy of the gland demonstrable by rectal examination. Sometimes this progresses until the gland becomes very small in size; in other cases the decrease in size is less marked; occasionally atrophy does not seem to occur at all, or takes place after some weeks. Albarran observed a case in which no change had occurred at the end of a month, but a marked decrease in size had taken place at the end of four months.

Immediately after the operation there is always the relief afforded by the decrease in the congestion of the parts, which occurs also, as Guyon has pointed out, after bilateral section of the vasa deferentia. Of itself, alone, congestion can increase the size of the prostate at least a third. The lessening of congestion causes diminution in the size and consistence of the prostate and frequently relieves the urinary symptoms a few hours after the operation.

II. *Effect of Castration on Vesical Contractility.*—The relief of the congestion seems to give new power to the bladder muscles. This is, according to Albarran, the explanation of spontaneous urination in one of his own cases four hours after operation, when it had been impossible for six months before; in Eastman's case after twelve hours, after having retention for a year; and in Horwitz's case after retention for five years.

Castration acts differently on vesical contractility according to the case.

(a) In hypertrophied prostate with dysuria, but without retention, the frequency of urination at once diminishes. In 13 cases this improvement came in the first two days, though sometimes it was delayed for a week to two weeks, and in one case for five weeks. In but one case was the function of urination unimproved six weeks after operation. There has been no recurrence in the

¹ *University Medical Magazine*, March, 1897.

² *Annales des Maladies des Org. Genito-Urin.*, Dec., 1895.

cases observed by Albarran, though one patient was seen fifteen months after operation.

(b) Hypertrophy with acute retention. In these cases relief comes from diminution of the congestion. In 13 cases one urinated spontaneously at the end of eight hours; the others after two or more days, just about as in the cases of this kind treated by catheterization alone.

(c) Hypertrophy with incomplete retention of urine. Here not the lessened congestion, but the gradual diminution in the size of the prostate, brings relief. Vesical tone gradually returns. In a case in which observations with the manometer were made before the operation, 300 grams of liquid were injected before reflex contraction of the bladder was aroused, and then the contraction lasted but a very short time. Three months after castration manometrical observations showed that 180 grams sufficed to cause the bladder to contract, and the contraction was vigorous; the force increased gradually as more liquid was injected.

In 24 cases of this class operated upon there was one death. All the others have had a notable amelioration of symptoms.

(d) Hypertrophy with complete chronic retention of urine. In these cases, after castration, there may be extremely rapid improvement, and even complete cure, which shows that there has been but little sclerosis of the vesical muscle. In one of Albarran's cases of this kind the prostate could not be felt by the finger in the rectum four months after the operation. Though there have been a number of deaths in patients of this class, they have been due, not to the operation, but to the preceding infection of the kidneys consequent upon the accumulation by stasis of urine in the bladder.

With regard to the mortality, Albarran finds 22 deaths in 135 cases (16 per cent.), but thinks this large mortality ought not to deter operators in *properly selected cases*, as in most of the fatal cases death was inevitable anyhow.

"There are," he says, "in surgery, general contraindications to every operation of any gravity. If these had not been neglected this lamentable mortality need not have resulted." As to precise indications for castration in hypertrophied prostate he would hesitate to speak. The question is open for study. At present he would not operate in cases of dysuria without retention nor in acute retention, but would treat them by the ordinary methods. He would suggest it in chronic retention, complete or incomplete, when catheterization does not suffice to cure or the passage of the catheter is habitually difficult.

The operation will have its best chance of success when manometric examination of the bladder shows that the vesical muscles still retain their contractility, although it may prove that this contractility has been considerably lessened and is not very persistent in its action.

Removal of One Testicle.—The objection to castration met with in a certain proportion of cases, whether from sentiment or from the fact that the testicles have not lost their function, has led to the suggestion of removing one testicle only. The evidence regarding the value of this procedure is conflicting. Fenwick¹ reports 20 cases in which one testicle was undescended, had atrophied, or had been removed. The examination of the prostates in these cases did not show any constant results. In some cases the lobe of the prostate corresponding to the testicle which had atrophied or had been removed was equal in size and consistence to that of the opposite side; in some cases it was smaller, and in others larger than its fellow. The

¹ *Brit. Med. Journ.*, 1895.

same statement applies to other cases that have been reported. There have been fewer observations in cases of hypertrophy of the prostate. The reports seem to show, however, that in a certain proportion of cases the removal of one testicle will be followed by a reduction in the size of the corresponding lobe of the prostate, or of the entire gland. In a personal communication¹ Dr. Horsley of Staunton, Va., reports having removed one testicle on account of a cystic condition in the case of a man who was also the subject of enlargement of the prostate. A rectal examination at that time showed that the prostate was considerably enlarged. The patient was obliged to rise several times during the night, and he complained of dysuria. Three months after the operation the prostate gland was found to be considerably smaller, particularly on the left side. The patient also reported that he had very little trouble in urinating, and as a rule did not have occasion to empty the bladder after bedtime.

Euren has² had very good results from the ablation of a single testicle in cases of prostatic hypertrophy. In patients under seventy years of age, and in whom urinary retention is not extreme, he thinks that the removal of a single testicle selected, if possible, with due reference to the lobe of the prostate that most interferes with urination, may suffice. He performs this operation under local cocaine anesthesia. In two of his cases digital examination *per rectum* some time after operation showed that the half of the prostate corresponding to the removed testis was softer and smaller than that of the opposite side.

Whether removal of a single testicle will induce atrophy of median enlargements is still an open question. This portion is probably equally influenced by each testicle. A case in point is reported by Moullin:³ The patient was nearly sixty years of age, and to all intents and purposes a monorchid. Shortly after birth the left testis had been subject to a proceeding similar to bistournage and had wasted in consequence. The patient complained of symptoms characteristic of median valvular enlargement of the prostate. The residual urine amounted to 10 or 12 ounces. As long as the patient was lying down and made no particular effort, micturition was easy. If he stood upright, and especially if any vigor was thrown into the attempt, the stream would stop abruptly. Examination by the rectum showed but little change in the apparent size and relations in the prostate. The prostatic portion of the urethra was more than two inches in length, and a metal catheter could not be passed without depressing the handle to a very considerable extent. A median perineal urethrotomy was performed and a pedunculated growth nearly the size of a pigeon's egg was found hanging in the orifice of the bladder and acting like a ball valve.

The removal of one testicle has the merit of being less objectionable to many patients than removal of both testicles, and from past experience we may expect sufficient relief in a fair proportion of the cases. To obtain the best results the conditions should be carefully studied with the view of determining the side upon which to operate. In case of failure we may still operate upon the other side.

Operations upon the Vas Deferens.—In the discussion that followed the proposition to remove the testicles for the relief of the conditions incident to hypertrophy of the prostate, a number of suggestions were offered as a substitute in order to avoid the sentimental objection to the operation of cas-

¹ *University Medical Magazine*, March, 1896.

² *Upsala Läkareforenings Forhandlingar*, Dec. 23, 1895.

³ *Lancet*, London, Feb., 1896.

tration. Among these may be mentioned ligation or section of the vasa deferentia, section of the nerves of the cord and ligation of the arteries supplying the testicles. The most important of these are the operations upon the vas. It appears, however, that the procedure was not entirely new. R. Harrison reports¹ having divided the vasa deferentia in a case of prostatic enlargement as a compromise for castration, which the patient had earnestly requested. The patient is said to have been alive and well six or seven years later. It seems strange that this very happy outcome of so simple an operation should have passed unnoticed until the present time, particularly in view of the fact that we had no satisfactory means of affording relief to this large class of sufferers.

In 1894, in a series of experiments on dogs, the vasa were ligated or divided with the view of determining the effect upon the normal prostate.² The results show that there was a constant loss of weight in the prostate of every dog that died eight days after the operation or later. In the dogs that were kept alive for fifty-two days the atrophic changes were unmistakable. These results were obtained without any particular change in the testicles, so far as could be observed.

The experimental evidence on this subject is somewhat conflicting. Curling³ concludes from his studies that obliteration of the vasa, whether congenital or the result of disease or other lesion, does not as a rule affect the development of the testicles. Griffiths⁴ found, after ligating the vasa deferentia in young dogs, that the testicle developed normally, and after a passing swelling of the epididymis did not show any changes in structure or in the production of spermatozoa. Leguen,⁵ after ligating the vasa, did not observe any change in the testicles at the end of from two to five months. Przewalski⁶ has arrived at the same conclusion.

These observations are in accord with the experiments above referred to.⁷ On the other hand, Alessandri⁸ in similar experiments observed atrophy of the testicle and epididymis. The parenchyma showed fatty degeneration and connective-tissue overgrowth.

Burnett⁹ observes that obliteration of the ejaculatory ducts happening in childhood causes arrest of development of the prostate and seminal vesicles, without affecting the testicles. In support of this he cites the case of a man thirty-five years of age upon whom lateral lithotomy had been performed thirty years before. The ejaculatory duct was injured at the time and became closed from cicatricial contraction. The testicles were found to be normal and the sexual power was not affected, but there was no discharge of semen. The seminal vesicles could not be felt, and the prostate was said to be smaller than would ordinarily be found in a boy ten years of age. Pavone¹⁰ reports the result of his experiments on dogs with removal of one and of both testicles and of bilateral ligation and resection of the vasa deferentia. He observed atrophy after all three procedures; in conclusion, he recommends ligation and excision of the vasa for prostatic hypertrophy.

Przewalski¹¹ concludes from his experiments on dogs that the effect produced on the prostate by these operations is brought about by the division of Cooper's nerves, which were accidentally severed in the course of the ope-

¹ *Brit. Med. Journ.*, Sept. 23, 1893.

³ *Diseases of the Testicles*, London, 1866.

⁵ *Semaine méd.*, No. 52, 1895.

⁷ White: *loc. cit.*

⁹ *Journ. Cut. and Genito-urin. Dis.*, No. 9, 1895.

² *Annals of Surgery*, July, 1895.

⁴ *Lancet*, April 13, 1895.

⁶ *Vratch*, Nos. 41 and 43, 1895.

⁸ *Il Policlinico*, No. 9, 1895.

¹⁰ *Il Policlinico*, No. 11, 1895.

¹¹ *Vratch*, Nos. 41 and 43, 1895.

ration. He states that the double-sided section of the *plexus deferentialis*, either with or without section of the vasa deferentia, caused atrophy of the prostate.

The particular method of dealing with the vas, whether simple ligation be performed, or ligation with division, or double ligation with resection, seems to be a matter of indifference as far as the result is concerned. Helferich practised evulsion of the vasa, but gave it up as an unnecessarily violent procedure.

In all of these cases the symptoms have been more or less relieved, and in some to a marked degree. Bruns¹ has analyzed 11 examples with the following results: In 4 there was decrease in the size of the prostate after three, six, and eight weeks. In 2 the gland was reduced to one-half the size it was before the operation, and in 1 case could not be felt. In 3 instances no change was noted in the size of the prostate at the end of two months, but there was an improvement in the function of the bladder. The urinary symptoms were cured in 2 cases, although no change in the prostate was noted. Finally, in 2 cases no change whatever was observed.

We now have records of some 100 cases of operations on the vas for prostatic hypertrophy. Of these, 8 died (8 per cent.); 59 (59 per cent.) are said to have been more or less improved; in some cases complete relief was experienced. In 21 cases (21 per cent.) the prostate is said to have become smaller after the operation. The testicles were found to have undergone atrophy in a few cases only.

The results in the cases collected by Pavone² and Herhold³ are better than those just given. The former reports 34 cases: of these, 4 (12 per cent.) died, 2 (6 per cent.) were not benefited, and 28 (82 per cent.) were cured or improved. Herhold adds 3 cases to 41 previously reported. Of these, 30 (70 per cent.) are said to have been entirely relieved of their troubles. Drézigni records⁴ having performed resection of the vasa deferentia in 22 cases, with notable improvement in each case.

It will be seen that the mortality after this operation is about the same as that after castration, while the chances of relief are less. Vasectomy should be advised in certain cases in which castration is refused, and in those of the milder type as the best alternative.

The only untoward result that has been recorded was a troublesome and imperative desire to urinate, accompanied with severe pain and tenesmus, in the beginning of the improvement, in one of Helferich's cases. This was also observed in two of Dr. White's patients. It disappeared gradually in both.

A few cases of mental disturbance have been observed after vasectomy; all recovered, however.

The advantage that vasectomy offers is one of sentiment in those cases that object to castration. Against this possible advantage there is the probability that the same benefit will not be secured as would be followed by castration, and the relief is less rapid. Guyon says of excision of the vasa: "Although this operation cannot pretend to affect a radical cure of hypertrophy of the prostate, as does that of total castration, yet it may take rank among those measures addressed to certain complications of prostatism." Wider experience leads us to recommend the operation with more confidence than at first seemed justified.

¹ *Separatabdruck der Mittheilungen aus den Grenzgebieten der Medizin und der Chirurgie*, verlag von Gustav Fischer, in Jena.

² *Il Policlinico*, No. 15, 1896.

³ *Deutsches med. Woch.*, June 14, 1897.

⁴ *Bull. méd.*, Jan. 3, 1897.

Operation.—The vas is so superficial and so easily reached that it may readily be exposed by means of local anesthesia secured by hypodermic injections of cocaine, by the Schleich method, or by the spray of ethyl chloride. The vas will be recognized by its cord-like hardness when rolled between the finger and thumb before operation, and by its white, glistening appearance after making the incision. In the present state of our knowledge it does not seem to be a matter of importance just how the operation is concluded if the canal be obliterated. Some employ a simple ligature, others divide the vas between two ligatures, and still others remove a greater or less portion of the duct after having tied it on both sides.

Isnardi,¹ who has performed this operation in 14 cases, believes that the failure to secure beneficial results is due to the fact that after the ligation and section of the vas obliteration of the distal stump does not occur, which he thinks it is necessary to secure in order to bring about atrophy of the prostate. He therefore recommends that the distal end of the divided vas be fixed in the skin wound and cauterized repeatedly (on the third day with 1 per cent. nitric-acid solution to set up a funiculitis).

Harrison adopts the following method :² “The scrotum having been shaved and prepared antiseptically, the tube is carefully sought for as it enters the scrotum. It is then held subcutaneously in position between the finger and thumb ; a vertical incision through the skin is made over it to the extent of an inch or so. The spermatic cord having been recognized, the vas is separated from the other constituents by the finger and probe by merely carefully teasing away the connective tissue about it. In doing this care should be taken not to drag on the testicle too much, but to support it whilst a loop of vas is detached, so that the connections of the former may not be loosened. The vas should be well cleared of all other tissues, and then a loop is gently drawn through the wound with a blunt hook. The loop is next encircled below the hook with a silk ligature, which is tightly knotted. The ligature is cut short, the extraneous portion of the vas removed by seissors, and the pedicle dropped into the wound, which is closed with one or two sutures.”

In performing vasectomy we have found it convenient to isolate the vas from the other structures of the cord by manipulating between the fingers and thumb and thrusting a hare-lip pin through the scrotum beneath the vas, which is thus fixed and does not escape in the succeeding steps. It is thus possible to operate through a one-quarter or one-half inch incision.

Miscellaneous Operations upon the Cord.—With the view of exhausting this line of thought as nearly as possible, the effects of other operations upon the cord have been studied.³

In a series of dogs all of the structures of the cord were ligated, and, in addition, in some instances divided between two ligatures. The testicles, as might have been expected, sloughed in almost every instance. The prostate was found to have undergone atrophy without exception, the changes being as unmistakable as though primary double castration had been performed. It is possible that sloughing would not be so constant after this operation in the human subject, as the details of asepsis and of the after-treatment of the wound could be so much better regulated than in the case of dogs. It is certain, however, that sloughing would be very commonly met with. The venous and lymphatic channels both being obliterated, absorption could not occur, as the testicle underwent atrophy and moist gangrene would result.

The same remarks apply, but to a less extent, to ligation of the vascular

¹ *Semaine méd.*, No. 64, 1895.

² *Lancet*, London, Feb. 22, 1896.

³ White : *loc. cit.*

structures of the cord. The possibility of sloughing of the testicles would be present in every case. Beneficial results may be expected if atrophy of the testicles can be secured, but it would be impossible to tell in a given instance just how many vessels could be ligated without endangering the vitality of the testicles.

The value of the division of the nerves of the cord is still an open question. A series of observations were undertaken with the view of determining this point, but it was found that the nerves in the dog were so small and difficult to find that the idea was abandoned. Some writers, among whom is Przewalski,¹ believe the effect upon the prostate of the various operations described is due to the division of Cooper's nerves. He claims to have secured atrophy of the prostate in dogs after resection of these nerves. The result seems to have been as pronounced in the cases in which he performed the simple resection of the nerves as in those in which the vas deferens was divided in addition. The subject needs further investigation. At present it can only be said that with the much greater security of beneficial results following one of the operations upon the vasa deferentia the latter should be selected if for any reason castration is declined by the patient or, in the opinion of the surgeon, undesirable.

Ligation of the Internal Iliac Arteries.—The fact that ligation of the uterine arteries was sometimes followed by atrophy of fibroid tumors of the uterus led Bier² of Kiel to practise ligation of the internal iliac arteries for hypertrophy of the prostate. Although Bier's cases were improved by the operation, the result is obtained at too great a cost. In the first case the operation was attended with a great deal of difficulty and consumed considerable time. The patient died of septic peritonitis on the third day after the operation. Although the operation was said to have been easily performed in his subsequent cases, it must be admitted that difficulty would occasionally arise. Surgeons generally have not been willing to perform this operation.

Further, the operation is not parallel with that of ligating the uterine arteries for fibro-myomata, for in this case simply the blood-supply to the affected part is cut off, while in the ligation of the internal iliac arteries the vessels going to important structures beside the prostate are obliterated.

Meyer³ has performed this operation in 3 cases with the following results: "One patient was only partially improved, one died of unknown cause seven days after the operation, and the third has not been improved at all."

The author believes, however, that the operation has a field of usefulness. He prefers the extra-peritoneal method. He adds: "In view of the brilliant functional results after castration, also after resection or division of the vas deferens, I should say to-day, 'Bier's operation seems to be indicated only in patients below the fiftieth to sixtieth year with absolute retention due to the hypertrophied prostate, who are tired of catheter-life, but refuse to lose one or both testicles, and are unwilling to become sterile, in spite of the probability of an otherwise undisturbed power of sexual intercourse.'"

Resume.—In the early stages of prostatic hypertrophy, when there is slightly increased frequency of micturition, which may be either nocturnal, diurnal, or both, some hesitation in starting the stream and diminution in its force, in conjunction with moderate enlargement as detected by rectal examination, it is sufficient to place the patient upon a proper diet, and to regulate the habits so as to avoid, as far as possible, all conditions which give rise to

¹ *Vrach*, Nos. 41 and 43, 1895.

² *Wiener klin. Woch.*, No. 32, 1893.

³ *Annals of Surgery*, June, 1896.

prostatico-vesical congestion. In addition, the introduction of full-sized steel sounds once or twice weekly for a long period should be recommended. The latter has seemed in many cases to relieve the mild symptoms of the early stages of enlarged prostate and to postpone for a long time at least further trouble. Small doses of ergot, continued for a long period, will be useful in certain cases by reducing the prostatic congestion, and strychnine should be administered to tone up the vesical wall.

If, in addition to the symptoms already mentioned, or if they are present in a more aggravated form together with three ounces or more of residual urine, regular catheterization should be employed in addition to the measures already described. The frequency will depend upon the amount and the character of the residual urine. If the urine be sterile, the catheter should be used once daily if the quantity amounts to three ounces, twice daily for six ounces, and once more for each additional two ounces. If there be cystitis with ammoniacal urine, the irritability of the bladder may require the more frequent use of the catheter. In these cases it is well, after drawing off the urine, to irrigate, at least two or three times a day, with some antiseptic fluid—viz. boric-acid solution, 10 grains to the ounce; silver nitrate, beginning with 1 to 10,000 and gradually increasing the proportion; corrosive sublimate, beginning with 1 part to 50,000 and cautiously adding to the strength; or potassium permanganate, beginning with 1 to 10,000. The bladder will be found to become more tolerant to these remedies after they are used for a time, and as there is in some cases an idiosyncrasy, it is better to err in the direction of having the fluid too weak than too strong.

If this treatment has been carefully carried out without relief, or if the frequency of urination increases, if the cystitis grows worse, and particularly if the introduction of a catheter becomes more and more difficult and painful, some form of radical treatment will become necessary if we wish to prolong the life of the patient. We have to select between prostatotomy, or simple bladder drainage, some form of prostatectomy, and castration or one of its substitutes. We are not yet in a position to dogmatize in this matter. The particular conditions present will usually indicate one or other of the procedures mentioned. We believe that the fields of prostatotomy and prostatectomy have become very much restricted during the last two or three years. If we are satisfied that we have to deal with hypertrophy confined principally to the so-called "middle lobe," and if the condition of the patient is such as to warrant incurring the risk of a major operation, suprapubic prostatectomy would be, theoretically, the operation of choice. The mortality of this operation, according to the most recent statistics, is about 20 per cent.

If the lateral lobes are prominently enlarged, they cannot be dealt with in this way, and the combined suprapubic and perineal operation seems an unnecessarily severe attack when we have at command less serious and more efficient means. The simplest of these, and that which we believe we are justified at the present time in advising, is ligation or excision of the vasa deferentia. This of course would render the person sterile, but that could hardly be urged as an objection at the time of life at which prostatic hypertrophy is met with. It would be entirely proper, if the condition of the patient was not too urgent, to operate on one side only, as has been recommended by Mr. Reginald Harrison,¹ when if the symptoms do not improve the procedure may be repeated on the opposite side. This method would be particularly applicable if it could be determined that one side of the gland was more enlarged than the other.

¹ *Lancet*, London, Feb. 22, 1896.

In more advanced cases, in which it is necessary to secure relief without delay, or if the last-named operation has failed to give relief, castration offers by far the best chance of bringing about a rapid and permanent amelioration of the urinary symptoms. In comparison with prostatectomy castration has a lower mortality, the proportion being as 20 to 7.1 In addition, the relief after castration and the return to the normal, local, and general conditions have been, in the successful cases, much more rapid and complete than after prostatectomy. The convalescence from the operation occupies a much shorter time; the annoyance of a urinary fistula which may become permanent is avoided; and relapse after castration has been recorded much less frequently than after prostatectomy.

As was mentioned in speaking of the previous operation, if the age of the patient or other conditions makes the removal of both testicles objectionable, the operation may be done on one side only. This has been particularly urged by Euren.¹ In 3 patients so operated upon the results were entirely satisfactory. In a fourth case it was necessary to remove the second testicle before relief was afforded. Euren thinks, however, that if, in this case, the last testicle had been removed first, a satisfactory result would have been obtained without the second operation. Digital examination per rectum showed in 2 cases atrophy and a softer consistence on the side of the prostate corresponding to the testicle removed. He performs the operation under cocaine anesthesia. He believes with Esmarch that these patients should be kept at rest for about a month before active exercise is allowed, in order to secure proper involution of the prostate.

Finally, if the patient is sixty-five years of age or older, and if the obstruction is complete or nearly so, if catheterization is very difficult, and if there is a high degree of cystitis, castration is undoubtedly the operation of choice.

Fenwick² concludes that double castration will prove of value in the following conditions: (1) In reducing bulky overgrowth of the lateral lobes of the prostate: it may be found that the small tough fibrous median or lateral vesical outgrowths will be better removed by suprapubic prostatectomy; (2) in controlling the distress and danger of an inflamed, senile, enlarged prostate; (3) in lessening the frequency or difficulty of introducing the catheter in advanced or confirmed catheter-life; (4) in avoiding the mechanical difficulty of crushing a post-prostatic or a post-trigonal stone by levelling the base of the bladder, thus rendering the operation of litholapaxy feasible in a condition in which before it was impracticable; (5) in reducing chronic cystitis and recurrent phosphatic calculus in cases of confirmed catheter-life.

Tuberculosis.—Tuberculosis of the prostate is said to be always secondary to deposits in some other portion of the genito-urinary system. Marwedel has contributed a very valuable article on this subject,³ in which the following statistics appear: In 35 cases of uro-genital tuberculosis the prostate was found affected 26 times (Simmonds); in 27 cases, 18 times (Oppenheim); in 15 cases, 14 times (Krzywicki); in 70 cases, 44 times (Collinet).

Rokitansky believes that as a rule tuberculosis of the prostate and seminal vesicles is secondary to deposits in the epididymis. From the prostate and seminal vesicles the disease involves the urinary organs, perhaps extending to the kidney. Virchow appears to favor the theory of the ascending involvement of these organs. Klebs has met with no case in which a descend-

¹ *Upsala Läkareförenings Förhandlingar*, Dec. 23, 1895.

² *Brit. Med. Journ.*, March 16, 1895.

³ *Zeitr. z. klin. Chir.*, Tübing., 1892, ix.

ing extension could be shown. On the other hand, Cohnheim claims that uro-genital tuberculosis is a descending disease—a disease of elimination; the virus, he states, is discharged through the glomeruli and may attack any point, but most frequently the pelvis of the kidney is affected. The disease, he claims, extends from the prostate to the testicles. Steinthal agrees with Cohnheim that uro-genital tuberculosis starts from the kidneys.

Orth says that in the majority of cases of tubercular disease of the testicle the infection has spread from the prostate and seminal vesicles. Weigert supports the view that tuberculosis is an ascending process, beginning either in the testicle or the prostate. Simmonds believes the epididymis is the point primarily involved. Orth admits an ascending infection; he states, further, that uro-genital tuberculosis very seldom begins in the prostate. Krzywicki states that his study leads him to believe that the prostate is mostly the central point from which the disease disseminates itself. He describes 15 cases in support of his view, in 14 of which the prostate was the seat of tubercular disease. The primary location in the prostate was shown by the presence of old cheesy deposits, while in the other organs the process was more recent. He points out that the prostate must play some rôle in uro-genital tuberculosis, either in its genesis or in the transfer of the disease from the genital to the urinary system or *vice versa*.

Uro-genital tuberculosis is, in the majority of cases, secondary to deposits in the lungs or in the osseous system; according to Hjalmar Heiberg, it is most often associated with the latter. Jani has found tubercle bacilli in the healthy prostates of phthisical patients. Given a tubercular patient, therefore, and a prostatic trauma, with a resulting *locus minoris resistentie*, a tubercular inflammation is apt to develop. Gonorrhœa may be in this manner an exciting cause.

A prostate the seat of tuberculosis may contain one or several cheesy foci, which may later break down and form an abscess, or in some cases the more fluid portion is absorbed and the resulting mass is encapsulated. In some cases the cheesy deposit becomes the seat of calcareous change and the lesion heals. Broca has reported a case in which nearly the whole of the gland thus became a calcareous mass. Klebs and Krzywicki claim that distinct miliary involvement of the prostate has never been shown, although it would seem that such might occur.

The disease is usually manifested by circumscribed cheesy collections or an abscess of the prostate. In the case of small abscesses it is possible that the pus might find its way out of the ducts of the glands. Larger abscesses are apt to break through the capsule and empty into neighboring organs, with the formation of fistulæ. The most frequent direction seems to be into the urethra, and next toward the perineum. Several cases are reported in which the abscess opened into the rectum; cases are on record in which the pus discharged above the pubis. Socin described a case in which the abscess opened into the abdominal cavity. Perforation upward behind the vesical sphincter is more frequent. In the late stages of tuberculosis of the prostate the bladder becomes extensively involved, as do also the seminal vesicles. The prostate is usually enlarged in these cases. Réclus describes a tuberculous prostate 64 mm. in diameter. Socin places the average maximum diameter at 44 mm. Lancereaux speaks of a case in which the gland was enlarged to five times its normal size. In rare cases there may be some diminution in size.

Symptoms.—This subject has not received the attention its importance deserves. Thompson devotes but a brief space to its consideration, and he

denies that tuberculosis of the prostate presents a characteristic symptom-complex. Perhaps one-third of the cases are either free from symptoms, or the inconvenience is so slight as not to attract the attention of the individual.

The first symptoms usually described are those belonging to a catarrhal prostatitis. There is slight irritation of the bladder, some increased frequency of urination, which is attended by burning pain; there is a sense of weight or of pain in the perineum: pain in the back and in the glans penis. There may be a muco-purulent discharge from the urethra. The disease usually occurs in anemic persons already the subjects of tuberculosis elsewhere. It may, however, develop in strong, apparently healthy individuals.

It is impossible to make a diagnosis in the early stages of the disease. The discharge is apt to be attributed to urethritis. Fever may be a late symptom, and may rapidly be followed by abscess and retention of urine. English points out that tuberculous individuals are predisposed to urethral discharge. Tuberculosis of the prostate does not appear to be accompanied by the peculiar mental depression that is frequently observed in chronic inflammation of this organ.

The disease begins, in the majority of cases, between the twentieth and forty-fifth years, which corresponds to the greatest activity of the genital apparatus, but pronounced cases have been observed in childhood and in old age.

Diagnosis.—A number of writers have called attention to the similarity that exists between the symptoms of prostatic tuberculosis and of vesical calculus. A consideration of the symptoms and the use of the sound will lead to a correct diagnosis. Hematuria may raise the question of a malignant tumor of the bladder or prostate. The presence of tubercular deposits in other portions of the body, the condition of the urine, and particularly if the latter contains tubercle bacilli, will usually be conclusive. In old age it may be attributed to simple prostatic hypertrophy, but the condition of the seminal vesicles, epididymes, etc. will materially assist in arriving at a conclusion. The tubercular nodule in the prostate is more circumscribed than is observed in simple enlargement. The absence of tubercle bacilli in the urine must not be considered as conclusive evidence that the disease does not exist. Guyon states that in cases of undoubted tuberculosis of the urinary organs examination fails to detect the bacilli in 50 per cent. of the cases. Marwedel claims, however, that in his cases the bacilli were found in every instance. The tubercle bacillus must be distinguished from the smegma bacillus, which has the same resistance to acids. It may be necessary to draw the urine carefully with the catheter or to make inoculations in guinea-pigs. The course of the disease depends upon the strength of the individual; usually the patient succumbs sooner or later to the local disease or its complications, or to general tuberculosis. That the disease may run a slow course is shown by the case of Mitscheilich's, in which the latent stage lasted sixteen years, the disease being relighted by an attack of gonorrhœa. The prognosis is not entirely hopeless, even after fistulæ have formed. A local and general cure is sometimes possible, usually, if at all, through surgical measures.

Treatment.—The disease can be best avoided by guarding against an attack of gonorrhœa or other influences that would induce a congestion or inflammation of the prostate. The general condition of the patient will usually require careful attention. Any indication for treatment that may exist is to be met with appropriate measures. In regard to the local affection authorities differ: some refrain almost entirely from local treatment. On the other hand, Berkeley Hill has introduced iodoform into the bladder and

speaks enthusiastically of its value. His formula is as follows: Iodoform, 2 parts; mucilage of gum arabic, 4 parts; glycerine, 2 parts; water, 20 parts. After washing out the bladder a dram of the mixture is introduced. The applications cause considerable pain, for which Hill recommends the use of cocaine or even ether narcosis. The omission of the glycerine was found to lessen the pain following the application. In some cases symptoms of iodoform-poisoning were noted. Balsam of Peru, in 2 to 3 per cent. emulsion, also acted well, and was found to be efficient in relieving the cystitis. Von Dittel has used iodoform, but without result.

It is important to avoid as far as possible all local irritation. Therefore, the use of urethral instruments must be discontinued or very carefully and infrequently employed.

It has been the custom to delay operation in cases of tuberculosis of the prostate as long as possible. In the light of our present knowledge of tubercular processes it would seem that earlier interference should be the rule. It is reasonable to suppose that a fair proportion of localized deposits in the prostate would heal up if removed with the curette and if proper drainage was secured. The prostate should be approached from the perineum by incision in the median line, going down layer by layer between the bulb and the rectum until the gland is reached. A bougie should be introduced into the urethra in order that it may be avoided. Some operators prefer a transverse or an elliptical incision in front of the anus.

Wickham and Desnos both advocate a trial of the sclerogenic method of Lannelongue, which consists in the injection of a solution of chloride of zinc around the area involved, after having made a perineal section.

Tumors.—Cysts are occasionally found in the neighborhood of the prostate. These may be either hydrops of the seminal vesicles, dermoids, or echinococcus cysts. More rarely they may result from dilatation of the sinus pocularis. Thompson refers to 7 cases of hydatid cysts between the bladder and the rectum near the neck of the former, which caused retention of urine. In 3 instances the condition very closely simulated that of prostatic enlargement, and in 2 the prostatic catheter was employed under the belief that this was the source of the trouble.

The **diagnosis** of these cysts, which usually cause retention of urine when they attain a sufficient size to disturb the relations of the urethra and bladder, would be made by excluding other causes of retention, other forms of tumor, by passing the catheter or sound, by rectal touch, etc. Usually it is possible to detect a fluctuating swelling in the rectum which has been mistaken for the distended bladder. Thompson reports the case of a boy nine years old who was supposed to have retention of urine. A trocar was introduced through the rectum for the purpose of relieving the supposed distended bladder, as no instrument could be passed by the urethra. The cannula withdrew not urine, but fluid from a cyst. The patient was cured. In a somewhat similar case Bryant made a rectal puncture without effect. He then made a perineal incision and evacuated an echinococcus cyst the contents of which measured three quarts.

Treatment.—As already indicated, this consists in withdrawing the fluid by means of a trocar and cannula or an aspirator through the rectum or by incision in the middle line of the perineum.

Carcinoma.—Carcinoma of the prostate is a rare affection. According to the statistics of Tanchou, it was recognized as a primary lesion 5 times in 1904 males who died of carcinoma. Of the entire collection of 8289 cases, the bladder was given as the seat of the disease 72 times, of which

one-half or more could very properly be said to have occurred in males. Many of these doubtless started in the prostate, involving the bladder secondarily, so that the 5 cases mentioned considerably understate the true proportion. The form of carcinoma met with in the prostate is the encephaloid. Thompson thinks the evidence of the occurrence of true scirrhus is wanting. He further states that no authentic case of malignant disease is on record between the ages of eight and forty-one.

In 28 cases of carcinoma of the prostate collected by Wyss there was carcinoma also of other organs—the kidney, testicle, greater and lesser omentum, vertebra, liver, lung, and pleura.

Two forms of the disease are described: (a) A circumscribed variety, growing slowly and remaining nearly or entirely limited to the prostate; (b) a diffuse, rapidly-growing variety, called by Guyon the “diffuse prostatopelvic” form.

Symptoms.—The symptoms of carcinoma of the prostate are those of prostatic obstruction from other causes, but they generally develop with greater rapidity. There is, however, as a rule, more acute pain in the perineum and rectum, in the course of the crural and ischiatic nerves, in the nates, the lumbar region and glans penis, more or less frequent hemorrhages, and sooner or later cachexia. The blood is frequently voided almost pure and either during or after attempts at micturition. In some cases the hemorrhage is almost continuous, communicating a bloody tinge to the urine, which is more pronounced at some times than at others.

The enlargement of the prostate when due to carcinoma is always hard at first, although some softening may take place at a later period. The outline of the gland may be regular or nodulated. The adjacent lymphatic glands sometimes become involved, and enlargement of those accompanying the iliac vessels or of those in the inguinal region, if observed, would be very significant. According to Wyss the inguinal, mesenteric, and retroperitoneal glands are relatively infrequently affected. In the 28 cases reported by him the inguinal glands were enlarged but 3 times.

The urine should be examined for the presence of fragments of tumor which may be found from time to time in cases of fungating growths. Pus is also frequently present in the urine.

Diagnosis.—Careful attention to the history and symptoms, together with the usual urethral and rectal examinations, will commonly lead to a correct diagnosis. The features which are most characteristic are the hardness of the prostate as felt by rectal touch, the severity of the pain and its wide distribution, and the rapid course.

As a rule, the troubles in connection with prostatitic hypertrophy are especially marked at the acts of micturition, while the symptoms of carcinomatous involvement are independent of urination.

If infiltration of the wall of the rectum or of the seminal vesicles is detected, the disease is probably carcinoma if tuberculosis can be excluded. If the person is not too corpulent and the bladder empty, valuable information may be obtained, by bimanual palpation under ether anesthesia.

The cystoscope may aid in clearing up a doubtful diagnosis in rare instances. It will be useless in the cases in which there is free hemorrhage, either spontaneous or induced by the introduction of an instrument.

Hematuria occurs in both hypertrophy and carcinoma, but is apt to occur earlier and to be more profuse in the latter.

If fragments of growth be found in the urine, they may be a valuable aid in arriving at a diagnosis. It is, however, generally admitted at the present

time that individual cells in the urine are in no wise characteristic. The different portions of the urinary passages furnish epithelial cells of all forms and sizes, which would make the detection of "cancer-cells" extremely doubtful.

It is doubtless true that a certain percentage of cases of enlargement of the prostate considered to be of senile origin have in reality been cases of malignant disease. The possibility of a prostate already the seat of hypertrophy becoming affected with carcinoma must also be borne in mind. Thompson has recorded an example of this condition, and Isnardi has reported an instance in which he performed ligation and division of the vasa deferentia for prostatic hypertrophy in a case which was later found at post-mortem examination to have been one of cancer of the prostate.

Treatment.—The treatment of carcinoma of the prostate will consist, in many instances, solely in meeting indications as they arise. It is desirable to avoid the use of urethral instruments if possible, but if there is retention it will be necessary to use a catheter, preferably one of the soft varieties, at regular intervals. If the pain is excessive, it should be allayed with opium or morphine. If the hemorrhage is profuse, the patient may be given the fluid extract of ergot, gallic acid, aromatic sulphuric acid, or some other astringent internally. At the same time, it is desirable to secure rest in bed, with the hips elevated on a thick pillow. Cold applications may be made to the hypogastrum and perineum, and cold rectal douches may be given or small suppositories of ice may be employed.

In rare cases it may be proper to attempt to remove the diseased gland. Küchler of Darmstadt advocates the removal of the prostate by median perineal incision or by going through the anterior wall of the rectum. After reaching the gland it is to be drawn downward with forceps, split in the middle line, and each half removed separately. It is necessary to introduce an instrument into the urethra in order that it may be recognized and avoided. Küchler has operated on the cadaver only, but is so convinced of the practicability of the operation that he says he shall employ it in the first suitable case that comes under his care. Billroth appears to have been the first to remove a malignant tumor of the prostate in the living. The patient did well after the operation. A recurrence could be detected two months later, however, and the patient died fourteen months after the operation. The whole course of the case was six years. The method of operation is not stated. Another case operated on by Billroth and recorded by Winiwarter, in which a median cystotomy was performed, lived but four days after the operation. Demarquay reports a case in which he removed the lower portion of the rectum, the prostate, the seminal vesicles, the fundus of the bladder, and nearly the whole of the membranous urethra for an extensive carcinoma of the prostate. The patient died at the end of seven days from peritonitis. Harrison reports a case operated upon by the median perineal incision that remained well for fourteen months after the operation, when the glands of the groin began to enlarge, and the patient died at the end of two months. Leisrunk operated in one case by making a semilunar incision from one tuberosity of the ischium to the other, anterior to the rectum. The prostate was easily brought into the wound by means of a strong hook and separated from the bladder and other contiguous structures. In this case the anterior wall of the bladder was sewn to the upper extremity of the membranous urethra, and the posterior wall was brought downward as far as possible, in order to close the gap as nearly as might be. Stein reports from the Heidelberg clinic a case in which a boutonnière was made on account of retention, and as the bladder did not drain well a suprapubic cystotomy was performed, but

without affording relief. He reports another case in which, after a suprapubic cystotomy, a soft, compressible tumor was removed from the left lobe of the prostate, partly by the finger-nail and partly by the sharp spoon, and the wound cauterized with the Paquelin cautery. The bladder-wound was left open and a permanent catheter introduced into the urethra. The patient was discharged at the end of four weeks, free from pain and able to retain his urine from four to five hours. The urine was clear, acid, and free from tumor particles. Two other cases are reported; one lived nine months and finally died of uremia, and the other succumbed on the twelfth day after operation from double pleuro-pneumonia.

Sarcoma.—Sarcoma of the prostate may occur at any age, but is most frequent in early life, and at least one-half of all the cases are said by Barth to appear between the first and eighth years. This observation may be explained by the fact that at this period the muscular and connective tissues are greatly in excess of the glandular elements. Sarcoma appears to be the only form of malignant tumor which affects the prostate in childhood.

Symptoms.—The common symptoms are dysuria, retention, perineal pain, constipation, and the presence of a tumor detected by rectal palpation. Hematuria is usually present, and pus in the urine is commonly observed. The growths in some cases reach considerable proportions, when difficult and painful micturition and defecation are complained of. The sensation given to the examining finger in cases of sarcoma of the prostate is that of a semi-fluctuating tumor. Many forms of sarcoma have been described in connection with the prostate.

Diagnosis.—In the great majority of cases sarcoma makes its appearance in early life, before either hypertrophy or cancer of the prostate would be observed. The disease usually runs a more rapid course than any other form of growth involving this region. The duration varies from six weeks to two years, the fatal termination frequently occurring in from six to seven months. The condition of the patient may not be seriously affected so long as the functions of the bladder and bowels are not interfered with. Death may occur from an ascending pyelonephritis or metastasis if the patient does not succumb to the local extension. The tumor in some cases becomes so large as to be seen and palpated above the pubes.

Tuberculosis of the prostate is the only condition with which sarcoma would be apt to be confounded. In some instances the growths are limited to one lobe.

Treatment.—As in the case of carcinoma, the treatment will in many cases be palliative only. The disease is apt to be so diffused by the time the patient consults a surgeon that operation is not to be thought of, except if necessary to relieve painful symptoms. If there is retention, either a perineal or a suprapubic opening will be necessary to drain the bladder. If the diagnosis was made early, an attempt might be made at radical cure. Czerny operated upon a case by the suprapubic route and scraped out a sarcoma of the prostate, which is said to have been followed by improvement in the urinary symptoms, but the duration of the improvement is not stated. If there is obstruction of the bowel, it may be necessary to perform colotomy. It is needless to say that in the vast majority of cases the prognosis is absolutely hopeless.

Prostatic Calculi.—Prostatic calculi are of two kinds—those formed in the kidney or bladder and lodging in the prostatic sinus, and those which originate in the gland itself. They vary in size from that of a pin's head to that of a nut. They may be either single or multiple, and may occupy a

pouch connected with the urethra or they may be imbedded more deeply in the substance of the prostate. In composition they are mainly phosphate of lime.

The symptoms induced by the presence of these calculi are those of prostatic or vesical irritation. In some cases the size and form are such as to interfere with the free passage of urine, and difficult micturition or even retention results in consequence.

The diagnosis is easy in the cases in which a grating sensation is imparted to the hand on passing a urethral instrument. The presence of a calculus of large size may often be detected by noting a hard, irregular body in the substance of the gland by rectal touch. Sometimes these concretions are followed by the formation of an abscess of the prostate, when the symptoms of the latter would be most prominent.

The prophylactic treatment is identical with that applicable to the prevention of calculi in any portion of the urinary tract—namely, the correction of undue acidity of the urine by the administration of one of the salts of lithium or similar remedies, or of alkalinity by boric or benzoic acid, and overcoming too great concentration by the free use of lithia or other diuretic water.

Small calculi lying in the prostatic urethra may sometimes be extracted by means of appropriate forceps. If this is impossible, it will be necessary to perform a median perineal urethrotomy in order to remove the stone. If an abscess should form, immediate operation is to be recommended.

Polyps of the Prostatic Urethra.—These are of very rare occurrence, but the possibility of their existence must not be lost sight of.

The common symptoms are hemorrhage from the urethra, perhaps some obstruction to the passage of urine, and difficulty in catheterization. There may be also some vesical irritation and increased frequency of micturition. Mr. Bryant¹ reported the case of a man sixty-three years of age who had complained of hematuria for six years. The hemorrhage at times was very profuse. A median perineal cystotomy was performed, partly for diagnostic purposes, when the bladder was found free from disease and the vesical lobe of the prostate was not enlarged, although the lateral masses were greatly hypertrophied. On careful exploration of the prostatic urethra with the finger a small polypus was detected projecting from the floor. The pedicle was divided with scissors. A year and a half later the patient was in good health, the prostate having contracted to the normal size. A distinctive feature of these growths in the urethral canal is hemorrhage independent of urination. In this case suprapubic operation would entirely have failed to locate the source of the trouble. On microscopic examination the growth was found to be purely prostatic.

Atrophy of the Prostate.—Atrophy of the prostate is a rare condition observed in some instances in wasting diseases. It is also met with in very advanced age. It is probable that it would commonly be found after the period at which the testicles become functionless. It has been shown by a number of observers that active spermatozoa continue to be formed late in life, so that the individual is usually carried off before atrophy of the testes takes place. Absence of one or both testicles or atrophy from any cause will usually be followed by a shrinkage of the prostate. Atrophy of the prostate may also be expected in any case in which the development or integrity of the testicles has been interfered with.

The condition does not give rise to any symptoms unless it be sterility. No treatment is called for, and there is none that would be of any avail.

¹ *Lancet*, London, 1893, vol. i.

DISEASES OF THE BLADDER.

BY EDWARD MARTIN, M. D., AND A. E. TAYLOR, M. D.

ANOMALIES OF THE BLADDER.

THE bladder is formed from the lower portion of the stalk of the allantois. It is toward the close of the second month that the stalk becomes dilated. It is in communication behind with the uro-genital cloaca, and is separated from the rectum by a septum which becomes complete during the third month. The ureters originally opened also into the uro-genital cloaca, and when the closure occurs it is behind and below them. The primitive bladder is at first spindle-shaped; one end, being the prolongation of the stalk of the allantois, extends up to the umbilicus (the remains of the early tube which communicated with the allantois), while the other end communicates by a short tube with the primitive intestine. The upper end, the remains of the upper part of the allantoic stalk, becomes obliterated and constitutes the urachus. The canal which communicates with the primitive intestine becomes the first part of the urethra. It is in connection with closure of the anterior wall, the urachus, and the posterior connections of the primitive bladder that the malformations of this organ occur.

Exstrophy of the bladder is the most important malformation. The general condition, exstrophy, implies a cleft in the anterior abdominal and vesical walls. There are, however, many degrees of this malformation. There may, in the first place, be a simple lack of union of the abdominal parietes, so that the bladder projects into the cleft. This is known as *ectopia vesicae urinariae*; the bladder is normally formed, the defect is entirely in the abdominal wall. Another form is the absence of union of the pubic bones,



FIG. 105.—Complete exstrophy of bladder, kidneys suspended by ureters (Wistar Institute of Anatomy, Univ. of Penn.).

together with the cleft in the parietes just described. When the division affects not only the parietes, but also the anterior wall of the bladder, the condition of true exstrophy exists. When the cleft in the bladder is at the top of the anterior wall and the symphysis is closed, the condition is termed *fissura vesicæ superior*. When the cleft is in the lower anterior wall of the bladder, the symphysis pubis being normally united, the condition is named *fissura vesicæ inferior*. The third degree, *eversio vesicæ* (Winckel), designates the condition in which there is a cleft in the parietes and the anterior bladder-wall, together with lack of union of the symphysis pubis. Above the bladder there is often an area in the median line composed of connective tissue, but not covered in by skin.

With this malformation others are commonly associated: epispadia of the penis or clitoris is very often seen, and usually there is a marked aplasia of these organs; in the female particularly the urethra becomes reduced to a short, shallow groove. The scrotum may be entirely normal, also the testicles, but the latter are frequently very imperfectly developed or undescended. Cleft scrotum has, however, been rarely observed. External inguinal herniæ are quite commonly observed, unilateral or bilateral: it is probable that these are simply the result of the weakness of the abdominal walls. Ventral herniæ are also commonly observed just above the bladder: this is the result of a lack of union of the recti abdominales muscles at the linea alba above the point where the skin closes in the cleft; should this skin be cleft, the condition would be that of *fissura abdominalis*. Anomalies of the kidney, ureters, absence of the prostate or seminal vesicles, double uterus or vagina, patulous urachus, are conditions which may accompany exstrophy.

In a few cases the posterior closure is not complete, so that the intestine opens into the bladder, while the colon is rudimentary. In other cases the rectum communicates with the bladder.

In any case of exstrophy the posterior wall of the bladder is exposed, and if the defect be sufficiently large, the openings of the ureters are visible. Usually there is almost no urinary cavity, but in the recumbent position there may be exceptionally a cavity of considerable capacity. In the *fissura superior* or *inferior* there is obviously more or less of a bladder-cavity.

In marked cases of exstrophy the exposed mucous membrane extends from the genitalia up to the umbilicus: this is always in a condition of chronic or subacute inflammation, while at the sides and above where it joins the skin a zone of granulations is usually present. The skin upon the parts of the body upon which the urine dribbles is inflamed and excoriated, and may be the seat of a severe dermatitis. The degree of secondary inflammation corresponds inversely to the care given the patient.

In the cases in which the intestine or rectum opens into the bladder the bowel-contents greatly aggravate the severity of the inflammation and markedly favor ascending infection.

Exstrophy is usually observed in the male, very rarely in the female.

Symptoms.—These consist in the appearance of the deformity, together with the secondary inflammation. The conditions of cleft in the abdominal wall, with or without cleft symphysis, give no urinary symptoms, and are important on account of intra-abdominal rather than urinary complications.

Prognosis.—When the ureteral openings remain unobstructed, in spite of the severe cystitis which invariably accompanies exstrophy, there is little tendency toward ascending infection of the kidneys. In the majority of cases, however, from infiltration and thickening of the mucous membrane, often aided by papillary outgrowth, there is a tendency toward gradual ure-

teral obstruction, with dilatation of the ureters and ultimate degeneration of the kidney-substance. Even under these circumstances ascending infection is not so common as would naturally be expected. It is most likely to take place shortly following operation for the closure of the bladder, and is then probably due to retention of urine, with back pressure into the ureters, already chronically congested and ripe for infection.

Probably the large majority of cases of exstrophy perish in infancy or early childhood, and usually as a result of surgical operations, since the condition is so distressing that no risk seems too great to be taken, provided there is a prospect of ultimate cure. With the improved technique and the more rational conception of urinary antisepsis it is reasonable to hope that the prognosis of this affection and of the operations performed for its relief will be materially improved in the future.

Treatment.—The slighter degrees of exstrophy may be satisfactorily treated by a urinal. Where the defect is large, even the most carefully adjusted appliance either fails to prevent leakage of urine or produces pressure-ulceration. Because of the constant dribbling of urine and the painful inflammation of the vesical mucosa and surrounding skin these patients nearly always consent to surgical operation.

Before operating for exstrophy the skin and mucous membrane of the bladder must be brought into as healthy a condition as possible. This is effected by rendering the urine bland and unirritating by administering urinary antiseptics, such as salol and boric acid; by irrigating twice daily the skin and vesical mucosa with nitrate of silver, 1 : 2000, or witch-hazel, 1 : 5, or other antiseptic astringent lotion; by protecting the surrounding skin by a thick, pasty ointment of zinc oxide. It is well to delay operation until the third or fourth year of life, though from earliest infancy an attempt should be made to close the bony defect by a spring truss or an elastic bandage.

The defect in the bladder-walls may be closed by flaps raised from the surrounding integument or by dissecting the bladder free from its parietal attachments and folding it in upon itself. The area to be covered by flaps may be materially lessened and the bladder-cavity may be increased by bringing the pubic bones together; finally, in place of attempting to form a new bladder, the urine may be diverted from its normal course and may be made to flow either from some portion of the surface or into the bowel.

Closure by Skin-flaps.—Of the flap operations, the two which have stood the test of clinical experience are Wood's and Thiersch's.

In *Wood's operation* the abdominal defect is covered in by three flaps: the first is formed above the defect, and is of such size that when turned downward it completely covers the exstrophied bladder without tension. The skin faces toward the vesical mucous membrane, and is designed to form the inner surface of a new anterior vesical wall. Preceding the operation all the hair-follicles upon this surface should be destroyed; otherwise the growing hair will form nuclei for phosphatic deposits. Two lateral flaps are cut from either inguinal region and turned inward, the raw surfaces being apposed to the raw surface of the upper flap, which has been turned down.

Wood's directions for cutting these flaps are as follows: The length of the upper flap should be equal to the distance from the root of the penis to the upper margin of the bladder. This is outlined by carrying a cut vertically upward from the side of the bladder the required distance convexly across the front of the belly and vertically downward to the other side of the bladder. The inguinal flaps have a rounded shape, with their attached pedicles lying in the base of the scrotum, the incision being carried downward

on the side of the urethral groove half its length. The length of these lateral flaps should be so calculated that when freed and carried to the middle line of the body their entire inner surfaces can be apposed without undue tension. The cut by which they are outlined joins the vertical incision made for the formation of the upper flap about its middle.

In dissecting the upper flap it must be remembered that the tough tissue filling in the interval between the separated recti muscles is extremely thin and that the peritoneal cavity may be readily entered.

The flaps having been freed, care being taken to avoid bruising or devitalizing them in any way, and the bleeding having been checked, the upper one is folded downward and secured by catgut sutures to the borders of the incision at the root of the penis. The inguinal flaps are then brought inward, their raw surfaces being apposed to the raw surface of the upper flap, and are sutured in the middle line, the lower portions being brought together over the root of the penis as closely as possible. The raw surfaces left after securing the flaps in place are closed by plate sutures or hare-lip pins.

Thiersch's operation covers in the bladder by lateral flaps. These are made larger than is apparently necessary, to allow for shrinkage, and are not shifted into position for several weeks after they have been raised from their deep connections, pieces of tin-foil being placed beneath them until the surfaces have granulated.

The first flap is formed by two vertical incisions, and is of a size sufficient to cover the entire exstrophied bladder. The first incision passes from the upper border of the defect to the root of the penis immediately beside the bladder; the next is parallel to this and is continued down to Poupart's ligament. This flap is undermined throughout its whole extent, and separated from the underlying superficial fascia by tin-foil. In three weeks the upper extremity is cut free, and the flap is carried across the lower portion of the defect, and is secured in place by suturing it to the freshened margin. After healing has taken place the second flap is cut on the other side of the bladder, the lines of incision being the same, with the exception that they are not carried below the upper attachment of the first flap, but, beginning at this point, are continued upward above the upper borders of the defect. This flap is treated as the first one was. In three weeks it is freed above, is carried across the bladder, and secured to the freshened surface on the outer side, thus closing the upper portion of the defect. After complete healing the adjoining borders of the two flaps are freshened and secured by suture. The final step of the operation consists in freshening the upper border of the upper flap and securing it to the freshened abdominal walls above.

Before the anterior wall of the bladder is completely formed by the flap method repeated operations are necessary. As many as eighteen or twenty have been required even by surgeons most expert in this class of work, and the course of treatment has been continued over one or two years.

Closure by Direct Suture.—The formation of the vesical cavity by direct union of the freshened edges of the defect is always the operation of choice when it is practicable. It can usually be made practicable by performing a preliminary disjunction of the sacro-iliac symphyses, but this preliminary operation is not devoid of risk, and in the main the results have been bad. By lateral pressure in young children the pubic bones can be brought together without preliminary operation. The edges of the abdominal defect are freshened and approximated by suture.

When it is impossible to close the bladder in the aforesaid manner, Segond has proposed an operation which more fully realizes the requirements of ideal

plastic surgery than the methods already described, since it makes a new vesical cavity, the walls of which are made up entirely of mucous membrane. The method consists in performing an extraperitoneal dissection of the mucous membrane of the bladder, turning this flap down, and securing it to the freshened borders of the penile furrow. An incision is then made through the prepuce; it is drawn over the glans, dissected up, and its raw surface, together with lateral abdominal flaps, is used to cover in the mucous membrane thus obtained.

The main objection to this operation is dependent upon the fact that it is difficult to dissect up the mucous membrane without either injuring the peritoneal cavity or making the tissue so thin that its vitality will not be preserved. The dissection should be carried downward and backward to a point a little above the attachment of the ureters, the entire flap being utilized.

Pousson has proposed a modification of this operation which practically does away with its one objectionable feature. He carries an incision along the border of the exstrophied bladder into the peritoneal cavity, thus forming a flap made up of the entire thickness of the bladder-wall. This is turned down, sutured to the freshened penile furrow, and the resulting defect in the abdominal wall is closed by direct suture.

Derivation of the Urine.—The method of derivation, which at one time was practically abandoned because experiments and clinical trials seemed to show that it was invariably followed by ascending infection, has received a new impetus by more modern investigations, which apparently prove that ascending infection is not inherently connected with implantation of the ureter into the bowel, but is due rather to cicatricial contraction, and consequently narrowing of the new ureteral orifice, from which result hydro-nephrosis, congestion, and infection. When the vesical orifice of the ureter is transplanted into the bowel such infection apparently does not take place.

The operation of choice is that described by Maydl. The peritoneal cavity is opened along the borders of the abdominal defect, the urethral continuation of the bladder is cut across, ureteral catheters are inserted, and the entire bladder is resected, with the exception of a small oval portion circumscribing the ureteral orifices. This flap, with the ureteral orifice, is made freely mobile. The colon is then drawn forward, a longitudinal opening is made into it, and the vesical flap attached to the two ureters is sutured in this opening. The first line of sutures unites the mucous membranes; the second line apposes the serous and muscular coat of the gut and the muscular coat of the bladder-flap. The operation is concluded by closing the abdominal opening.

Pousson has lately tabulated 52 operations for exstrophy of the bladder performed since 1889: 4 cases perished; these all followed Trendelenburg's operation of direct suturing of the freshened borders of the bladder after closure of the bony defect by symphysiotomy. One of the fatal cases was due to chloroform, 1 to iodoform intoxication, 2 to acute nephritis.

In Segond's tables no deaths are found among the cases treated by the autoplasmic method or by derivation of the urine. The author holds, therefore, that the dangers of these operations are reduced to a minimum, and that the surgeon should select his method uninfluenced by fear of mortality, but rather with a view to the best results—*i. e.* protection of the mucous surface, collection of the urine, and return of the external genital organs to a normal appearance.

Segond holds that the ultimate results of the autoplasmic method are

excellent. Of 17 operations, there was only 1 failure from sloughing of the flap. In the remaining cases the restoration of the anterior surface of the bladder and the upper wall of the urethra was perfect, with the exception of 1 case, in which a fistula remained.

As to the functional results, these are no better than in former years. It is possible in some cases for the bladder to retain urine for five or six hours, not because of preservation of muscular fibers, but because in the formation of flaps the urethra was so well closed that it only yielded to considerable tension from within.

The skin-flap operation is nearly always followed by the formation of calculi. These, however, do not cause a great deal of trouble, and unless the urethra is tightly closed can be readily removed.

Methods of direct suture of the margins of the bladder have been practised in 127 cases; in 16 of these the pubic bones were brought together either by means of pressure-apparatus or by operation. The defect was readily closed, but the bladder was no more retentive than in other ways.

Segond's method of dissecting loose the mucous membrane of the bladder and turning it down has been performed 10 times with excellent results; the flap retained its vitality.

The method of derivation performed twice by implanting the ureters into the furrow and covering this with transplanted prepuce, gave satisfactory results. The implantation of the ureters into the rectum or colon was not followed by inflammation of the bowel or rectum, as at one time feared. Krinsky reports a patient with rectal implantation who can retain urine for three or four hours without inconvenience.

The statistics of Pousson, which have just been summarized, are, we believe, utterly misleading. He would have us believe that, in so far as the mortality of the operation is concerned, excepting for disjunction of the sacro-iliac symphysis, the operation of exstrophy is an absolutely safe one. On the contrary, it is extremely dangerous. The great majority of fatal cases do not appear in medical literature. It can be confidently asserted that practically all the successful cases are published; unfortunately, they are often published so shortly after operation that they are utterly useless in so far as considering the immediate and remote mortality of the various operations is concerned.

The authors believe that the high mortality, which we should place at between 30 and 40 per cent., even from the autoplasmic method, is due to ascending nephritis, and this in turn is excited because the surgeon attempts too much. He endeavors to close the bladder so that it may act as a reservoir—hence adds to the chronic cystitis, rendered acute by the mechanical disturbance incident to operation, the element of more or less retention. The writer knows of 8 cases of exstrophy in which operation was performed by different surgeons, with a mortality of 50 per cent. None of the fatal cases have appeared in medical literature.

The writer believes that immediately following flap operations the bladder should be frequently irrigated and freely drained—that no effort should be made to form a reservoir, the surgeon directing his attention mainly to covering the defect and enabling the patient to wear a serviceable urinal.

The plastic method which promises most is that in which the whole bladder-wall is freed from its parietal attachments and turned down, since thus the danger of calculus-formation is obviated.

The implantation method must still be considered as on trial. Should it be definitely proven by a wider clinical experience that ascending infection

does not result from rectal implantation of the ureters, together with a surrounding portion of the bladder-wall, this will undoubtedly be the method of choice.

The mechanical treatment should begin immediately after birth, an elastic bandage or truss being so fitted to the child that constant pressure is exerted, having for its end the approximation of the pubes. Operation for closure of the defect should be undertaken about the third or fourth year.

Recto-vesical fistulæ are rare forms of congenital malformation, and are due to a failure in the closure of the septum which divides the primitive dilatation of the stalk of the allantois into the rectal and vesical cavities. The entire dividing wall may be absent or only a small fistulous tract may exist.

Symptoms.—The symptoms of this condition are those of recto-vesical fistula in general, and will depend for their severity on the size of the opening. The most obvious symptoms are the passing of gas and portions of feces per urethram, cystitis, and watery diarrhea. Cystitis is always present and is severe. Ascending infection occurs early.

Treatment.—Cases of congenital and posterior defect of the bladder, rare even in museums, are so seldom encountered in clinical practice that the treatment for the condition has not been formulated. On general principles it may be said that the small opening should be dealt with as an acquired recto-vesical fistula. A large opening might be treated by suprapubic cystotomy and closure.

Patulous urachus is a not infrequent malformation. This may be complete or incomplete. When complete, urine escapes at the umbilicus. When incomplete, the condition may be present in one of three forms: (1) patent at the vesical end and closed at the umbilicus; (2) patent in the center, but closed at both ends; (3) closed at the bladder, but patent through the rest of its course, and open at the umbilicus. In the complete form the urachus may be so large as to allow of a partial or even complete prolapse of the vesical wall.

Patent urachus has in some instances been caused by obstructions to the natural flow of urine, but this is not the rule. Calculi have been found in the tract, and suppuration is almost constant.

Symptoms.—An escape of urine or muco-pus from the umbilicus, or the formation of an elongated cystic tumor occupying the position of the urachus, sufficiently indicates the nature of the affection.

Treatment.—Since the escape of urine from the umbilicus is often due to a condition of vesical tension caused by urethral obstruction, the first consideration in the treatment of patulous urachus is the provision for the unobstructed escape of urine by its natural channel. When this end has been accomplished, either by incision of a narrowed meatus, for instance, or removal of a valvular obstruction, and when the escape of urine continues, the umbilical opening may be touched by the galvano-cautery. Powdered acetanilid is dusted over the seat of cauterization, and a compress of antiseptic gauze is secured over the umbilicus by means of adhesive straps.

If this method of treatment is unsuccessful, the umbilical opening, together with the accessible portion of the urachus, may be freshened and apposed by suture. This failing, the urachus may be freed by an incision made in the linea alba, carried from the umbilicus to the pubis, and the urachus may be divided a little above the bladder, invaginated upon itself, and sutured: the upper portion of the canal should then be removed, since it represents a suppurating mucous channel. This operation would be especially indicated when

calculi are deposited in the nrachus or when this canal, patulous in its middle portion only, forms a retention-cyst.

Multiple bladder is a condition infrequently referred to, but true multiple bladder is very rare. *Vesica bipartita* is produced by a central antero-posterior membrane dividing the organ into two halves, each with its own ureter: the dividing membrane may be complete or incomplete, and the division may extend down the urethra. It is doubtful whether a horizontal division of the bladder has ever existed. All other conditions known as multiple bladders are doubtless diverticular formations or congenital cysts.

Congenital diverticula usually occur just to one side and in front of the mouth of the ureter or above it, and are probably due to the arrangement of the muscular fibers (Englisch).

The cystic conditions which are liable to be mistaken for multiple bladder are—cysts of the nrachus, of a blind ureter, of the seminal vesicles, or of the utriculus prestativus.

Complete absence of the bladder has been described by Merkel, Blasius, Fleury, and Oliver. The ureters ended in the urethra; there were no other malformations.

There have been, furthermore, cases of widespread uro-genital malformation in which the bladder has seemed to have been absent and the ureters emptied into the rectum or vagina.

Congenital hypoplasia has been rarely observed; the bladder in such a condition is so small that urine must be voided very frequently. Another rare condition is atresia of the neck of the bladder, causing death from distention and back pressure.

Treatment of *multiple bladder* or congenital diverticula would not be required, excepting after the advent of cystitis. This complication having once developed, it is likely to persist, since in these deformed bladders there is a tendency toward stagnation of urine, which necessarily aggravates the inflammation. The best that operative interference can promise in such cases is the removal of partitions which interfere with free drainage. Such an operation is not likely to be planned beforehand, but if in the course of suprapubic cystotomy for stone, for instance, or for severe cystitis, diverticula or partitioned bladder should be found, such procedure might be serviceable.

The only treatment which is applicable to the complete *absence of the bladder* is either the wearing of a properly fitting urinal or implantation of the ureters into the bowel.

Congenital hypoplasia, a condition in which the patient has to urinate very frequently because of smallness of the bladder, has been successfully treated by long-continued progressive dilatation by means of hydrostatic pressure.

The diagnosis of this condition is extremely difficult, and should not be formulated until the patient has been examined under profound narcosis. If the history of the case shows that there has always been frequent micturition since earliest childhood, that the frequency is both nocturnal and diurnal, that there is no cystitis or no cause for vesical irritability, and if examination under ether by palpation and injection of measured quantities of fluid shows an abnormally small bladder, it is fair to assume that the cause of frequency may be due to incomplete development.

Under these circumstances the bladder may be distended by means of a gravity-bag and a short urethral nozzle once daily or once every other day, the quantity of fluid injected being slowly increased. The treatment may have to be continued for from six months to a year. Successful results have, however, been recorded. It seems scarcely necessary to call attention to the

fact that when the bladder is emptied with undue frequency the kidneys are always in a more or less congested state, and that the infection in these cases is likely to result seriously.

Atresia at the bladder-neck should be treated by cutting or dilatation.

CYSTITIS.

UNDER the heading of Cystitis we shall describe all forms of inflammation of the bladder. The cystites are manifold in their origin, lesions, and course. We do not believe that all cystites are caused by pyogenic micro-organisms. Not only are there aseptic inflammations of the bladder in which there is no form of pus produced, but there are purulent inflammations in which necrobiosis has been the primary condition and the suppuration secondary. The distinctions are often of practical importance, and will be brought out in the discussion of the etiology and pathology.

Etiology.—The causes of cystitis are extremely numerous. They can, however, be conveniently grouped into classes:

1. **Cystites occurring during the Course of Acute Infectious Disease.**—Acute articular rheumatism, typhoid fever, diphtheria, scarlet fever, small-pox, measles, influenza, mumps, cholera, cerebro-spinal fever, and typhus are the diseases of this class in which cystites occur—most frequently in typhoid fever, scarlet fever, and diphtheria. This complication may set in during the height of the disease or may appear during convalescence. Toward its cause a number of factors probably contribute. The chemical constituents of the urine are often profoundly altered: the urine is concentrated; it contains abnormal substances which have come from the disturbed metabolism of fever and specific infections. Furthermore, the tissues of the bladder are doubtless improperly nourished, and are thus deprived of their full powers of resistance.

Whether or not the cystitis be a local manifestation of the micro-organisms which we know or suppose to lie at the bottom of the diseases is almost entirely a matter of conjecture. For typhoid fever, diphtheria, and cholera, whose micro-organisms are at least partially well known, the cystitis has not, as a rule, been shown to be the result of a local action of their bacteria. The forms of cystitis seen in these diseases are simple inflammation, purulent inflammation, membranous and phlegmonous inflammations.

2. **Cystites occurring during the course of constitutional diseases,** such as gout and diabetes. In both these diseases the conditions are hard to explain. From what we now know of gout, it cannot be held that uric acid produces it, and, since the urine in these cases is not always concentrated, the oft-given explanation of direct irritation falls to the ground. In cases of gout associated with gravel the cystitis is of obvious origin.

In diabetes some cases develop with an acid urine, and here the causation is entirely obscure; in other cases there is fermentation of the glyco-genic urine within the bladder, following which the urine becomes ammoniacal, and here the inflammation has probably been the result of the chemical irritation.

3. **Cystites complicating Nervous Diseases.**—Cystites of neuropathic origin may be caused by paralysis of the bladder or by trophic changes in the bladder-tissues. These may coexist, but they need not. In any form of paraplegia or myelitis vesical paralysis and retention may occur, and under such favorable conditions infection soon follows. In the slow sclerosis and in the general paresis of the insane there is often a marked atrophy, particu-

larly of the tunica muscularis, which may result in a hernia of the mucous membrane and rupture.

Trophic changes are frequent and often extensive, appearing in forms of necrosis and membranous formations, widespread phlegmonous infiltrations with paracystitis, and not infrequently rupture: these are the striking phenomena observed in the cystites of nervous diseases.

4. **Cystites developing in the Course of General Septic Conditions.**—Erysipelas, pyemia, internal suppuration in almost any part of the body, may produce a metastatic suppurative cystitis. It must be borne in mind that the pyemia need not be a manifest clinical condition: it may be the so-called cryptogenic pyemia, of which the metastatic cystitis (or other local suppuration) is the first clinical sign. These cases are very common in connection with paravesical sepsis. The extension may be by contiguity or by the lymph- or blood-channels.

Such infections occur in connection with suppuration in the uterus or adnexa, in the scrotum or its contained tissues, in the pelvic, lymphatic, and connective tissues; from adjacent bone-suppurations; from the appendix, caput coli, cecum, rectum, intestines, ischio-rectal space, paranephritic tissue; from peritonitis, however produced. The infection is sometimes due to a recto-vesical or vesico-vaginal fistula.

5. **Cystites from Irritating Ingesta.**—Cantharides, turpentine, the balsams, phosphorus, corrosive sublimate, and an excess of alcoholic beverages are capable of producing a cystitis which may be simple, suppurative, or membranous. Certain articles of food will produce the same result in certain persons.

6. **Cystites from Surface-chilling.**—Exposure to cold and wet is a rare but undoubted cause of cystitis, which is usually mild in type, and especially attacks any bladder vulnerable from chronic congestion.

7. **Cystites from Trauma.**—Trauma applied to the perineum or hypogastrium may produce a cystitis independent of the introduction of germs through wounds. As sources of traumatism are also usually reckoned the pressure of pessaries, of fecal accumulations in the rectum, displacements of the womb anteriorly, and the pressure of the fetal head in childbirth. It is obvious, however, that in these cases trauma alone can rarely be held responsible; for example, in fecal accumulations the conditions are favorable for the migration of bacteria, while in uterine displacements and in childbirth septic conditions are often associated.

There is, furthermore, a purely traumatic cystitis produced by the rough use of perfectly aseptic vesical instruments. Such are, however, rare—much more rare, unfortunately, than the cases due to instrumental infection.

8. **Cystites from Irritating Injections.**—The injection of aseptic irritating chemical substances can produce a simple inflammation by their direct action on the mucous membrane, or may cause acute congestion by overdistention.

9. **Cystites from Descending Infection.**—Infection from the kidney and ureter is frequent. The infection may be by the urine, by the lymph-channels, or by contiguity from the tissue of the ureter. The importance of these cases lies in the fact that vesical treatment alone is not serviceable. Such cystites may be suppurative, phlegmonous, or membranous, and are often very severe in character. In some cases both kidney and bladder are simultaneously affected by metastatic infection.

10. **Cystites from Ascending Infection.**—Infection from the urethra, with or without urethral disease, is the cause of the great majority of cystites.

Infection from the nrethra without urethral lesions is of common occurrence. In the infectious diseases, in states of profound systemic depression from any systemic disease, in intoxications, in nervous diseases, there may be retention of urine or retention with incontinence in which urethral infection occurs. It may even develop in simple incontinentia urinæ. The vesical infections occurring as sequelæ of stone, tumor, and prostatic disease are often of urethral origin. Whether or not the normal urethra always contains pyogenic micro-organisms is not yet settled: certain it is that they are sometimes present. It is certain that in the conditions just enumerated the urethra is usually healthy, while the bladder is ripe for infection. The *modus operandi* is, we admit, not clear, but it is certain that in many cases of this class infective cystitis occurs through a urethra not diseased, though it is usually due to instrumentation. Infection through the healthy urethra may also occur from deferentitis not secondary to urethritis.

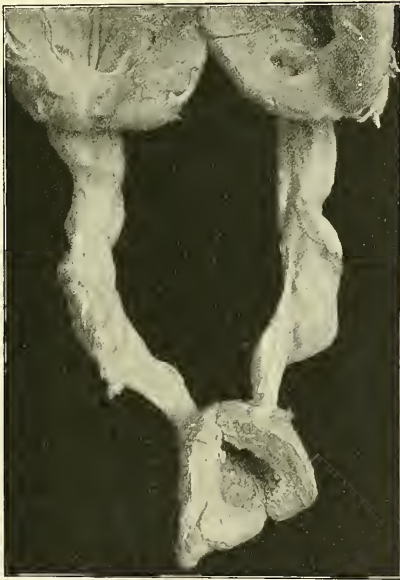


FIG. 106.—Urinary sepsis in an infant, secondary to stricture (Wistar Institute of Anatomy, Univ. of Penn.).

Usually the urethral cystitis are associated with urethral disease. Septic infection may occur either in a healthy bladder or in a bladder made vulnerable by over-distention and retention of irritating urine.

Infection is common in gonorrhœa. Probably pyogenic bacteria always play an important rôle, though it is useless to discuss this question when the nrethral bacteria are so little understood as at present. In acute gonorrhœa cystitis rarely occurs before the third week. It is caused by the passage of bacteria through the sphincter vesicæ or by extension in the mucous membrane or the submucosa. Sexual excitement and alcoholic beverages or highly stimulating foods by causing vesical congestion favor the ascent.

In chronic gonorrhœa, especially when the prostatic urethra is deeply involved, infection, which occurs just as in acute gonorrhœa, may be excited by trivial causes, as over-exertion, exposure to cold, etc. Here too venereal excitement and alcohol are often the provoking causes. Injections and the use of instruments are often the exciting causes of the cystitis.

Cystitis often complicates urethral stricture. Behind a fully-formed stricture conditions are favorable for the growth of bacteria, which may ultimately reach the congested and over-distended bladder, which, because of retention, is peculiarly susceptible to microbic invasion.

Any condition which diminishes the caliber of the urethra, such as para-urethral growths, may in like manner be complicated by cystitis. The cystitis of prostatic disease is classed under the vesical causes of cystitis.

Cystitis occurring during puerperal fever may be, from urethral infection, travelling directly from the vagina.

11. *Cystites from Vesical Conditions.*—Prostatic disease is the most important of these, particularly chronic prostatic hypertrophy. In any case of prostatic hypertrophy of long standing there is usually a congestion of the base of the bladder directly dependent upon the contiguous prostatic congestion, and wholly independent of general vesical congestion due to obstruction, retention, etc. In nearly all cases of marked hypertrophy there is more or less obstruction to the outflow of urine; there is a consequent hypertrophy of the muscular coat, and some general congestion due to the increased muscular functions. When the relations between expulsive power and obstruction become such that retention of urine exists, there is an increase in the congestion. Should decomposition of the urea occur, the congestion will be markedly aggravated by the irritation of the alkaline urine. With a subsequent dilatation the conditions become much worse.

At any stage in the evolution of these vesical conditions septic infection per urethram may occur; it is most likely to take place after retention of urine has been established. Very often there is some slight provoking cause, such as exposure to cold or wet, indulgence in alcohol, etc.

Tumors of the prostate can cause a cystitis in like manner.

Calculus is a common cause of cystitis: we refer, of course, to primary calculi of renal origin. Small smooth stones may produce no discoverable inflammation. As a rule, however, the mechanical irritation causes congestion or a mild degree of simple aseptic inflammation, really a traumatic cystitis. Infection per urethram may occur at any stage; it is, however, usually late. After infection has occurred the cystitis of calculus may be violent, and deep ulcerations may occur. We have recently seen the specimens of a case in which the stone had ulcerated through the posterior bladder-wall and lay in front of the rectum beneath the peritoneum.

After ammoniacal decomposition of the urine has become established the stone increases rapidly in size from phosphatic depositions. The immediate cause of the vesical infection may be a chilling, a jolting of the body, etc.

Foreign bodies in the bladder and animal parasites are rare causes of cystitis.

Tumors of the bladder are nearly always complicated by cystitis, since the neoplasm invariably causes congestion, and there is present an abnormal tissue of low vitality. These conditions, associated with retention of urine and blood in the bladder, are most favorable to the development of bacteria; hence septic infection often occurs early in the case. This is also true of tuberculosis of the bladder.

12. *Cystites from Instrumental Infection.*—Accidental infection of the

bladder, in both healthy and pathological conditions, is commonly produced by the use of unclean instruments. It is scarcely necessary to-day to insist upon asepsis in surgical procedures, even in the most trivial manipulation, such as catheterization. We must, however, urgently protest against the practice of sterilizing urethral and vesical instruments in strong solutions of corrosive sublimate, carbolic acid, etc., as the small quantity of such solution carried into the bladder may be sufficient to produce a cystitis from chemical irritation. Asepsis is demanded, not antiseptis.

Pathology.—The pathology of cystitis is to an extent complex, due largely to the peculiar circumstances which surround septic infection of the bladder per urethram. We are not yet fully in the light regarding the bacteria which cause cystitis. It seems to us an error to term all varieties of cystitis septic. There can surely be an aseptic inflammation of the bladder, just as well as of the liver—inflammation caused by the presence of dead cells which have been killed by chemical irritants, metabolic toxins, or trophic

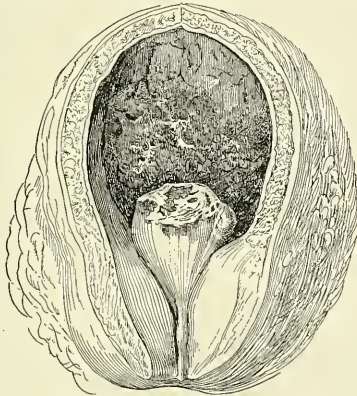


FIG. 107.—Prostatic hypertrophy (Orth).

influences, etc. Even though in a number of cystitides bacteria have been invariably found, this does not prove that in each of these cases the inflammation was first set up by bacteria.

The writers regard it as erroneous pathology to state that “congestion of the bladder,” as the term is used in clinical surgery, and not as in exact pathology, predisposes to cystitis. Congestion is one aspect of inflammation; the chronically congested bladder is in a state of simple aseptic inflammation; there is doubtless always round-celled infiltration and the proliferation of connective tissue. Such a bladder is extremely predisposed to septic infection, and will become infected, but it must be recognized that prior to the moment of infection the bladder was, in the strict pathological sense, inflamed. The authors thus believe it justifiable to include under one heading all conditions of this class, some of which have been correctly described as congestions; and this heading shall be designated—

The Simple Aseptic Cystitides.—These are very common. They are usually of short duration; should they not recover promptly, septic infection usually occurs. Three general groups of cases can be recognized: (1) Those

caused by irritating substances in the urine, metabolic or ingested; (2) those due to disturbances in the function of micturition; and (3) those due to disturbances in the circulation incident to vascular or nervous conditions.

Of ingested substances which when eliminated irritate the vesical mucous membrane, the most important are caustics, turpentine, the balsams, and bichloride of mercury. The hyperemia may be moderate, or so extreme that capillary bleeding occurs into the cavity of the bladder or into the tissues. Unless the poisoning be very intense or prolonged the inflammation remains aseptic.

Irritating injections cause a similar inflammation. Whether or not the simple cystitis of the infectious disease are in part or entirely due to urinary alterations is a subject which we are not able to discuss. In certain constitutional diseases, however, not bacterial, perhaps dependent upon and cer-



FIG. 108.—Hypertrophy of bladder with contraction of cavity, secondary to obstruction (Wistar Institute of Anatomy, Univ. of Penn.).

tainly associated with marked metabolic disturbances, simple cystitis is not uncommon; as instances may be mentioned gout, diabetes mellitus and phosphatic, idiopathic cystinuria and oxaluria, and scorbutus. It is known that ammoniacal urine is an active irritant to the bladder. The cystitis of this group are often very mild and may remain uninfected for a long time.

Disturbances in the functions of the urine provoke a more or less marked degree of hyperemia and simple inflammation. Over-distention of the bladder, either voluntary or pathological, the too frequent and superforceful contractions in the act of micturition, and retention, however slight, are the chief agents which contribute to the condition.

When the causes of the over-distention, retention, and obstruction are organic, septic infection commonly occurs, and often very early. In non-organic over-distention the condition is usually transient and septic infection rarely occurs. In the more persistent cases due to central vesical paresis septic infection is invariable.

Simple cystites due to disturbances of circulation of vascular or nervous origin are uncommon.

In extreme stagnation in the inferior vena cava passive congestion occurs in the bladder, with the production of a low grade of inflammation, as is seen in passive congestion elsewhere, often with considerable fibrous production. In severe cases the veins of the bladder may become varicose, especially at the base and neck, from which bleeding is not uncommon. The dilatation of these veins may be so extreme as to constitute an obstruction to the outward flow of urine. These cases sometimes become infected.

In disease of the central nervous system, especially in injuries to or inflammation of the cord, there is a most marked hyperemia of the bladder, vaso-motor in origin. Since they are usually associated with paresis of the muscularis, infection occurs early.

The presence of calculus and of the animal parasites also causes a simple inflammation which persists long and is very liable to become septic.

The septic cystites are, unfortunately, much more common than the aseptic cystites. In the infection of a bladder by pyogenic micro-organisms many factors play a rôle, some of occasional and others of constant importance. The general systemic condition of the subject has a distinct bearing on local infection. Local or general conditions which depress the health render the subject less able to resist microbial processes, and this applies very aptly to vesical infection. But the contrary is not true: even perfect health will not protect against infection of especial virulence.

The condition of the mucous membrane is of prime importance. Irritation of the epithelium or simple aseptic inflammation, however produced, predisposes most markedly to infection, and under such conditions even bacteria of mild virulence excite suppuration. Especially active are the processes of suppuration when the nutrition of the bladder has been altered by some diseases of the spinal cord; but the most healthy bladder may become infected by highly virulent bacteria.

The reaction of the urine is another important factor. Infection is much more likely to occur in a bladder whose urine is alkaline than in one containing acid urine. No doubt this occurrence is partly accounted for by the inflammation produced by ammoniacal urine and the precipitation of phosphates; but pyogenic bacteria also flourish better in such a urine than in normal acid urine. Acidity is, however, no hindrance to infection, since there are many cystites, and severe ones, in which the urine is always acid, provided there is no obstruction.

Disturbances in micturition are predisposing factors in the development of infection. We have seen that simple overwork of the muscular coat of the bladder will produce a mild inflammation. But it is in connection with obstruction and retention of urine that septic infection is almost invariable. Acute retention with over-distention produces a severe simple inflammation, which if properly treated does not, as a rule, result in infection. It is chronic partial retention, the condition in which there is always a residue of urine in the bladder, which so inflames the organ and lowers its powers of resistance that infection occurs. These conditions are typically seen in prostatic hypertrophy and urethral stricture and in some cases of vesical stone or tumor.

Retention alone will produce cystitis, but not suppurative cystitis; alkaline urine alone may produce cystitis, but not suppurative cystitis. This fact has been made very clear by animal experimentation. The sole causes of suppuration are bacteria introduced from outside the bladder, generally through

the urethra. The above conditions modify infections, but while highly favorable to its development, they are not essential, since suppurative cystitis can be produced by the injection of virulent pyogenic bacteria into a healthy bladder. It is commonly stated that the presence of blood or albumin in the urine favors the growth of bacteria; and while this assertion may be true in the laboratory, it is doubtful whether it is of much importance, since with hematuria or albuminuria some one or other of the above-mentioned conditions favorable to infection are usually present.

The Bacteria of Suppurative Cystitis.—A great variety of bacteria have been found in the pus of cystitis. For many of them it has not been shown that they stand in any etiological relation to the suppuration.

The forms which have been shown to be present, and whose pus-producing faculty is known, are the following:

The staphylococcus pyogenes aureus, albus, and citreus, which also possesses the power of decomposing urea.

The streptococcus pyogenes.

The various members of the family of bacterium coli commune. These have been shown to be of especial importance in the cystitis of retention. Whether or not these bacilli can break up urea is not definitely known. Certainly their power must be weak, since in suppurative pyelitis, which is commonly caused by them, the urine is usually acid.

The proteus vulgaris. This form also possesses the power of breaking up urea, with the production of the ammoniacal reaction. When such decomposition is present in cystitis due to other bacteria, it is caused by saprophytic micro-organisms, of which the most important is the micrococcus urea, though four other forms have been described by Leube and Glazer.

It is thus evident that ammoniacal decomposition is not necessarily a result of cystitis *per se* (apart from that caused by the proteus vulgaris and the staphylococcus); that it may and often does antedate suppuration; and that suppuration may and does occur without it.

A very rare form of bacillus is the urobacillus liquefaciens septicus.

The gonococcus alone is perhaps not capable of producing a vesical suppuration; at least it has been impossible to produce suppurative cystitis by intervesical injection of cultures of the gonococcus supposed to have been pure, and to have been the real gonococcus. Nevertheless, since it has been conclusively shown that the gonococcus can produce septic internal inflammations—endocarditis, pleuritis, lymphadenitis, for example—it must not be held that it is incapable of producing suppurative cystitis.

The tubercle bacillus produces a form of chronic inflammation peculiar to itself, and it has been consigned to a special description elsewhere.

The Lesions of Suppurative Cystitis.—These are many and varied; as a rule, no one form of lesion exists alone. For the sake of clearness and brevity they will be described separately.

In simple *catarrhal* suppuration there is during life more or less congestion, which, as a rule, does not persist post-mortem. In very acute cases the hyperemia is intense; in chronic cases the color may be no more deeply pink than in health. The surface of the mucous membrane is covered with a thick coat, which may be very tenacious, very rich in pus-cells and epithelium.

Blood may be present, usually only the faintest trace. There may be minute hemorrhages in the acute form; in the chronic form of simple catarrh they are rare. They are especially common in the cystitis of scorbutic patients and in those complicating severe cases of infectious diseases. They

are usually confined to the mucosa, and appear in the form of minute points of extravasation.

There may be marked edema of the mucous membrane in violent acute cases, and this may be so extreme that the tissues may be torn by the pressure, and then the serum collects under the epithelium in the form of small blebs. There is round-celled infiltration beneath the epithelium, particularly along the lines of the capillaries. The epithelial cells may be more or less swollen, and present a cloudy appearance or the first signs of fatty degeneration.

In *chronic catarrhal* cystitis the formative changes are usually very marked. The mucous membrane becomes thickened by reason of round-celled infiltration and the conversion of this into fully-formed connective tissue. The vessel-walls likewise show a proliferative periarteritis. The overgrowth of the mucous membrane is often not regular, and this fact, when taken into connection with the hypertrophy of the muscularis and the contraction of the bladder, explains the rugous appearance often seen.

The epithelium may be thickened by excessive cell-proliferation or may be thinned by degenerations. In all cases there is abnormal degeneration of the cells, usually fatty in character, with indistinctness of the nuclear chromatin. Often the epithelial proliferation may be so active that villousities are formed—tiny excrescences composed of a capillary stalk surmounted by epithelium, and readily bleeding. The fungo-vascular structures upon which Albarran has laid especial stress are of the same formation, except that they are larger and more vascular, being, in fact, sometimes almost telangiectatic.

Mucous polyps are also seen; in these the vascular elements are less pronounced, while the epithelial overgrowth is such that they quite resemble papillomata. Retention-cysts are common; they are usually small, and may be composed of involutions of the superficial epithelium or of obstruction to the outlet of the submucous glands. True cystic formations are rare, and occur at the base.

Entirely different in appearance are the hypertrophied lymphatic follicles of the mucosa, which in chronic cystitis become so enlarged that they can be both seen and felt as hard, round clumps in or just beneath the mucous membrane. They are most marked about the base and neck, and have been mistaken for tuberculosis.

Hemorrhage in chronic cystitis not complicated by ulceration is rare. Should it have occurred and the urine be alkaline, there will be a dirty-brown deposit upon the mucous membrane. The coating of detritus, pus, and epithelium and nucleo-albumin is much more marked than in the acute inflammation, and, when the urine is alkaline, very tenacious. There is usually more or less of an incrustation of this covering with phosphates.

Membranous (diphtheritic) formations are not rare in cystitis. There is exceptionally a fibrinous transudation not connected with tissue-necrosis, but this is unimportant, except that it may block the opening of the urethra.

The true membranous formation occurs most often at the trigonum, and, even when universal, usually starts from this region. There is a superficial necrosis of the mucosa; a transudation occurs beneath this, breaks through it, and covers it, and the whole is then converted into a membrane by the formation of fibrin. When such membrane becomes detached, another promptly forms upon the area, while the detached mass may obstruct the urethra.

Hemorrhage is usually marked in connection with diphtheritic processes; indeed, it is often over the site of a hemorrhage that the initial necrosis

begins. If the formation occurs about the neck, the urethral orifice may be much narrowed or entirely closed. The color of the membrane is usually of a reddish gray; this will, however, be modified by the amount of blood present. The membrane may become incrustated with triple phosphates, and when such a membrane becomes detached and rolled up, it may be mistaken for a calculus.

Membranous formations occur mostly in the cystitis of cord-disease or injury and in those which complicate the acute infectious diseases; but they may develop in any bladder-inflammation, especially that of severe cantharides-poisoning.

Ulceration is very frequent both in acute and chronic cystitis. It may form at the site of a hemorrhage. Usually it begins in an area of extreme desquamation, mostly at the base. Such ulcers are commonly shallow; their edges are rough and elevated, their bases are formed of the thickened submucosa. In chronic cases they may penetrate to or even through the muscular coat.

Hemorrhage is frequent from such ulcers, and they are often covered with a crust of salts colored by blood-pigment.

In some cases the suppuration assumes a virulent character, and burrowing from the ulcerations produces a *phlegmonous cystitis*. This burrowing

may be lateral between the coats of the walls, or it may be centrifugal, with the frequent production of perforation, the intramural abscesses opening again into the bladder-cavity. Such cases are characterized by rapid tissue-disintegration, with little attempt at round-celled infiltration or fibrous formation. Should the perforation occur through the vault, a peritonitis is inevitable; should it occur at or about the base, which is more common, a phlegmonous paracystitis will be produced.

The most virulent forms are seen in the cystitis of myelitis, complicating acute infectious diseases, and occurring late in the course of prostatic obstruction.

In exceptional cases the process becomes *gangrenous*: there is little pus formed, but large areas of the bladder-wall slough. Such cases are nearly always in connection with cord-diseases. We have no knowledge bearing upon the bacteriological aspects of these various processes.

There is a rare ulceration of the bladder, not associated with ordinary cystitis, described by Rokitsansky under the name of simple perforating ulcer of the bladder. It consists of a small ulceration at the base which has a cut-out appearance and Nothing is known as to the etiology or



FIG. 109.—Gangrenous cystitis secondary to calculus (Wistar Institute of Anatomy, Univ. of Penn.).

advances rapidly to perforation. pathology of this condition.

Syphilitic ulceration of the bladder is almost unknown.

The contents of the bladder in severe cystitis deserve a moment's description. Calculi are often present—formations secondary to the precipitation of salts by the ammoniacal reaction. They are usually small, but may be of extreme size.

When the urine is markedly ammoniacal and a large amount of pus is present, this in the presence of sodium chloride and ammonium carbonate becomes converted into a gelatinoid mass which is difficult to void. In a few rare cases pneumaturia has existed; the gases were CO_2 , H or H_2S , or N, probably produced by special bacteria.

In nearly all cases of chronic cystitis hypertrophy of the muscular coat occurs. It develops early, and is pronounced in those cases in which the cystitis is secondary to obstruction. It occurs in all other cases as the result of the disturbed micturition. Late in the cases of obstruction the muscular wall may become so weakened by fatty degenerations that dilatation occurs. In other cases there is fibrous overgrowth, causing contraction and muscular

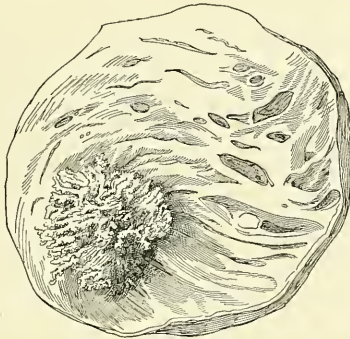


FIG. 110.—Tufted inflammation on the posterior wall of the bladder, which shows a muscular hypertrophy (Orth).

atrophy. This thickened, contracted bladder with ribbed mucous membrane is a familiar condition in old cystitis.

In some cases the contraction of the bladder seems to have been irregular, and sacculations are produced. These may be large, and several may coexist. They form a favorite lodgement for calculi.

Another uncommon condition seen in cystitis is false diverticulum. This is supposed to be produced by a break in the muscularis, so that a portion of the mucous membrane projects through it to the perivesical fibrous tissue. Such diverticula may be as large as the bladder-cavity itself, and have not infrequently been described as double bladder. They are usually posterior.

In some cases of obstruction, where the dilatation of the ureters is extreme, the appearance of the base may be much distorted by the opposing forces of fibrous contraction of the base and ureteral dilatation.

Pericystitis implies inflammation of the tunica adventitia of the bladder. Paracystitis is inflammation of the tissues surrounding the bladder.

Paracystitis can arise from within the bladder or from without. In the majority of cases paracystitis is secondary to extreme ulceration or phlegmonous suppuration, with or without actual perforation. In rarer cases it

occurs by lymphatic or vascular transmission or by bacterial migration through a normal or even hypertrophied wall.

Paracystitis due to extra-vesical infection may be secondary to peritonitis, intestinal or rectal ulcerations, pelvic abscesses due to genital or bone diseases, etc. This inflammation may develop behind or in front of the bladder, or laterally in the connective tissue. When pus is formed, it may open into the bladder, into the rectum, or may burrow in the lines of least fascial resistance.

The *urinary signs* vary greatly with the reaction of the urine. In those cases where the reaction is acid the appearance of the urine is little changed, a slight turbidity being the only macroscopic departure from normal. Upon standing a whitish sediment collects and the supernatant urine becomes clear.

The quantity of urine in cystitis varies according to the other conditions or diseases affecting the patient, and especially according to the condition of the kidneys. There is a true polyuria of vesical irritation, but frequent micturition must not be interpreted to mean polyuria.

Albumin is present in all cases of pyuria, but may not be demonstrable by clinical methods. It may be desirable in a given case to determine whether an albuminuria be due solely to a pyuria or to an associated nephritis. Posner has found that 1 per cent. of albumin in the filtered urine, estimated by Esbach's method, corresponds to 100,000 pus-cells in 1 c.mm. of the mixed undiluted urine counted by a Thoma-Zeiss blood-counting apparatus; should the relation be much higher than that—for example, 1 per cent. albumin to 10,000 or even 50,000 pus-cells per c.mm. urine—a renal albuminuria is indicated. The quantitative estimation of serum-albumin and globulin in the urine (as given in the section on Tumors of the Bladder) may also be made in a doubtful case.

Should blood be present in quantity sufficient to complicate the diagnosis, Goldberg's method could be employed to eliminate or diagnose a renal albuminuria.

Sugar is, as a rule, not present; mild cystitis is, however, frequent in diabetes.

When the urine is neutral or ammoniacal the entire appearance of the urine is changed. It is turbid, contains tenacious flocculi of altered pus; there is a large amount of precipitated salts and detritus; on standing a heavy sediment forms, but the supernatant urine does not become clear. There is a disagreeable odor to the urine; it may be ammoniacal, it may be fermenting. The albumin-tests do not respond so sharply as in acid urine on account of the turbidity: for careful testing a little of the filtered urine should be carefully warmed, and then brought back to a faint acid reaction by dilute acetic acid; then strongly acidulated and tested with a solution of potassium ferrocyanide.

The sediment contains the most important signs. Pus is present in all cases of septic cystitis. The quantity varies greatly, and, estimated from day to day in samples taken from the well-mixed twenty-four-hours' urine, the quantity furnishes valuable evidence of the intensity of the infections. In mild cases there may be no more than 500 pus-cells in the c.mm. of mixed urine; in very severe cases the discharge may be so excessive that there may be 150,000 in the c.mm. When we consider that in such a case 150,000,000,000 pus-cells are discharged in every twenty-four hours, while as a liberal estimate there are not over 150,000,000,000 leukocytes in the circulating blood, we are brought to consider the astounding powers the lymphatic tissues must possess.

The counting of pus-cells is often difficult or even impossible in strongly alkaline urine; as before mentioned, the pus becomes gelatinous and cannot be well mixed into the urine. The pus-cells are polymorphous leukocytes, and contain, as a rule, neutrophilic granulations, rarely oxyphilic. They are often more or less degenerated, particularly in decomposed urine.

The blood in the urine of cystitis is usually trivial in amount. It may, however, be profuse, and clots may form in the bladder so large that they are voided with difficulty or not at all. In acid urine the blood-cells are usually well formed, though always crenated: in decomposed urine they may be fragmented.

Vesical epithelial cells are present in the sediment of the urine of all cases of septic cystitis; they are usually of the superficial layers, but in severe cases the deeper cells (ovoid or cylindrical with one or more processes) may become desquamated. These cells are usually badly degenerated. We do not believe that it is possible to distinguish these cells from those of the ureter.

Fragments of tissue, necrosed mucous membrane, or even portions of the deeper tissues, are sometimes seen, especially in trophic cystites. They should be carefully distinguished from fragments of neoplasms.

The crystalline sediment consists of a moderate amount of amorphous phosphates, amorphous or ammonium urates, and large quantities of triple phosphates. The crystals of ammonium urate are dark balls which may be spiculated; the triple phosphate commonly appears in the form of slab-shaped crystals; there may, however, be needles, squares, and many forms of irregular crystallization.

Tube-casts will be present in all cases complicated by nephritis. Hyaline casts and cylindroids can be found in the freshly centrifugated sediment in many cases which show no signs of renal disease.

Cultures of the bacteria may be made upon blood-serum and agar and upon bouillon, from which plates should be prepared. In all doubtful cases the tubercle bacillus should be carefully sought for—by injection-experiment if necessary. If no culture-media be at hand, one can be made by adding to fresh urine some of the numerous preparations of hemoglobin for internal administration; and this, too, is a medium upon which the gonococcus can be grown.

Symptoms.—The symptoms of cystitis are local and constitutional. Both are more likely to be severe in acute cystitis. The severe constitutional symptoms of chronic cystitis are many, due to the complications, especially secondary renal lesions.

Pain is an early and quite constant symptom. There is pain not connected with micturition—a deep ache over the pubis or in the perineum: such pains are more often seen in the acute cases, and are especially marked in the aseptic inflammations which follow sudden distention and the ingestion of substances whose elimination irritates the bladder. These pains do not radiate.

The pain connected with micturition is of more importance. A common form is a burning in the urethra during urination, often especially severe at the meatus. At the close of micturition the pain may become somewhat colicky in character. It may cease directly the act has been completed or may continue for some time thereafter.

Another form of pain is that of a distressful straining. This precedes the act of urination, is a deep spasmodic pain, and is relieved by voiding the urine. Whenever the urine contains large clots of blood, or whenever ex-

cessive ammoniacal decomposition renders the pus so gelatinoid and tenacious that it can with difficulty be voided, a colic is produced—at first urethral, but later vesical if the obstruction does not yield.

The pains connected with micturition are usually severe in proportion to the severity of inflammation and the frequency of micturition, but there are notable exceptions to this rule. Pain is likewise more marked in cases with obstruction than without, but to this rule there are also exceptions.

Cystitis due to or complicated by stone may commonly excite the pain characteristic of that condition—*i. e.* most severe at the end of micturition. There is said to be great pain in the parasitic cystites which occur in the tropical regions.

When renal involvement has occurred, especially if connected with ureteral and pelvic dilatation, the pains of these conditions, especially those of nephro-ureteral colic, are added to the case.

There is in many cases a para-anal pain: this may be a part of a sympathetic anal tenesmus, but in some cases is quite constant and independent of anal tenesmus.

The pains of paracystitis depend entirely upon the position of the inflammation and the direction of burrowing. In many cases there are vague pains down the inner aspect of the thighs, but whether these are radiated or referred is not known.

The condition of the vesical tension has a marked influence upon the pain, which is usually most severe when the organ is either full or empty, and is often proportionate to the degree of dilatation.

The condition of the urine also exerts a marked influence: pain is usually moderate so long as the urine is acid. When it becomes alkaline the pains are augmented, particularly the urethral pains, and are usually proportionate to the intensity of the ammoniacal decomposition. Ulceration also has a bearing on pain, since the ulcerated surface is, as a rule, more sensitive to the irritation of ammoniacal urine and the precipitated salts than the inflamed mucous membrane. In the rapid necrosis of cord-diseases or injuries pain is usually not marked, and with anesthesia below a certain cord-segment is of course absent.

Disturbances in the Act of Micturition.—Unusual frequency of micturition is present in all cases. In mild cases, particularly when the urine is acid, the daily number of micturitions need not much exceed the normal. Early in the case the abnormal frequency may be limited to the waking hours; later, however, even the patient's night is disturbed, and sometimes scarcely less than his daytime.

The causes of frequency are threefold: The reflex influences of an inflammation of the vesical mucous membrane are alone able to provoke frequent micturition. In an analogous manner the irritation of ammoniacal urine and of precipitated salts effects contractions of the organ. In the cases of obstruction the partial retention powerfully excites the detrusors. Thus the condition of frequent micturition is usually worse in the contracted bladders of prostatic obstruction. In calculous cystitis exercise usually aggravates the condition.

Tenesmus is frequently present. A small degree of tenesmus is constant in all marked cases of increased frequency. In some cases it becomes exaggerated and remains almost constant, and, goaded by its intense pain, the patient is almost constantly attempting to force a few drops of urine from a bladder which may be entirely empty. In these cases a reflex rectal tenesmus is excited which aggravates the already miserable condition. It

should be mentioned that, inversely, a full rectum excites vesical tenesmus and frequency of urination.

The general symptoms of cystitis are usually not marked and are often entirely absent.

Fever is common in acute cystitis; it may range high and may be associated with chills and sweating. In chronic cystitis, with free drainage of the pus, fever is rare. Persistent elevation of temperature in a chronic case indicates either an aggravated acute exacerbation, paracystitis, prostatitis, or, most commonly, extension to the ureters and kidneys. Fever should never be attributed to inflammation of the uro-genital tract until the possibility that the cystitis might be due to one of the general diseases already mentioned has been excluded. The fever of paracystitis is liable to be more constant than that of suppurative uretero-nephritis, which is often markedly intermittent.

The gastro-intestinal tract of nearly all cases of chronic cystitis is more or less disturbed. Anorexia, distress after eating, eructations of food or gases, and constipation are common complaints. In severe cases the loss of sleep consequent upon nocturnal tenesmus and frequency of urination may reduce the subject to a miserable condition of nervous weakness.

There is another group of nervous symptoms which are often severe, and may be of sudden or gradual onset—headache, vertigo, temporary mental aberration, paroxysmal vomiting. These are most pronounced in cases exhibiting extreme ammoniacal decomposition of the urine, and it has been suggested that they may be due to the resorption of products of decomposition—sulphuretted hydrogen, ammonia, etc.

In such cases, however, the surgeon should suspect uremia; renal symptoms are indeed very common. The renal lesions are those either of suppuration from ascending infection or of mixed nephritis, the parenchymatous element predominating in some cases, the interstitial element in others. Healthy kidneys in a case of chronic cystitis are almost unknown; it is in the obstructive cases that the renal lesions are most destructive.

The symptoms of renal suppuration may appear at any time in the course of chronic cystitis; a cold or an exacerbation of the cystitis may seem to have induced them. These symptoms are, as a rule, insidious. Dropsy is generally slight; there are often symptoms of arterio-sclerosis and cardiac hypertrophy; dyspnea and gastric irritability trouble the patient, who suffers additionally from a great deal of headache. Violent outbursts of acute uremia are not uncommon, but mild chronic uremia is much more frequent.

When suppurative paracystitis sets in, the process may be limited by adhesions, but usually there is absorption at least of toxic substances, with the production of septicemia and the pronounced symptoms of internal suppuration, or even of the bacteria themselves, with the production of pyemia.

Prognosis of Cystitis.—The prognosis of cystitis when it is not due to infection is good. The disease subsides in a few days or at most one or two weeks, and has no sequelæ beyond slight vesical irritability and tendency to renewal of acute congestion from trifling causes.

When inflammation of the bladder is due to infection, prognosis must always be guarded. In the absence of irremediable urethral obstructions most patients recover more or less completely. Exceptionally—and it is impossible to predict the exceptions—the inflammation ascends along the ureters and involves the kidney pelvis and the kidneys, causing pyelitis and pyelo-nephritis. This backward extension is much more likely to occur when cystitis is complicated by retention of urine. It may happen, however, in the

absence of retention, and is more likely to occur during the early acute stage of inflammation.

It is a commonly accepted doctrine that ureteritis and pyelitis are dependent in the main upon the purulent contents of the bladder being forced into the ureters. This can scarcely occur unless the bladder is full of urine and the urethral outlet is closed or at least obstructed. It is maintained that ascending infection is more common in the early stages of acute cystitis, because at this period the vesical muscles still retain their power, and by their vigorous contraction force a portion of the bladder-contents back into the ureters when the latter are reflexly opened during the downward discharge of the secretion of the kidney.

The writers believe that ascending infection is not due to reflux, but that it travels by continuity of tissues; that it is more likely to reach the kidneys when the bladder is over-distended, because this condition engenders great congestion of the entire urinary tract, and hence predisposes it to sepsis; that the infection is likely to ascend early, because this represents the period of greatest virulence of the germs and most pronounced reflex congestion from functional disturbance. The variety of germ-infection has a distinct bearing on prognosis. The colon-bacillus group seems to be the most virulent and tenacious, and is most likely to invade the higher urinary tract. The gonococcus very exceptionally reaches the kidney. The germs of ordinary supuration in the absence of distention remain limited to the bladder and cause less severe forms of inflammation.

The prognosis of parenchymatous cystitis is grave. Intramural or paracystic abscesses may form, resulting in septicemia or pyemia. The musculature of the bladder is always seriously affected, the disease in its involution producing an incurable thickening, rigidity, and cicatricial deformity, which may absolutely incapacitate the bladder as a reservoir.

The prognosis of pseudo-membranous cystitis is fairly good. This disease is rarely recognized until exfoliated shreds of membrane are passed through the urethra. The chief danger is that incident to obstruction from these shreds; if this is relieved by prompt cystotomy, the patients usually recover, often with functional bladders, although muscular fibers may be found in the exfoliated tissue.

The prognosis of gangrenous cystitis is practically hopeless.

Diagnosis.—It should be remembered that none of the symptoms usually considered characteristic of cystitis—*i. e.* pain, frequent micturition, and pyuria—are necessarily indicative of this condition, since they all may be caused by inflammation of the prostatic urethra. It is also true that a deep and progressive cystitis may be present without a single subjective symptom. As a rule, however, inflammation of the bladder can be readily determined. In acute cases there is distinct tenderness on suprapubic and rectal palpation; there is a superabundance of epithelium; the urine contains more pus than is common in urethritis; the last portion passed is as turbid or even more so than the first; intravesical injections show that the bladder is extremely sensitive to tension; an instrumental exploration, providing this is considered advisable, will show the hypersensitiveness of the mucosa to direct palpation.

In chronic cases there may be neither sensitiveness to pressure nor any other characteristic symptom; the urine is, however, always purulent, and is often ammoniacal, though not necessarily so.

It may happen when the urine is acid, and when vesical symptoms are not pronounced or are entirely absent, that it may be extremely difficult to determine whether the pus is of vesical or of renal origin. In renal sup-

uration there is usually renal albuminuria, and hyaline casts are commonly found. It is, however, very often impossible to determine the source of the pus, excepting by cystoscopic examination. This is serviceable in determining the character of the inflammation and its seat of greatest intensity, thus enabling the surgeon to make a rational selection of the treatment most likely to be serviceable.

The diagnosis of a gangrenous cystitis, which sometimes occurs in the course of acute fevers, may be suggested by the passage of necrotic shreds and the foul odor of the urine. Membranous cystitis is usually not suspected until the advent of acute retention calls for operative interference.

Treatment of Cystitis.—**Acute Cystitis.**—The underlying principles in the treatment of acute cystitis are—(1) To render the urine bland and slightly antiseptic; (2) to put the bladder at rest and relieve pain; (3) to lessen pelvic congestion.

When inflammation is strictly confined to the bladder and is superficial, as is the case ordinarily in acute cystitis, excepting when this attacks a previously diseased viscus, there are no constitutional symptoms, and hence treatment directed to the relief of fever and its concomitant phenomena is not indicated.

The urine is rendered bland by the ingestion of large quantities of hot water and a milk or buttermilk diet. If it is strongly acid, as is often the case in the gouty or rheumatic cases, a vegetable acid or an alkaline preparation may be administered. We have found that the best method of diluting the urine is to give milk and Vichy or other effervescing alkaline mineral water, mixed in equal proportions. This is extremely digestible, and is likely to correct gastro-intestinal disturbances. Four ounces of milk and an equal quantity of the effervescing water should be ingested every two hours, making in all about sixty-four ounces of fluid a day, since it is not necessary to disturb the patient during the night for the purpose of giving him nourishment. When the milk disagrees, causing biliousness and constipation, koumyss or koumyssgen or buttermilk may be given with Vichy.

For the purpose of rendering the urine slightly antiseptic small doses of salol are administered, 5 grains three times a day. In these small doses the drug does not interfere with digestion and prevents intestinal fermentation. It is eliminated through the kidneys in the form of carbolic acid. Exceptionally, patients exhibit an idiosyncrasy toward the salol. In these cases boric acid (10 grains thrice daily) may be substituted.

When diluents do not sufficiently counteract acidity, citrate of potassium (10 grains three to six times daily), well diluted, bicarbonate of soda (20 grains six times daily), or lithium citrate (10 grains six times daily) may be administered, but not to the point of making the urine decidedly alkaline.

Pain when constant and harassing should be controlled by opium. This is best administered in the form of either suppositories or hypodermic injections. In either case the narcotic is advantageously combined with belladonna or one of its derivatives. There is no routine dose, the narcotic being pushed until its end is accomplished—*i. e.* the relief of pain. The prescription we commonly employ is the following:

R. Extract. opii aquas.,	gr. 1;
Extract. hyoseyami,	gr. $\frac{1}{4}$;
Ol. theobrom.,	gr. 15.
Make 1 suppository.	

Sig. Administer one such suppository every hour until pain is relieved.

As further means of combating pain the various methods shortly to be described by which pelvic congestion is lessened are serviceable, and indeed may be so efficacious that a narcotic will not be needed.

In certain cases of gonorrhœal cystitis attended by veritable anguish the inflammation is mainly limited to the prostatic urethra and vesical trigonum. The suffering is so severe that it is unrelieved by opium, even though this drug be pushed to the limit of safety. The patient is exhausted. Under these circumstances instillations may prove serviceable. Fifteen drops of 4 per cent. solution of cocaine injected by means of an instillator, the point of which is carried within the grip of the compressor urethræ, will be followed by relief of pain which will last for several hours. Ten drops of a 5 per cent. solution of silver will produce the same effect. The action of the cocaine is readily understood. No explanation is offered for the almost immediate and often permanent relief following instillation of silver. This treatment is given simply on the basis of clinical experience.

Hypodermics of morphine are indicated when opium suppositories produce obstinate constipation.

The bladder is best put at rest by opium and belladonna suppositories; in certain aggravated cases, where full doses of these drugs fail to relieve, where the inflammation is steadily advancing in spite of careful palliative treatment and instillations simply aggravate the suffering, we believe the dangers of ascending infection or interstitial inflammation will be lessened by continuous catheterization practised in the manner described in the Treatment of Chronic Cystitis.

Pelvic congestion is lessened by putting the patient to bed with the pelvis elevated, the thighs flexed on the body, and the knees supported on a pillow, securing regular evacuations from the bowels by either salines or cold normal saline enemata, drawing the blood to the surface by counter-irritation applied over the pubis and to the perineum, rendering the urine bland, and relieving vesical spasm by anodynes.

Counter-irritation may be applied in the form of blisters, which should be small and repeated. Hot fomentations, changed every hour, are more serviceable and less disturbing. Turpentine stupes and mustard plasters applied to the suprapubic region are also efficacious.

Hot general baths or hot sitz-baths are powerful revulsives, and often so relieve the spasm and congestion that the patient remains comfortable for hours afterward, and is able to void his urine almost without pain. Exceptionally, leeches may be applied to the perineum and above the pubis.

The treatment thus outlined—*i. e.* rest in bed with a liquid diet and urinary antiseptics, regular evacuation of the bowels, counter-irritation, and the use of hot baths—is usually all that is required during the acute or hyperacute stage of cystitis, unless there be retention of urine either from congestion, spasm, or obstruction of the urethra by clot, calculus, tumor, or other body; when this occurs the indication for relief of obstruction is imperative, since tension in an acutely inflamed bladder is the most favoring factor in the development of an ascending pyelo-nephritis. The retention is best relieved by permanent catheterization. Should this prove insupportable, there should be no hesitancy in performing perineal cystotomy and draining through this opening. The method of dealing with blood-clots is described elsewhere.

On the subsidence of acute inflammation a treatment somewhat more active than that outlined may be instituted. The urine may be rendered not only antiseptic, but stimulant and astringent; the bladder may be treated

directly by antiseptic lotions. Of the long list of medicines which have been given by the mouth for the purpose of hastening the resolution of inflammation of the bladder, but few are really serviceable. The drugs which have given the authors the best results are sandalwood oil, copaiba, gaultheria, salol, saw-palmetto, and pichi extract. These may be given in the following prescriptions :

R_y. Ol. santal.,
 Balsam copaiv.,
 Ol. cinnamom., āā. ℥v.
 Ft. capsul. No. j.
 Sig. Take one hour after meals thrice daily ; gradually increase to six a day (two after each meal).

R_y. Ol. gaulther.,
 Balsam copaiv., āā. ℥v.
 Ft. capsul. No. j.
 Sig. Three to six capsules daily, after meals.

R_y. Saw-palmetto (berries), gr. xv ;
 Ol. santal., ℥v.
 Ft. capsul. No. j.
 Sig. One capsule thrice daily, one hour after meals.

R_y. Ex. pichi, gr. v.
 Ft. capsul. No. j.
 Sig. Three to six daily, after meals.

If the urine is persistently alkaline, this may be corrected by benzoic acid.

The treatment of the declining stage of cystitis is particularly important, since the disease commonly exhibits a tendency to become chronic. The change from liquid to solid diet should be gradual ; there should be no hurry in getting the patient out of bed, and the urine should be carefully watched to see that it becomes neither markedly acid nor alkaline.

The direct bladder-treatment has for its end the washing out of decomposing and hence irritating urine. By no possibility can an antiseptic be so employed that it will thoroughly disinfect the bladder-walls. It can and does stop fermentation and decomposition, and can be made to replace a fluid which is keeping up irritation. It is essential that the surgeon should clearly understand the limitations of irrigation and the object for which this treatment is applied.

In the treatment of acute cystitis bladder-washing is never indicated when the urine is bland and the bladder is thoroughly evacuated by the act of micturition. Should there be retention and decomposition, as shown by the passage of foul, ammoniacal urine, irrigation is indicated even at the height of the severest form of inflammation. Since the irrigating fluids are solely for the purpose of disinfecting the discharge in the bladder and preventing fermentation, they should be so selected that they do not add to the existing inflammation. This implies the choice of weak lotions. Those which are most serviceable are normal salt solution .7 per cent., permanganate of potassium 1 : 12,000, creolin 1 : 500, boric acid 1 : 100.

The irrigation may be practised with a short urethral nozzle or with a

soft catheter. When there is still dysuria with pain the catheter is preferable. When the patient micturates with comparative ease and comfort a short urethral nozzle should be chosen.

The method of conducting irrigation is as follows: The patient is first instructed to empty his bladder; he is then placed in the dorsal decubitus; an irrigating-bag containing 1 pint of the lotion at blood-heat is hoisted eight feet above the bladder, and the nozzle, shaped like a flattened cone or the extremity of the ordinary gonorrhœal syringe, is attached to the end of the pipe leading from the bag. The fluid is allowed to flow through this nozzle, and is first directed against the glans and the lips of the meatus, which are held apart by the thumb and finger of the surgeon. The tip of the nozzle is then introduced into the urethra, the meatus-lips being pressed against it laterally. The solution is allowed to flow until the anterior urethra is thoroughly distended. The stream is then cut off, and the fluid contained in the urethra is allowed to escape. This process is repeated several times for the purpose of thoroughly cleaning the anterior urethra. The tip of the nozzle is then again introduced into the meatus, the stream is turned on, and is allowed to flow until the compressor urethræ muscle yields and the lotion passes back into the bladder. As soon as the patient expresses a desire to urinate the injection is stopped, and he is instructed to empty his bladder; this process is repeated once or twice.

It is important to avoid injecting so much fluid that the bladder is markedly distended; if this is done, undue reaction will follow the treatment and inflammation of the bladder will be aggravated.

When the patient still suffers from marked tenesmus and has difficulty in fully emptying his bladder, a soft-rubber catheter is employed if this can be introduced. If spasm of the compressor urethræ muscle is so obstinate that it resists the introduction of a soft instrument, the English catheter may be used, its passage being preceded by instillation of a few drops of a 4 per cent. solution of cocaine into the posterior urethra. When the catheter has entered the bladder, as shown by the escape of purulent fluid, from 1 to 3 ounces of the lotion are injected either by the fountain syringe or an ordinary piston syringe. The solution is allowed to escape immediately, but the bladder is not completely emptied. This injection is repeated two or three times, and the catheter is withdrawn whilst the injecting fluid is still flowing through it.

Irrigation or injection into the bladder may be repeated once or twice daily. It is well to employ first normal saline solution at blood heat; if this is followed by undue reaction, the symptoms increasing in severity, and if the surgeon has been careful not to over-distend the bladder in the course of his treatment, irrigations should be dispensed with, unless indications for their use are absolute—*i. e.* ammoniacal and decomposing purulent urine stagnating in the bladder.

If the normal saline is well borne, and particularly if it seems to relieve inflammatory symptoms, one of the mild antiseptics may be substituted for it, preferably permanganate, the strength of the solution being gradually increased in case it does not excite undue reaction. It will often happen that no antiseptic can be employed without increasing inflammation. In this case normal saline solution should be used.

When the urine is clear immediately after having been passed, and on microscopical examination shows no pus, the case can be regarded as cured.

Chronic Cystitis.—The treatment of chronic cystitis will be conducted more successfully if it is borne in mind that septic inflammation of the blad-

der has no tendency to persist in the absence of favoring causes, such as obstruction to the outflow of urine or vesical stone or tumor or chronic congestion. The first consideration in the treatment of chronic inflammation of the bladder is, then, removal of the cause. This in itself is often curative. Thus, a cystitis originally due to gonorrhœa, but which has persisted because of stricture, usually disappears promptly when the narrowing is fully dilated. (This fact does not hold good, however, of chronic posterior urethritis.) Chronic inflammation of the bladder dependent upon stone is promptly cured by removal of the foreign body; a cystitis dependent upon obstruction caused by prostatic enlargement clears up when the obstruction is removed. It often happens, however, that the causes which predispose the bladder to inflammation, and which prevent complete resolution when infection has once taken place, are irremediable. Thus the muscular atrophy following spinal injuries, the obstruction due to inoperable tumors, the infiltration of advanced tuberculosis, will indefinitely prolong an inflammation and are past surgical help. When a chronic inflammation is due to an irremediable cause, or when the cause of such inflammation cannot be discovered (in this case it is usually tubercular), treatment must be directed toward lessening the severity of the cystitis and thus limiting the hurtful effects of chronic inflammation on the bladder-walls.

The therapeutic indications are in general those applicable to acute cystitis, but with some differences of major importance. Thus, chronic cystitis is unbenefited by rest in bed. Powerful antiseptic and stimulant injections are at times highly serviceable, and medicinal treatment by the mouth is markedly beneficial.

The treatment is constitutional and local.

Constitutional Treatment.—Every effort should be made to improve the patient's health. Exercise and diet, so selected that gastro-intestinal disturbances are avoided and constitutional dyscrasie are corrected, are directed, and the hours of sleep are properly regulated; the bowels are kept soluble, preferably by enemata of normal saline solution; the skin is properly stimulated by daily cool sponging followed by brisk rubbing; ordinary water or mineral waters are taken freely, preferably hot and an hour before meals; prepared foods, tonics, and even stimulants, are given in accordance with general requirements. The patient is especially cautioned against over-fatigue, constipation, prolonged standing, resisting the desire to urinate, long course-dinners, chilling of the surface, dampness or chilling of the feet, or excesses in the way of alcohol.

Some of the natural mineral waters are extremely serviceable, probably not so much because of the solid ingredients as because of the quantity ingested. Of these may be mentioned Londonderry lithia and Poland waters, or, when iron is advantageously associated with the diuretic ingredients of the water, those of the Columbia Springs of Saratoga are useful.

Medicinal treatment should, in the first place, be directed toward improvement of the general health. Thus the uric-acid or oxalic-acid diathesis should receive appropriate medication. Valvular lesion or insufficiency of the heart should be treated, and feeble digestion should be stimulated.

It is well to administer a drug which while not irritating the kidneys may make the urine feebly antiseptic. Salol best answers this purpose, and may be given in doses of 3 to 5 grains three times daily. Every third week salol should be replaced by boric acid, oil of gaultheria, or other urinary antiseptic.

In chronic cystitis the urine is commonly alkaline, and irritating because

of this alkalinity: an acid urine is less likely to decompose, and the acid lessens the rapidity of bacterial growth. Hence it is well to administer some form of acid: hydrochloric acid may be given with wine of pepsin after meals, or benzoic acid or benzoate of soda, 10 grains, three times a day.

The balsams have had their chief applications in the treatment of chronic cystitis, particularly that form of inflammation which persists in the vesical neck after the subsidence of an acute gonorrhœa. Of these sandalwood oil is most serviceable. It may be given in the form of an emulsion, but better in soluble elastic capsules one hour after a full meal; from 5 to 15 drops may be given three times a day. Oleoresin of copaiba stands next in efficiency. The dose is the same as for sandal, and these two drugs may be advantageously mixed. Fluid extract of pichi is distinctly less powerful, and the same can be said of saw-palmetto. It must be remembered that the good which is accomplished by these drugs is in no way commensurate with the disadvantage incident to disturbing digestion, and that on the first sign of dyspepsia the balsams must be immediately withdrawn. Even though they agree with the stomach, if after they have been given for three days there is no marked improvement of symptoms—*i. e.* lessened frequency of urination, lessened pain, and diminution in the quantity of pus—there is nothing possibly to be gained by their continuance. They seem to act as stimulants to the sluggish circulation of the chronically inflamed mucous membrane.

Of other drugs serviceable for their direct action on the bladder, may be mentioned tincture of cantharides, given in drop doses hourly for two or three days; oil of turpentine, 5 drops in emulsion six times a day; arbutin, 5 grains three times a day; oil of eucalyptus, 10 drops six times a day.

Among other forms of systemic treatment the beneficial effects of change of climate and surroundings and of properly directed hydro-therapeutic treatment can scarcely be exaggerated.

As a means of throwing a certain amount of the burden of elimination upon the skin, the writers have long been in the habit of directing patients, particularly those whose kidneys show signs of giving out, as also those suffering from cystitis without involvement of the higher tract, to use a vapor-box. This can be built in the patient's bath-room. It consists of a box large enough for the patient to sit in with his head projecting from a hole in the top. A door is cut through the side and the top is provided with a hinge. Within the box is placed either a gas stove or an alcohol lamp. The patient sits on a chair, placing a towel around the neck, thus covering the opening through which the head is thrust. The lamp is lit, the door is closed, and the bath is prolonged for from five to fifteen minutes, always to the point of producing a dripping perspiration. This is followed by a cool sponge-bath and vigorous friction with a coarse towel. It seems to exert a markedly beneficial effect upon the more distressing symptoms of chronic cystitis, but it is not adapted to all patients, since certain ones exhibit an idiosyncrasy against surface heat.

The *local treatment* of cystitis consists in irrigations, instillations, and drainage through the urethra or through a perineal or suprapubic opening.

Irrigation is applied to the bladder for exactly the same reason that it is applied to any suppurating surface. It is designed to remove, mechanically, decomposing discharges, to exert a healing and stimulating effect upon inflamed surfaces, and to lessen or prevent further fermentation or decomposition. It cannot possibly disinfect the entire diseased and suppurating tissues, since the micro-organisms are so deeply placed that they cannot be

reached or affected by the most powerful antiseptics. Solutions are usually chosen for their cleansing rather than for their stimulant effect, since it is difficult so to select a powerful drug that its irritating effects will not do more harm than good. Therefore weak, unirritating antiseptic lotions are usually chosen. Of these the most serviceable are silver nitrate 1 : 5000 to 500, potassium permanganate 1 : 5000 to 2000, carbolic acid 1 : 500, boric acid 1 : 50, normal saline solution .7 per cent.

When a stimulant effect is desired—and this is in cases of chronic indolent cystitis characterized by marked thickening of the bladder-walls and resistance to the milder forms of treatment—silver nitrate is the solution of choice in the strength of 1 : 500 to 1 : 50.

Irrigations may be applied either through the short urethral nozzle or the soft-rubber catheter. The bladder should not be distended to the point of causing pain and spasm. When these result from the injection of one or two ounces, irrigations should give place to instillations.

The treatment should be repeated in accordance with the amount of reaction excited. When the latter is practically wanting, and the suppuration is free and decomposition occurs rapidly, the washings may be repeated twice daily. Usually once daily is sufficient, though when there is retention of foul, ammoniacal urine, requiring for its removal the repeated daily use of the catheter, irrigation should be practised each time that the catheter is passed. The patient is taught to irrigate himself, and usually finds it most convenient to apply the treatment while sitting in the water-closet.

When the short nozzle is used the patient can usually tell when the fluid enters the bladder, and the steady flow of the fluid can be felt by the surgeon's fingers, since it imparts a certain thrill which when once recognized cannot be mistaken. This irrigation is repeated until the fluid injected returns clear of pus. The elevation of the irrigating vessel is from six to eight feet above the level of the bladder. The writers frequently use a narrow, deep glass reservoir with a gauge marked on the side. By watching the liquid in this reservoir it is easy to tell when the fluid is flowing into the bladder and to determine accurately the amount injected. This form of irrigation is applicable when the patient urinates easily and empties his bladder almost completely. When cystitis is complicated by retention of urine, or when the act of urination is extremely painful, irrigation should be accomplished by means of a soft catheter. This is attached to a fountain syringe; the lotion is allowed to flow through, and while it is flowing the catheter is slowly passed into the bladder; three to six ounces are injected, and the tube leading to the fountain syringe is disconnected and the injection is allowed to flow out. The bladder is emptied, is again injected with antiseptic lotion which is allowed to escape, and this process is repeated until the fluid comes away clear. About an ounce is left in the bladder and the catheter is slowly withdrawn, the fluid still flowing through it.

In practising the cleansing irrigations the strongest antiseptic solution should be selected which can be used without causing undue irritation. The latter varies in different cases, and even in the same case varies at different times. The least irritating lotion is normal saline solution; next in point of blandness comes boric acid, next permanganate of potassium.

It often happens, because of sacculation in the bladder, that the removal of all the decomposing uro-purulent secretion is extremely difficult. In such cases it is well to have the patient change position during irrigation, to stand up, to lie down in the dorsal and lateral decubitus, or even to assume the

knee-elbow position. Experience will soon show what posture is most favorable for thorough cleansing of the bladder.

The effect of these irrigations should be to diminish the quantity of pus and mucus, to render the urine bland and unirritating, and to lessen the severity of inflammatory phenomena, though these in chronic cases are often entirely wanting.

When irrigations are administered for their stimulant effect, strong antiseptic solutions are used. The purpose of this treatment is not to destroy all the germs lying in the bladder, but to set up an acute cystitis, thus stimulating sluggish circulation, replacing an old and organizing exudate by an acute and inflammatory infiltrate, and putting the bladder-walls in such condition that, after having ridden themselves of a long-standing inflammatory deposit, partial or complete resolution may take place.

The solution of choice is silver nitrate. The injection should be made through a catheter, and should be preceded by a thorough washing with boric-acid solution. The strength of the solution varies from 1 : 500 to 1 : 50. From 1 to 4 ounces of this lotion are thrown into the bladder, and left there one or two minutes and then allowed to escape. The bladder is then washed with boric-acid solution, and this washing is repeated twice daily for the next three or five days. This treatment is not free from danger, since by rendering a chronic cystitis acute it may cause infection of the kidneys by way of the ureters. It should never be employed when cystitis is complicated by retention, but in certain long-standing inflammations, persisting in spite of more conservative treatment, this method may prove serviceable.

Instillations are particularly serviceable, when because of irritability of the bladder and intolerance of distention, irrigations excite undue inflammatory reaction, and when the inflammation is limited in the main or entirely to the neck of the bladder and the vesical trigonum.

The symptoms of cystitis—*i. e.* frequency, urgency, tenesmus, strangury, and pain—are chiefly dependent upon inflammation located about the vesical neck; when these symptoms are particularly well marked, there is reason for believing that inflammation is thus situated.

Instillations are applied by means of an instillator, which is a silver or hard-rubber cylindrical catheter about 18 Fr. caliber, provided with a fine canal; to the end of the shaft of this catheter is fitted a hypodermic syringe with a capacity for forty minims. In applying the instillations the syringe is filled with the lotion of choice; the catheter is lubricated with glycerin or boroglyceride, and is introduced into the urethra until its tip is within the grasp of the compressor urethræ muscle. The piston of the syringe is then driven down, causing the injection to flow along the membranous and prostatic urethra and into the bladder. It is sometimes desirable to employ a more bulky injection, from two drams to half an ounce. In this case a larger syringe should be attached to the catheter.

The solutions of choice for instillation are silver nitrate from 1 to 5 per cent., corrosive mercurial chloride 1 : 6000 to 1 : 2000 iodoform emulsion, and glycerin, 10 per cent.; the corrosive-chloride solution and iodoform emulsion are mainly serviceable in tubercular cases. The silver nitrate is useful in gonorrhœal cystitis. It is nearly always followed by marked inflammatory reaction, which subsides in from one to two days, and is followed by a marked amelioration of symptoms.

Vesical drainage is indicated when, in spite of the general and local treatment already outlined, or because this cannot be borne without exciting undue inflammatory reaction, the symptoms of cystitis are steadily progress-

ing and the dangers of ascending nephritis are increasing. It is mainly in ribbed and sacculated bladders which cannot be thoroughly cleansed, and in the contracted, irritable bladders of long-standing parenchymatous inflammation, or in those that cannot be properly treated through the urethra, that drainage will be required.

The simplest and safest form of drainage is that by continuous catheterization. A soft catheter of medium caliber should be selected: since it is usually in patients with enlarged prostates that such drainage is required, the Nélaton "elbow" catheter is the one of choice. Important points to observe in the treatment are that the eye of the catheter lies just within the bladder, and that the instrument thoroughly and continually drains this viscus. To determine the position of the eye of the catheter in relation to the neck of the bladder, the instrument is introduced and the bladder is emptied. Four to six ounces of boric-acid solution are then injected, and the catheter is withdrawn until the fluid ceases to flow. It is then passed in until the fluid begins to flow, and is held in this position until the bladder is empty. It is secured by a thread tied around the shaft of the instrument a sixth of an inch beyond the lips of the urinary meatus; the ends of this thread are secured to adhesive straps which are fastened to the sides of the penis. The end of the catheter is plunged into an antiseptic solution contained in a urinal which is kept at a level lower than that of the base of the bladder. The catheter is carefully watched to see that the urine flows continuously. Twice a day the bladder is irrigated through this instrument with a mild antiseptic lotion, and once in forty-eight hours the catheter is changed. If it has been properly placed, it will usually excite little or no pain, but slight urethral inflammatory reaction, and it will promptly relieve the tenesmus and pain from which the patient has been suffering. If it becomes blocked or its end is introduced too far into the bladder, it is worse than useless.

This continuous catheterization may be kept up from one to three weeks. It usually causes a mild traumatic urethritis. This is treated by withdrawing the catheter slightly at each irrigation until its end lies without the compressor urethræ muscle. By forcing an antiseptic solution into the catheter it will then flush out the entire anterior urethra. After thus flushing the entire anterior urethra with a pint of fluid the catheter is again introduced into the bladder.

When the catheter excites so much pain that it cannot be borne, or when it cannot be introduced, the indications are plain for continuous drainage through a perineal or suprapubic opening made into the bladder. If the opening is temporary—*i. e.* if there is reason to believe that cystitis is curable—the perineal opening is the one of choice. This is made by a median perineal cystotomy, as described elsewhere. A drainage-tube the size of the little finger is introduced, and is secured in place by a stitch to the skin, and through this opening the bladder is washed twice daily, the patient being allowed to move about wearing a urinal. The tube devised by Tilden Brown answers admirably for purposes of drainage.

Suprapubic drainage, particularly the method proposed by Hunter McGuire, offers the advantage of not requiring the patient to wear a urinal. The method of performing this is as follows: Preparations are made such as are customary in performing the operation of suprapubic cystotomy. The bladder is thoroughly irrigated with boric acid; a rubber bag is inserted into the rectum and distended with 6 or 8 ounces of water; 4 ounces of boric solution are injected into the bladder. With a small scalpel the incision is made through

the skin and superficial fascia in the median line, commencing about two inches above the pubic bone and extending a little below the level of its upper border. The fibers of the recti muscles are separated with the handle of a knife, and the wound is deepened to the transversalis fascia. When this is incised the prevesical fat is exposed. The large veins running through it are pushed aside, and the friable tissue is scraped through until the finger rests upon the wall of the bladder. The back of the knife is then placed closely against the upper border of the pubis; its point is pushed through the wall of the bladder and a cut is made upward about half an inch long.

Before all the fluid escapes a finger is introduced through the opening and the interior of the viscus is examined. The rectal bag is then removed; a rubber catheter is introduced along the finger into the bladder, and is stitched to the skin at the margin of the wound. There is practically no loss of blood, since the incision is made through tissues which contain no large vessels.

The wound is dressed by laying some gauze around the catheter, the patient is put to bed, and the free end of the catheter is inserted into the neck of a bottle to catch the urine. No stitches are employed nor is any effort made to approximate the surfaces of the cut. The wound heals by granulations, and in two weeks only a fistulous tract is left in the line occupied by the catheter.

The patient is kept in bed for two or three weeks until the wound heals. The urine is kept acid; the bowels are opened by regulation of the diet and the use of simple laxatives. At the end of two or three weeks there remains an artificial urethra lined with a coating closely resembling mucous membrane.

The patient is then fitted with a silver plug or stopper. This plug should have a diameter of about No. 20 Fr., and should be just long enough to enter the bladder. It keeps the opening patent and acts as a stopper to prevent dribbling of urine. It should be constantly worn, except when the patient wishes to empty his bladder or to irrigate it. The plug is kept in place by a belt which goes around the hips and passes over the plate of the plug. This belt is prevented from slipping up or down by a belt above, which is supported by the hips and by perineal bands which encircle the thighs. Through this short direct artificial urethra irrigations are readily accomplished. The operation is especially applicable to cystitis complicating enlarged prostate.

TUBERCULOSIS OF THE BLADDER.

Tuberculosis of the bladder is a not uncommon condition. There are two main classes of vesical tuberculosis: those of one class are a part of the systemic metastasis of pulmonic, osseous, or intestinal tuberculosis; those of the second class constitute uro-genital tuberculosis. Etiologically, no such division can be maintained, for perhaps the majority of cases of uro-genital tuberculosis are secondary to foci elsewhere in the body, either demonstrable or hidden. From the standpoint of practical surgery, however, the division is justifiable and advantageous.

The relations of the bladder to uro-genital tuberculosis are threefold: Either the bladder infection may be secondary to renal tuberculosis, or the primary focus may be in the bladder, or the vesical infection may be secondary to foci in the lower uro-genital tissues. That the first and third varieties are the common forms is in itself evidenced by the rarity of vesical tuberculosis in the female, which is well expressed by the figures of the pathological

department of the Dresdener Krankenhaus, where in 2500 necropsies on female bodies vesical tuberculosis was 4 times noted.

Concerning the relations of vesical to renal tuberculosis there has been much divergence of opinion. It is not always possible, even with the greatest care, to ascertain in the individual case whether it belongs to the ascending or to the descending form. Clinically, symptoms are liable to appear earlier after vesical than after renal involvement, so that, even though the renal lesions be the earlier, the first symptoms might be referred to the bladder. On the other hand, the extent of the lesions post-mortem may be misleading, since the progress of tuberculosis is usually more rapid and extensive in the kidney than in the bladder. Nor does the involvement of the prostate, seminal vesicles, epididymis, or testicle always furnish conclusive evidence, since their infection may be secondary to the vesical lesions.

Hamill has carefully studied the well-recorded cases of renal tuberculosis in children (55 cases in all, with 1 new case of his own), and in only 1 of these cases was there any genital involvement; this was regarded as secondary by the author of the report. In 1 other case the primary infection might have been in the bladder, but any conclusion was doubtful. In 16 cases the bladder was involved, in 4 cases extensively. It is therefore certain that in children the primary lesion of uro-genital tuberculosis is nearly always in the kidney.

In the adult the relations are very complex, and the views correspondingly divergent. Nearly all writers concede an ascending and a descending form of infection of the bladder; the relative frequency, however, is entirely unsettled. Camargo has published the records of the cases which came to autopsy in Geneva, and of the 30 cases of renal tuberculosis, 26 showed involvement of the bladder, while the genitalia were involved in only 11: conceding, what could not be reasonably assumed, that the 11 cases in which the genitalia were involved were of the ascending type, the decided majority would still lie with the cases of descending type. In striking contrast to the figures of Camargo are those of Simon, who in 14 cases found tuberculosis of the seminal vesicles 13 times, of the prostate 13 times, of the epididymis 12 times, and of the kidneys 9 times; but he did not show that the 9 cases in which the kidneys were affected could not have been of the descending type.

The experimental attempts at a solution of the question by injections of tubercle bacilli into a ligated ureter above the ligation have given discordant views: only once (Albarran) has renal tuberculosis followed the experiment. Although the matter is of considerable importance, it is obvious that more pathological data than are available to-day must be at hand before a definite statistical conclusion can be formed. It is nevertheless our present opinion that the bladder is more often infected by tuberculosis from the kidneys than from the genitalia. It is quite certain that in not a few cases there is a simultaneous infection of various parts of the uro-genital system.

The method of infection of the bladder obviously varies. Secondary to renal lesions the vesical mucosa may be infected from the urine, or the process may travel down the ureter, and from there attack the bladder: a hematogenous or lymphatic infection is rare, but such cases have occurred.

Infection from the genital system probably occurs always by contiguity. The process extends from the epididymis or vas deferens or the seminal vesicles to the prostate, whence it extends to the region of the canaliculus seminalis, and from here directly to the bladder, following which it extends by natural contiguity to the ureters. The process is the same in the primary infection of the prostate gland. Whether the semen can infect different

tissues in the same individual has not been decided. It is not probable that infection of the bladder from the genitalia by the blood-vessels or lymph-channels occurs. Ascending infection from the urethra has never been demonstrated.

In primary vesical tuberculosis the site of the lesion may be anywhere. Whether ascending or descending, in secondary infection the area commonly affected is the base, the neck, and around the mouths of the ureters, whence the process may extend laterally. The first stage consists in infiltration of the mucosa and submucosa. Often the appearance is that of typical miliary tuberculosis—tiny scattered clumps of round-cells, with a few giant-cells and the easily demonstrable bacilli. In other cases the growth is massive, and has not the tubercular appearance, being more of a uniform submucous infil-

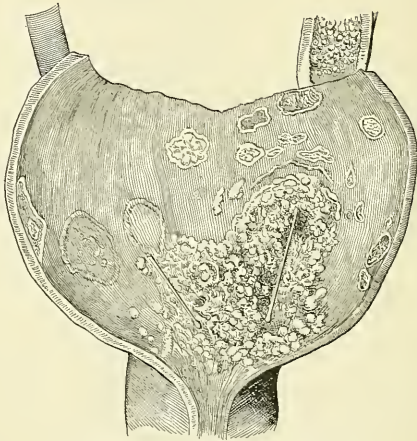


FIG. 111.—Tuberculosis of the bladder (Orth).

tration. It is probable that in all cases both these stages are traversed. Sooner or later caseous degeneration and necrosis occur, the mucous membrane sloughs away, and the typical tubercular ulceration is produced. In some cases the ulcers are tiny, numerous, and very shallow. In other cases the ulceration is extensive, irregularly deep, and in places excavating. Perforation is extremely rare; the process is so slow that the adventitia has ample time to protect itself by fibrous overgrowth.

The base of the ulcer is formed of round-celled infiltration; the edges are composed of the same tissue which extends for some distance beyond the edge of ulceration. Beside the ulcer is a more or less marked inflammation of the mucous membrane, usually septic in character. The mucous membrane may present tiny villousities, and may be covered with urinary salts and blood-pigment, with which the ulceration may likewise be encrusted. Calculus may coexist, and is obviously a secondary condition.

When the vesical infection is simply a part of a general acute miliary tuberculosis, the process rarely advances to the bladder the point of ulceration. There

is but little local reaction, the deposits are usually submucous, and cystitis is usually not present.

Vesical tuberculosis is usually seen between the ages of fifteen and thirty-five years. Cases in younger subjects are not infrequent; in older subjects the infiltration is rare. The vast majority of cases occur in males. In recent years tuberculosis of the Fallopian tubes and ovaries has been shown to be comparatively common, and in some of these cases the bladder has been involved, probably by paravesical extension. These cases, however, have not usually presented vesical symptoms. As vesical infection in women, apart from the problematical infection during coitus, must be either from the kidneys, tubes, and ovaries or primary in the bladder, it is obvious that, since vesical tuberculosis is rare, renal tuberculosis likewise must be rare; and this agrees entirely with pathological statistics. Just why renal tuberculosis should be so much rarer in women than in men cannot be explained. The advocates of the ascending form of infection find in this fact a confirmation of their view that the primary focus of uro-genital tuberculosis is in the testicle, epididymis, prostate, etc. As before stated, however, the pathological conditions are so complex and obscure that the matter cannot be settled in such an easy, offhand manner.

The conditions occur most often in families with tuberculous tendencies.

Symptoms.—The first symptom of vesical tuberculosis is pain, hematuria, or increased frequency of micturition. Usually pain and increased frequency of micturition are combined, and they are commonly the initial symptoms. The increased frequency of micturition is usually noticed during the day; in some cases it is not present during the night. Later in the course of the case it usually becomes aggravated, and after the voiding of urine there is not the sense of complete evacuation, but a constant desire to expel an imaginary residue. The symptom is in some cases not constant, but intermittent, and the patient may be free from it for weeks at a time.

The pain is at first only experienced during the act of micturition. It is a stinging, burning urethral pain, which may be felt in the deep urethra, but is more commonly referred to the anterior urethra, and often persists in the glans after micturition: should the urethra or the neck of the bladder be blocked by a clot of blood or by a mass of tenacious pus, the pains will at once become colicky in character. Later in the case penile pains are felt apart from the act of micturition.

A dull suprapubic pain develops in nearly all cases; it is increased by vesical distention, and decreased or entirely relieved by the evacuation of urine. In some cases there is a deep pain behind the scrotum, sometimes accompanied by a bearing-down which is usually interpreted to be the result of prostatic lesions. If the disease be secondary to subvesical genital lesions, the pains characteristic of such conditions would coexist with the vesical pains, which indeed they often precede. In similar manner renal and ureteral lesions would cause the pains proper to those conditions, but it must be remembered that even though the suprapubic lesions were the earlier, their symptoms would very often not have preceded the vesical pains.

The hematuria is often very variable. Usually there is but little blood, and often this is seen only toward the close of the urination. It may, however, appear with the beginning of the stream and may color the whole flow. The bleeding is likely to be constant, but may intermit, and long periods may pass without any bleeding. The quantity is usually slight, but may be very profuse, and rarely large clots may form in the bladder. As a rule, the

bleeding is spontaneous, but there can be no doubt that a strain or exposure to cold or wet can excite it.

As a rule, early in the case the stream of urine is not affected. Stoppage of the stream may, however, occur, and is either due to reflex spasm or is volitional (though scarcely conscious) stoppage. Later the urethra may be momentarily obstructed by blood, pus, or tissue, and a more or less complete stoppage of the stream will ensue.

Vesical tuberculosis is often compatible with moderate general health. Extensive renal lesions and severe cystitis, however, soon profoundly affect the patients. In all cases they gradually become emaciated, weak, and anemic. Later the anemia assumes a cachectic character, the general asthenia becomes marked, and the subjects fall into a wretched condition, frequently aggravated by systemic tuberculosis.

Fever is often present. It may be due to the vesical tuberculosis (including in this the uro-genital), to systemic tuberculosis, or to septic cystitis. It is usually moderate, with an evening rise; it may be accompanied by slight chills and by perspiration. In rare cases severe septic cystitis may cause high fever, with profound systemic intoxication.

The symptoms of acute or chronic uremia often alter the appearance of these cases, and obviously a systemic or other local tuberculosis would alter the symptomatology in various ways.

Urinary Signs.—Early in the case the urine is normal in quantity and acid in reaction. A rare reflex polyuria has been noted. Later, the renal lesions may produce the polyuria of interstitial nephritis, but oliguria is the usual condition. The advent of cystitis will be followed by a change in reaction to alkalinity.

The specific gravity is normal at first; later it is usually lowered. So long as the urine remains acid it will be fairly clear, although slightly opaque on account of the presence of pus: when it has turned alkaline it becomes very densely clouded. The color is whitish when no blood is present; according to the extent of bleeding it will vary from the faintest pink to a deep dark-red.

It is rare that macroscopic clots occur. Under spectroscopic examination, while the urine remains acid the absorption-bands are usually those of oxy-hemoglobin; when the urine is alkaline the absorption-bands of methemoglobin are more commonly seen.

Albumin is of course always present with pus or blood; it requires, however, a large amount of pus or blood to produce a marked reaction of albumin. In cases with renal involvement the albuminuria would be more marked, and in any given case it may be necessary to determine its vesical or renal origin by the methods given on pages 356 and 401. In this relation it must be borne in mind that amyloid disease is not uncommon, and that Senator's sign (excess of globulinuria) will be present in such cases.

The sediment varies greatly. In some cases it is slight; in others it is excessive. Pus is always present from the beginning. The pus-cells are the ordinary polymorphous leukocytes, often deeply degenerated. In alkaline urine they may become agglutinated and lose almost entirely their morphological characteristics. The blood-cells are usually well preserved in acid urine; in alkaline urine fragmentation is common. Microscopic clots are not uncommon. The crystalline sediment in acid urine is usually composed of urates, uric acid, and rarely oxalates. When the urine has become alkaline the triple phosphates are precipitated in large quantity.

Pieces of tissue are rarely voided in tubercular cystitis, and when voided

are usually so degenerated as to preclude any hope of a histological diagnosis. From them, however, the possibility of a neoplasm may sometimes be excluded. Leyden has called especial attention to gritty particles in the urine of these cases.

Tubercle bacilli are sparsely contained in the pus. In staining for them the older long method (Koch-Éhrlich) is undoubtedly superior to the Gabbet method. Another good method is that of Günther. When in a suspicious case no bacilli can be found, the sediment should be injected into the subcutaneous tissues of the abdomen of a guinea-pig, and the animal killed four weeks later: tuberculosis when present will be seen in the minute lymph-glands or throughout the entire body, and from the infected tissue the conditions may be confirmed by culture studies.

All urine examined should be perfectly fresh, since the smegma bacillus develops rapidly in standing urine. For the differentiation of the smegma bacillus from the tubercle bacillus no positive staining method is known. There is, however, evidence that the tubercle bacilli resist decoloration by alcohol longer than the smegma bacilli, and that they appear more clumped. In doubtful cases an injection-experiment should be made upon a guinea-pig.

When cystitis is present various micrococci, staphylococci, members of the common colon group, and the protens of Hauser may be found in the urine.

Vesical tuberculosis in the absence of cystitis may reach a comparatively advanced stage, at least in so far as the dissemination of the lesions is concerned, without exciting a single symptom sufficiently pronounced to attract the patient's attention. Careful investigation into the history of these cases will, however, show that there has been some slight frequency of urination, particularly marked during the night and after meals. Often the first warning the patient has as to the abnormal condition is the finding of blood in his urine by the medical examiner. Hematuria may be an early symptom; bleeding is slight, occurs without obvious cause, and is often terminal, one or two drops escaping with the last urine passed. Bleeding is irregularly recurrent, appearing and disappearing suddenly, but as the disease progresses it becomes more pronounced and constant. Very exceptionally, from erosion of a comparatively large vessel, there may be profuse hemorrhage. This is, however, much more characteristic of vesical tumor, and when it occurs should always give rise to suspicion of bladder-neoplasm. Patients usually pass a large quantity of clear urine.

Children often suffer from nocturnal incontinence. Pain is a symptom of cystitis rather than of tuberculosis. This complication (cystitis) almost inevitably occurs in every case of tuberculous bladder. Its exciting cause is usually instrumentation undertaken for the detection of a vesical calculus, the symptoms of which are often closely simulated by vesical tuberculosis. Infection may, however, occur in the absence of all urethral exploration. Having once developed, it is little influenced by treatment, and its symptoms completely overshadow those of tubercular infiltration. Pain is often extremely severe. There is often a torturing desire to urinate, recurring every few minutes, and accompanied by violent tenesmus each time an effort is made to empty the bladder. The symptoms are especially pronounced when the tubercular infiltration attacks the trigonum as the seat of preference; when the trigonum is spared, pain may be entirely wanting or be quite bearable through the entire course of the disease. In the late stages of the disease there may be incontinence of urine from tubercular infiltration of the sphincters.

Diagnosis.—This is based on the discovery of the tubercle bacilli, frequent urination, and hematuria occurring in a young man without appreciable cause, the presence of tubercular lesions in the epididymis, cord, prostate, or seminal vesicles or other portions of the body, and the absence of causes other than tuberculosis which can satisfactorily account for the symptoms.

When tubercle bacilli cannot be found, diagnosis may be made by cystoscopic examination. The finding of disseminated or grouped tubercles or of ragged, irregular, punched-out, necrotic ulcers will be conclusive. It is probably true that no lesion of the bladder requires for its cystoscopic detection and diagnosis more experience than tuberculosis. Hence, when the appearance is not typical and the examiner is not especially skilled, even the findings of the cystoscope may be inconclusive.

König states that one-half the patients who complain of pus and mucus in the urine as the principal symptoms are tuberculous. It is undoubtedly true that many cases of tubercular cystitis are not diagnosed as such, and the surgeon should always suspect tuberculosis when patients present themselves suffering from intractable cystitis, which careful examination and study of the history of the case show is not due to any other of the ordinary causes of this affection.

Prognosis.—Vesical tuberculosis as an isolated lesion is extremely rare; even in the absence of signs or symptoms of involvement of any other portion of the genito-urinary tract the ultimate prognosis is grave; it is made still more serious by the onset of cystitis. The disease may run an extremely slow course, lasting for many years, provided the bladder does not become infected. Under change of climate and the best hygienic surroundings it may become quiescent. It has, however, a tendency slowly to extend.

Treatment.—If vesical tuberculosis is recognized before the onset of cystitis, careful avoidance of the ordinary causes of vesical congestion, such as resisting the desire to urinate, chilling, over-fatigue, and irritating conditions of the urine, the administration of mild antiseptics, such as salol and boric acid, in small doses, due attention to diet and general hygiene, and an open-air life in a dry healthy climate, represent all that should be done besides the administration of preparations such as digested cod-liver oil, iron, nux, and other tonics. It is particularly at this stage of the disease that the passage of instruments into the bladder should be avoided.

It has been shown that it is practically impossible to render the anterior urethra entirely sterile; hence when the instrument is introduced into the bladder through the urethra, it is possible that infection may be carried back in spite of the most minute precautions. The tubercular bladder is predisposed to infection, owing to the chronic congestion or even ulceration caused by the tubercular lesions; infection, once started, is practically incurable, and transforms a painless, slow disease to one which may cause agony and may extend with great rapidity. It is therefore apparent that unless the surgeon is prepared to operate immediately in case conditions are favorable, instruments should not be introduced into the non-infected bladder. This objection does not hold against the introduction of the cystoscope or the sound after cystitis has developed, though the intravesical employment of these instruments undoubtedly aggravates the inflammation.

The local treatment of vesical tuberculosis must be conducted with great care, since violent inflammatory reaction is readily excited. The most successful treatment yet reported is that of instillations of corrosive mercuric chloride as practised by Guyon, who begins with solutions of 1:5000, gradually increasing the strength up to 1:1000. Even these weak injections

invariably excite some inflammatory reaction: this is usually slight and transitory, but may exceptionally be severe.

Before making the instillation the bladder should be entirely emptied. This may require the use of a catheter. In that case it is unnecessary to use two instruments, the lotion of choice being injected through the catheter after the bladder has been emptied and gently irrigated. In practising this preliminary irrigation, always indicated when the bladder contains residual ammoniacal urine loaded with mucus and pus, care should be taken not to produce undue tension, since this is always followed by inflammatory reaction. Two to four ounces of an irrigating solution should be injected at once and allowed to escape, this process being repeated until the liquid flows out clear. The catheter is then withdrawn until its eye lies just within the grip of the compressor urethræ muscle; from 20 drops to 2 drams of the corrosive-chloride solution are driven through it by means of a syringe, after which it is withdrawn.

When the preliminary irrigation of the bladder is not indicated—that is, when the patient is able voluntarily and completely to empty this viscus—the instillator is employed. It is introduced until its tip is just within the grasp of the compressor urethræ muscle, and the lotion is then driven in. The quantity and strength of the lotion introduced are increased carefully, the surgeon being guided by the degree of pain and reaction which is excited. If the tip of the instillator is properly placed, the entire prostatic urethra is moistened by the solution. Treatment is repeated daily or every second or third day, and in a number of reported cases has apparently been followed by definite permanent cure.

Instillations of a 10 per cent. mixture of iodoform in glycerin have been suggested, and, if reports are to be trusted, have given satisfactory results. Of this method of treatment the authors have no personal knowledge; theoretically, it should be serviceable, since iodoform seems to exert a specific effect upon tubercular lesions—not, however, unless it is driven into the substance of the tuberculous infiltration.

Operation is indicated when vesical lavage and instillations have failed to influence the disease beneficially, or when the pain becomes exhausting and is not influenced by safe doses of narcotics. These cases very commonly exhibit an extensive infiltration of the seminal vesicles and perivesical tissues; hence complete eradication of the disease is scarcely practicable. The operation is then performed for the relief of the frequency and urgency of the micturition and pain, the bladder being drained through a suprapubic opening. As the result of drainage the patient may be completely and permanently relieved of his suffering, though it sometimes happens that pain and straining persist.

A perineal opening is in the great majority of cases distinctly to be condemned in these cases. The tubercular infiltration is usually at the bladder-base, about the trigonum and the vesical neck; an incision through the tubercular tissues is likely to be followed by infiltration of the entire wound, resulting in the formation of obstinate, often incurable, fistula. A special advantage offered by the suprapubic operation is that it renders the tubercular lesions accessible to operation, provided these are so limited in depth and extent that it is possible completely to eradicate them. They may be thoroughly curetted and treated with iodoform, which is well rubbed in, or may be destroyed by the application of the galvano-cautery or the Paquelin cautery. According to reported cases, this method of treatment has been followed by some permanent cures. With tuberculosis, even in a reasonable percentage

of cases confined to the bladder alone, this form of surgical intervention is one which should be followed by cure in the majority of cases.

The bladder having been opened above the pubis, and the tubercular lesion having been scraped and cauterized, Guyon's double drainage-tube is introduced, the bladder is irrigated four times a day with normal saline solution or a weak antiseptic, and the patient is allowed to recover with a suprapubic opening, which is not allowed to close until cystitis and all painful symptoms have disappeared and no more blood is passed in the urine.

Even with a suprapubic opening there is a constant risk that the wound may exhibit tubercular infiltration, and may re-ulcerate and break down, thus forming a fistula, or that, the ulceration extending still farther, an abdominal hernia may result.

TUMORS OF THE BLADDER.

Pathology.—The pathology of the neoplasms of the bladder has been carefully studied by Virchow, Thompson, Guyon, Cahan, Le Dentu, Hasenklever, Rauschenbusch, Winkel, Sperling, Küster, Antal, Stein, Albarran, and Clado. Of these, Küster, Antal, Albarran, and Clado have written special treatises, which are not only superb contributions to the literature of pathology, but are, furthermore, works which deal in a most superior manner with the practical surgical problems connected with vesical tumors.

Neoplasms may be either primary or secondary: only the primary growths are of real practical interest, and it is these which are considered in the following pages.

Vesical neoplasm is an uncommon condition. Hasenklever collected the statistics of 7037 necropsies, and found cancer of the bladder noted in but 40; of these, 3 only were primary. Cancer is the second of the vesical tumors in frequency, and from the proportion (3 cases in 7000) a good idea is obtained of the frequency of primary vesical growths in general. Clinically, the primary growths are probably more often observed than are the secondary. In any attempt at classification vesical neoplasms must be considered from two points of view—the histological structure and the site of origin.

The direction of growth of any neoplasm is of great practical importance, and this will be discussed under each heading; but we do not think Guyon's classification into implanted, pediculated, and infiltrated tumors possesses more than clinical value, nor can a division into benign and malignant growths be supported: so many tumors are at the border-line that it seems better to consider these qualities while describing each variety of growth.

Not infrequently, the tumors are mixed—that is, composed of different types of tissue—a condition which often influences the clinical course of such growths.

As the largest general class of vesical neoplasms will be studied—

A. Tumors of Epithelial Tissue.—Of these there are many varieties, which will be considered seriatim.

Papilloma.—Papilloma is the most frequent neoplasm of the bladder. It is seen most often between the ages of thirty and fifty. It has, however, developed in a child of one year and in an old man of over seventy years. Males are more frequently affected than females. Although Stein in his table found the sexes equally affected, the statistics of all other surgeons who have given special attention to the matter show that about 70 per cent. of papillomata occur in the male sex. The majority of cases in women, however, occur at an earlier period of life than in men.

Site.—The base of the bladder is the favorite seat of papillomata. The vulnerability of the trigonum has been the subject of animated discussion. From the review of a large number of recorded cases it may be concluded that the trigonum is infrequently affected alone. It is, however, often involved with the base or the ureters. The papillomata of the base often extend to the posterior or either lateral wall. Such tumors, limited to the posterior wall, are, however, not uncommon. Somewhat rarer are growths upon the lateral wall, the vault, or the anterior wall. Papillomata usually spring from about the ureteral orifices, rarely from the neck or the opening of the urethra.

In a few cases the tumor has involved almost the entire surface of the bladder; it is single in about 60 per cent. of the cases. Even whenever

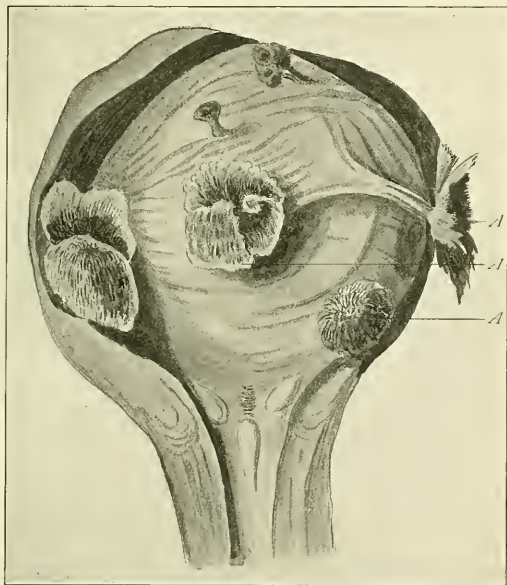


FIG. 112.—Papilloma, the vesical walls thickened by the interstitial sclerotic cystitis: A, A, A, epitheliomatous tumors attached to the vesical walls by long pedicles (Clado).

multiple, it is unusual for the number to exceed three or four, although more have been observed.

The macroscopic appearances of different papillomata vary greatly; they are in their very nature exogenous formations. Although the different growths are of different appearances, certain general types may be fixed. Some are simple villosities, small tender tufts which project into the cavity; as a rule, they are short, are quite prone to be multiple, and are very fragile and tender; they may grow into the ureter or urethra. Their color is a reddish-gray, with here and there an occasional hemorrhagic spot. Such growths must be distinguished from the mucous polyps of inflammatory origin.

Another type, the one most frequently encountered, is that in which the growth is pediculated; it is probably formed out of simple villousities, the growth of the pedicle being in some way associated with the varying physical states and movements of the bladder. The tumor presents the appearance of a bunch of villi surmounting a pedicle. This pedicle may be round or flat; it is rarely over one-third to three-fourths of an inch long, although pedicles several inches long have been seen. In a few rare cases there have been several pedicles. The pedicle is attached to the mucous membrane only; when it is pulled the mucous membrane follows in the direction of traction, and there is no induration nor infiltration of the submucous tissue—a point of extreme importance in considering the character of the tumor.

Generally, the size of such papillomata is that of a cherry, but in exceptional cases they have been seen as large as an orange. The surface presents the same appearance as the simple villousities, except that, since they are more liable to hemorrhage, the signs of it are more marked. Pediculated tumors are more often multiple than single. One will usually be large, with one or two smaller growths beside its base.

Another type is the sessile growth. This is distinguished from the simple villousities by its volume; it has a broad base instead of a pedicle, and thus presents the appearance of an elevation surmounted by fine, delicate villi. This form is usually single, but may cover a wide area.

Another rare variety is the coronoid type. This appears as ridges or crests, presenting quite a regular cockscomb appearance; the ridges are very vascular and their color is reddish. In any form of papilloma there may be ulcerations upon the surface or indeed deep areas of necrosis, while as a result of alkaline fermentation of the urine the villi of the tumor may be incrustated with the precipitated urinary salts. Vesical calculus rarely accompanies a papilloma.

Microscopic Appearance of Papillomata.—There are three general kinds of tissue in a papilloma—the stroma, the blood-vessels, and the epithelium. The central portion of a simple villosity is composed of connective tissue; in some instances this is massive, in others almost unnoticeable. This tissue is usually fully-developed connective tissue, but in some cases it contains cells resembling embryonal connective-tissue cells. Elastic fibers are present in variable number. A few muscular fibers may be contained in the mass of connective tissue—muscle-cells which spring not from the vessel-walls, but from the submucosa. The connective tissue may be normally arranged or may be reticulated in a most bizarre manner. In the coronoid form the connective tissue is usually arranged in regular layers up to the summit. (See Plate 4, Fig. 1.)

In the pedicle the connective tissue is usually more abundantly mixed with elastic and muscular fibers than in the sessile forms; the quantity is obviously much less. Round-cells of inflammatory origin may be found in the connective tissue of any type of papilloma, but below the mucous membrane no tissue-alterations can be found. Virchow laid great stress upon the connective tissue as the origin of these growths (*fibrome papillaire*). According to him, a submucous fibroma is the starting-point of the growth. This grows toward the cavity of the bladder, pushes out the epithelium, the vascular tissue hypertrophies according to the needs of the growth, and in this manner the fully-formed papilloma is produced.

The vascular tissue consists of capillaries with scarcely more than endothelial walls. Whether these vessels are formed by simply hypertrophy of the capillaries of the mucous membrane or are evolved from them by a

process of lateral budding is not clear. The terminal capillaries end just beneath the epithelial covering in tiny loops, being separated from the epithelium by a thin layer of homogeneous-appearing material which has been erroneously described as a membrane. In rare instance the capillary tissue assumes a true cavernous hypertrophy. In nearly all sections small areas of hemorrhage can be seen just outside the capillary wall.

Billroth—and following him Klebs and Rindfleisch—believed that the first steps in the formation of a papilloma was the formation of vascular loops from the capillaries of the mucosa, which later became surrounded by connective tissue and pushed out into the cavity of the bladder. Muron has expanded the idea, and compares papillomata to placental villosities, while Hicks has in addition insisted upon the active rôle of the vaso-formative cells.

The covering of the papilloma is composed of epithelium. The cells are cylindrical in shape, more or less regularly placed in parallel rows, several strata being superimposed upon each other. The most superficial cells are often flat, but the appearance is never quite that of the normal vesical epithelium. The nuclei are quite small, and located toward the base; the protoplasm is granular.

A rare form has been described by Albarran in which the cells are flat, polygonal, or even spindle-shaped, and arranged in layers like a pavement (*type de revêtement à cellules claires*). The same author has also described an atavistic form in which the tissue was of the allantoid type.

Clado believes that the epithelium is the tissue at fault in the formation of these growths. He contends that they develop by overgrowth of the normal papillæ of the vesical mucous membrane, which are most abundant at the base. He admits, however, the further possibility of their being developed by irritation of the epithelium entirely independent of the papillæ. He thus considers them as entirely analogous to cutaneous papillomata. It seems to the author, without insisting upon his views as to the consecutive steps in the process, that in these neoplasms the primary overgrowth is in the epithelium.

One further point must be insisted upon: below and to the sides of the site of the papilloma the tissue is entirely normal. Any extension or infiltration converts the growth into one of different type, with malignant tendencies. It is, however, undoubted that in rare cases true papillomata become carcinomatous. Beyond this type there is no mixed form of vesical tumor in which the papilloma is concerned. The only lesions consecutive to papilloma are mechanical.

Adenomata.—True adenomata of the bladder are very rare. They are situated near the neck of the viscus, may be pediculated or sessile, and in the latter event are encapsulated. The growths have always been single. The pedicle or base is composed entirely of the connective tissue of the submucosa; there is no infiltration of the adjacent tissue; the growths can be easily shelled out with the finger. They are very vascular.

The surface of the growth may be covered with villosities, which have, however, no connection with the tissue proper of the tumor. This consists of regular acini of cylindrical epithelial cells, the basement membrane is well defined, the lumen of the canals may be very large and filled with homogeneous substance or with bodies which resemble the prostatic concretions. Klebs, who described the first case, looked upon the glandular tissue as of prostatic origin, but careful study of later cases has shown that they have no relation to the prostate, and that they are, in fact, true adenomata whose type is the submucous glands. The canals may be so dilated as to

form small cysts in the substance of the growth. Although rare, such tumors, on account of their site, are clinically important.

Albarran's case presented symptoms which suggested vesical tuberculosis.

The true adenoma is entirely exogenous: any infiltration would indicate a carcinomatous process.

Carcinomata.—The carcinomata of the bladder vary greatly in appearance. Some are exogenous formations which have a marked resemblance either to papillomata or adenomata; they are, however, also always endogenous. Others are purely endogenous, and the mucous membrane may not be affected at all.

Primary cancer of the bladder is not only very rare, but is quite rare in comparison with secondary vesical cancer.

Out of 40 cases of vesical cancer reported in over 7000 necropsies col-

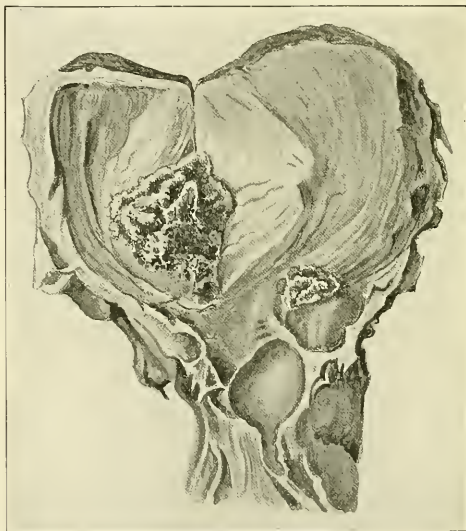


FIG. 113.—Adenoma of the bladder (Clado).

lected by Hasenclever, only 3 were primary, and only 14 cases were found in the records of the Pathological Institute in Munich (Zanseh). Males are more frequently affected than females, in the proportion of nearly 3 to 1: of 137 cases collected by Clado, 99 were in males. The age affected is usually between forty and fifty-five, although malignant disease has been seen in the infantile bladder.

It has been customary to divide the malignant epithelial growths of the bladder into epitheliomata and carcinomata, with the further addition by some authors of adeno-carcinomata. We do not believe such divisions to be pathologically necessary or clinically advantageous. All such growths are, in the strict pathological sense, carcinomata. As above stated, however, they differ widely in gross and microscopic appearances, so that for purposes of description it is convenient to divide them into several forms.

The first form is one which is closely allied in many respects to the adenoma—the adeno-carcinoma or cylindrical epithelioma. This is a rare tumor. Like the adenoma, it was originally classed by Klebs as of prostatic origin, but this has been disproved by its occurrence in the female bladder (Kaltenbach), and by the histological demonstration that it springs from the deep glands of the mucous membrane and has no connections with the prostate, which has, furthermore, in several cases, been shown to have been normal.

It is most often a pediculated growth, but may be inserted with a broad base. The surface is lobulated and covered with fine villi; the general aspect is often quite like the papilloma. It is not often found ulcerated.

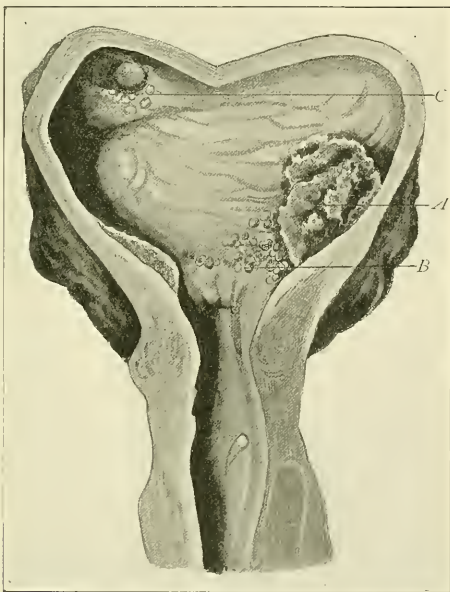


FIG. 114.—A, epitheliomatous tumor; B, wart-like growths; C, villous growths around a vesical cell (Clado).

When the site of implantation is examined, it is noted to be indurated and infiltrated; the mucous membrane is bound down and does not move when traction is made upon the pedicle. Upon section small cysts filled with a thick material may be exposed. In the recorded cases the growths have been most often on the base; the size has been that of a nut to an egg.

The stroma consists usually of fully-formed connective tissue, mixed with a few elastic and muscular fibers. In several cases, however, the connective tissue has been of the cellular embryonal type, which thus presented a sarcomatous appearance. The muscular tissue has been in several cases in great excess: Virchow indeed described under the name of myo-carcinoma a carcinomatous tumor whose stroma was entirely made up of muscular tissue. The epithelium is scattered regularly or irregularly throughout the stroma.

These growths are very vascular. The branches of the capillaries run out to the villosities and terminate in little loops. The villi are covered with several layers of cylindrical cells; between the villi the cells dip deeply into the stroma. (See Plate 4, Fig. 2.)

Throughout the mass of the growth the epithelium is present as the lining of gland-like tubes. Some of these tubes are very regular, with one or two regular layers of cylindrical cells and a clear lumen; others, however, are very irregular; the cells are of variable depth and regularity; the nuclei are irregular in size and location. In some places the cavity of the tubes is filled with the cells, so that an epithelial nest is produced. Very often cavities are present deep in the growth, lined with the same epithelium, which often extends into the cavity as a dendritic process. These cavities usually contain a gelatinoid material.

At the base of the growth the epithelial tissue pushes itself into the sub-mucous or muscular tissue, with the production of nodules between the bundles of connective tissue or muscle. Quite large cystic cavities may be seen. Hemorrhage into the growth is not uncommon; the blood is often extravasated in the cavities as well as into the tissue.

A second form of vesical carcinoma is the epithelioma or the villous cancer. This form of growth is more common than the one just described. It is generally seated at the base of the bladder, and often seems to be multiple, although generally the different processes are connected. As a rule, it projects into the cavity, but a flat infiltrating form has been described. Nearly all of them possess a distinct pedicle, the insertion of which is infiltrated and thickened.

The crest of the growth is usually serrated and covered with fine villosities, with frequent hemorrhagic patches, which may be large and of a very dark color. The ordinary tumor may attain the size of an egg, and even larger growths have been seen. Surface ulceration is common; it may be extensive and deep; the surface of the ulcer is usually very soft.

Microscopically, these growths present a characteristic appearance. The stroma is scarce, composed of fully-formed connective tissue, with embryonal cells, elastic and muscular fibers in variable number. In the older parts of the tumor the stroma presents an alveolar structure, but in the more recent part it simply represents a delicate layer between the tubules of epithelial cells.

The vessels are numerous, rather irregular in arrangement, and are often dilated. The mass of the tumor consists of solid tubules of epithelial cells. This epithelium is irregular in type. The arrangement is that of a pavement; the cells are oval or irregular, and intimately bound together. The nuclei are small and irregularly situated. The typical epithelial columns are best seen in the young portions of the growth; in the older parts the arrangement is much less regular.

Colloid degeneration may be seen in small areas. There are no cylindrical cells of the normal mucous membrane to be found upon the growth; the mucous membrane is usually destroyed up to the insertion of the pedicle, and sometimes farther along the bladder-wall. The columns of cells push their way into the bladder-wall and likewise extend laterally. Albarran has described growths in which the arrangement was not tubular, but lobular. Hemorrhagic areas are not uncommon.

Closely allied to this form is the reticulated epithelioma described by Albarran, in which under low powers the arrangement was seen to be precisely that of a lymphatic gland, which under higher powers was seen to be made up



FIG. 1.—Tuft of papilloma of the bladder. (Thionine, $\times 90$.)

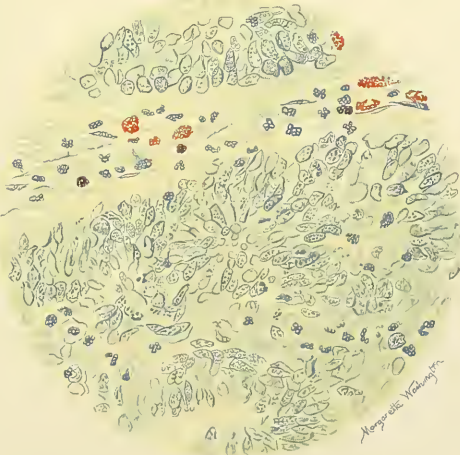


FIG. 2.—Cylindrical carcinoma of the bladder. Leukocytes and mast-cells in stroma. (Thionin-orange-G, $\times 500$.)

of polymorphous epithelial cells. The same author has also described a tumor in which myxomatous degeneration of the stroma had produced the appearance characteristic, in other parts of the body, of a cylindroma.

Another important form of malignant epithelial growth is the alveolar carcinoma, the typical vesical cancer. According to the varying relations of the fibrous and cellular tissues, these tumors may be hard or soft, the latter the more common, and they may become colloid. They are usually situated upon the base, but may spring directly from the trigonum or from the lateral walls. There is usually one tumor or several growths connected by areas of infiltration, but there may be multiple growths. In a few instances there was an infiltration of nearly all the bladder-wall. It has in some cases seemed that where a tumor of one side of the wall touches the opposite wall secondary inoculations have occurred.

In most of the well-studied cases the growth of the tumor has stopped at the borders of the ureteral orifices, and has not infiltrated their walls; but in other cases this rule has not been observed.

The form of the alveolar carcinoma may be very varied. A long-recognized form is the cauliflower-shaped encephaloid of the older writers. This is usually a large growth, and is composed of a mass of irregular tufts surmounting a wide base. This base is intimately attached to the entire thickness of the bladder-wall, and is surrounded by a well-defined area of marked induration. The surface may be covered with fine villi or with tuberculous nodules. They may be very large, and are generally accompanied by several small adjacent growths.

In rare cases an attempt at pediculation has been observed. The consistency of these growths is quite soft, and there may be, furthermore, areas of necrotic softening which are semi-liquid. Ulceration is usually present, sometimes to a marked extent, and evidences of superficial and deep hemorrhages are abundant. The color may vary from gray to a deep brown.

Another form of alveolar carcinomata are the flat cancers. These appear as broad, shallow plates resting upon the mucous membrane, and intimately bound to the deeper tissues, which are indurated. They vary in size from the dimensions of a small coin to such an extent as to cover half the bladder-wall. They are usually multiple. The surface may be covered with a few villi, but more often it is ridged and nodular, with an occasional patch of ulceration or hemorrhage. The consistency, except in certain areas, is quite hard.

Another form, more rare, is the infiltrating carcinoma. In this case the bladder-wall is much thickened, very hard and inelastic, and the capacity of the bladder is much reduced in an advanced case. The surface of the mucous membrane may present no abnormal appearance, but may present small villi or tiny cysts. Ulceration is rare in this type.

Another form is the carcinomatous ulceration. Although any form may ulcerate, in this variety the ulceration is the chief characteristic. The surface of the bladder presents an ulceration of ragged outline and varying depth. The edges are hard, and there is an area of infiltration which passes beyond the ulceration. The infiltration is, however, so slight that it may only be upon section that the carcinomatous nature of the process is determined.

The protruding, the flat, and the infiltrating forms may coexist in the same bladder. Certain accidents of nutrition occur to all of them; certain areas become converted into soft yellow material, with quite the appearance of caseous degeneration. Hemorrhages frequently occur. They may be localized or infiltrating—in the first instance with the production of a cyst

or an area of degeneration, and occasionally an abscess. Cysts filled with simple fluid or with gelatinous material are common. Areas of actual gangrene are rare, but do occur, and the breaking down is in these cases very rapid. Areas of calcification (not calculus) are rare.

Colloid cancer is very rare. Less than a dozen cases have been described, and in most of these the growths were large and implicated the other pelvic tissue; in fact, it was not fully demonstrated that the growths were primary in the bladder: this has, however, been shown in two cases (Guyon and Lancereaux) in which only the bladder was affected. The larger tumors were notable for their extent, rapid growth, and the anatomical and physiological implication of the ureters, kidneys, and intestines. The appearance is that of colloid cancer elsewhere—a dense network of fibrous tissue, with lobuli filled with the mucoid material. Colloid cancer has no relation to the colloid degeneration of the bladder-wall of Rokitsansky.

The relations of the various types of alveolar carcinoma to the rest of the body are alike, and can be considered together. Extension by contiguity is not the rule in vesical cancer, rather the exception. Generally the growth stops at the adventitial connective tissue. In a few cases, however, it has extended beyond the bladder. Nodes have been found in the prostatic urethra, generally on the crest; the growth may extend into the prostatic gland or along the urethra, and then usually diminishes the caliber of the canal. In a similar way the mouth of the ureter may be attacked, but the process is not extensive. Fenwick has described a case in which the growth ascended the ureter and formed a muff. Complete occlusion (obliteration) of the lumen of the ureter has been described.

Extension from the exterior aspect of the bladder-wall may involve the prostate, the seminal vesicles, the colon, the small intestine, the uterus and adnexa, the soft and bony tissues of the pelvis, the peritoneum, and the abdominal wall. Of the portions of the colon, the sigmoid is most often affected, but even the caput coli has been involved. Ulceration of the intestine may occur, but the rectum is rarely affected. The growth may pass out of the pelvis by the greater sacro-sciatic foramen and involve the sciatic region, with inclusion of the nerves; it may grow anteriorly and appear in the groin. The vagina is rarely involved; it is, however, sometimes attacked with the rectum, thus resulting in vesico-vaginal fistula. Secondary glandular and metastatic deposits are not more common than extension by contiguity. The lymphatic glands most likely to be involved are the pelvic and retroperitoneal, but they seldom enlarge to a great size. The lumbar glands are rarely enlarged. It is important to note that the inguinal glands have been affected, also that secondary deposits have been seen in the cavernous bodies (Guyon). There may be nodules in the kidneys, and they have been seen in the liver, spleen, lungs, pleura, and in the dura mater. Ulceration may occur in any of the secondary growths, but are most common in the extensions by contiguity. Perforation of the wall of the bladder has been several times observed, usually located at the top. If the opening be small and of gradual formation, intestinal adhesions generally shut off the peritoneal cavity effectively, but in some cases perforation has permitted the urinary contents to enter the general abdominal cavity.

The microscopical appearances of alveolar carcinoma vary largely according to the relative proportions of cells and connective tissue. The general arrangement is that of bundles of stroma surrounding epithelial nests. The stroma is composed of fibrous connective tissue, which is in large amount in the scirrhus form. Mixed with the fibers are elastic fibers, occasional mus-

cular fibers, strands of myxomatous tissue, and not infrequently there are areas of round-celled infiltration. Deep in the tumor the stroma is more massive than at the periphery. In the encephaloid form the strands of stroma are delicate, and the alveoli are much larger than in the hard form.

Deep in the tumor the blood-vessels are in excess; their walls are at times affected, and the lumen of the veins may be obliterated by the growth. The alveoli are filled with polymorphous epithelial cells, whose nuclei are small, distinct, irregularly placed, and sometimes seen engaged in cell-division. The intracellular bodies (coccidia?) have been beautifully demonstrated in these cells. In some areas the cancer-cells are seen to be in various stages of degeneration.

There is usually no normal mucous membrane covering the growth, but patches may remain. From the center to the periphery the alveoli grow larger. Small or larger cysts are often seen; they are usually filled with a thick substance which takes the acid-aniline stains.

In the bladder-wall, besides the growth, the area of induration is seen to derive that character from an infiltration of the cancerous cells. These push downward and laterally between the bundles of fibrous tissue and muscle, which degenerate and atrophy, and thus a wide area is usually markedly cancerous. Ulceration and hemorrhage are seen in many sections.

Colloid cancer appears to be composed of a heavy fibrous stroma with the spaces filled with mucoid material. Epithelial cells are rare; in many sections none can be found, but in the younger portions of the tumor nests of cells may be seen, many of them apparently in the process of mucoid secretion, while many others are seen to be affected with fatty degeneration.

Secondary Carcinomata of the Bladder.—These are much more numerous than the primary growths, and are more common in the female sex. In women they are often secondary to cancer of the vagina, uterus, and adnexa; cancer of the rectum is the common primary growth in men.

More rarely, the bladder-neoplasm is secondary to cancer of the prostate and genitalia. In these cases the growths are of the nature of an infiltration, usually with little ulceration. In any case the site of attachment determines the phenomena. Metastatic nodules have been found in the bladder in cases of genital cancer of women; Marmaduke has described vesical metastasis in a case of cancer of the cavernous body. Colloid cancer has spread to the bladder from the abdominal cavity. In any case the histological characters of the secondary tumor depend upon the nature of the primary growth.

The Epithelial Cysts of the Bladder.—There are rare cases of cysts in the bladder-wall which bear no relation to dermoid cysts, ureteritis cystica, those cysts which arise from embryonal remains of the uro-genital tract, or from congenital malformations. On the other hand, they must be separated from cystic degeneration of the glands and from the retention-cysts which are seen in cases of chronic cystitis. Whether these cysts are true tumor-formations or are of inflammatory origin is not yet definitely decided. They are usually multiple, although large single cysts are seen. They are most often situated upon the base and the trigonum, about the opening of the ureters, and at the neck of the bladder. They may cover the entire vesical surface, and have even been seen in the urethra. In most of the cases described a dozen or more small cysts were present about the size of peas, situated in the mucous membrane and filled with an opaque fluid. In a few cases they were as large as a walnut. They may become pediculated: Vincent de Lyon described in the case of a child a cyst—which may not, however, have been of this type—

which possessed so long a pedicle that it passed out of the urethra and presented at the vulva.

The structure of these cysts consists of connective tissue and a lining of cuboidal cells, with occasional areas of stratified cylindrical cells. The contents are of a mucoid nature. It seems probable that they arise from localized epithelial proliferation, according to which they should be classed with neoplasms.

B. Tumors composed of Tissue whose Type is a Variety of Connective Tissue.—Some of these growths are benign, others are malignant. They will be considered individually.

Fibroma.—Growths classed as fibromata were first described by Rokitsansky and Virchow. They are rare. Men are more often affected than women, and they are generally found in the adult, though they have been seen in infants. They are usually located upon the base and trigonum, and are nearly always single.

The size varies from that of a nut to that of an egg, and even larger growths have been seen; they may be sessile or pediculated, hard or quite soft. The surface is lobulated and covered with normal or inflamed mucous membrane, which may or may not be firmly attached to the growth. When sessile the growth does not infiltrate, but can be easily enucleated, being distinctly encapsulated; there is no induration around it. On section the tumor is white and glistening; there may be patches of myxomatous softening or areas of calcification.

Microscopically, the mass of the tumor is composed of adult fibrous connective tissue, with here and there a few elastic fibers and patches of fusiform cells whence the growth proliferates. There are usually many streaks of amorphous substance which take the acid stains. In the tumor itself the blood-vessels are few, but around it they are plentiful and may be almost cavernous. There is no implication of the muscular layer of the bladder. In a few cases unstriped muscle-cells have been found in the growth, which was thus a myofibroma; it has also been mixed with myxoma.

The mucous membrane covering the growth may be entirely normal; in other cases it is inflamed. The epithelium is degenerated and there are areas of round-celled infiltration; or there may be tiny villous vegetations upon the growth, quite like the epithelial proliferation in papilloma.

Angioma.—There is only one properly-studied case of this tumor recorded—*i. e.* that of Albarran. The growth was small, situated midway between the mouths of the ureters, and provoked violent hematuria.

Myomata.—These are rare growths, and may be classified in two varieties, composed respectively of striped and unstriped muscle.

The leio-myomata, or smooth-fibered myomata, are met with in adult subjects, and most of the few cases have been in males. They are generally located about the orifices of the bladder, and are usually solitary. They may be sessile, but are more often pediculated. They have been noted from the size of a cherry up to such dimensions as to fill half of the cavity. The pedicle is short and thick.

The mucous membrane covering the growth may, as in the case of fibroma, be normal, inflamed, or covered with sparse vegetations.

The tumor is usually hard, though there may be areas of softening, and on section considerable elasticity is noted. In a few cases myomata have not projected into the vesical cavity, but have remained interstitial, producing a thickening and induration of the bladder-wall. In other cases the growths

have protruded outward instead of inward, so that it finally constituted paravesical tumors, to which Belfield first called attention.

The microscopic structure of the growths quite resembles that of the myofibroma of the uterus. The tumor is divided into lobules by connective tissue; its main bulk is composed of unstriped muscle-cells, in some places arranged in fasciculi, in others irregularly grouped. In the sessile and mural forms this tissue is directly continuous with the muscular layer of the bladder-wall, and even in the pediculated growths this direct connection can usually be established.

The epithelium covering the growth presents no alterations beyond inflammation and vegetations, which are not the rule. The vessels pass directly into the growth or through the center of the pedicle; the veins are often dilated and surrounded by hemorrhagic extravasations; the submucosa covering the growth is very vascular, may appear cavernous, and may contain extravasated blood.

Not all of the myomata are pure; they may be mixed with fibroma, myxoma, or sarcoma, under which circumstances the growths and the microscopic appearances are correspondingly altered. The occurrence of muscular tissue in carcinomata has already been mentioned, but the author does not think that such cases should be termed mixed tumors. In any case careful study of the tissue adjacent to the tumor must be made in order to exclude prostatic growths. The paravesical myoma will be again considered under Paravesical Tumors.

Rhabdomyoma.—Only one case of this remarkable vesical neoplasm has been described (Vicenzi). The subject was a child of thirteen years; the posterior base was affected. Cattani has, however, described a vesical polyp which contained striped muscle-fibers.

Myxoma.—Myxomata of the bladder are, comparatively speaking, frequently seen. By the older writers they were believed to have been very frequent, but it is evident that papillomata and mucous polyps were often classified as such. They are, however, rarely pure, being generally mixed with fibroma, myoma, or sarcoma. They are usually seated upon the base and the trigonum, but may spring from any part of the wall; they are commonly multiple.

The majority of these growths occur during the early years of infancy; after the fifth year they are rare, although myxoma has been seen in old age. The sexes seem to be equally affected. These growths may be pediculated or sessile. When multiple they are generally small, but from their number may almost completely fill the bladder. The surface may be smooth or lobulated; exceptionally the growths may be so grouped as to resemble the so-called hydatidiform mole. Small villousities may surmount the surface, but this occurrence is exceptional. When pediculated the pedicle is short and thick, but may be long and slender and allow the growth to float about.

Myxomata are usually soft, but the consistency is not uniform: some areas may be hard, while others are edematous and fluctuate. The color varies from a semi-transparent gray to a dull red, and areas of hemorrhage are often seen. The attachment is to the mucous membrane only.

The microscopical appearance of these growths is very striking. The bulk of the tissue is made up of a homogeneous proteid substance which stains with most acid stains, and especially well with thionin. Here and there are fine fibrillæ, with occasional strands of fully-developed connective tissue. Cellular elements are usually not abundant, and their distribution is irregular. In some instances these cells have been of the type of embryonal

round-cells—*i. e.* cells with small central nuclei and a large quantity of protoplasm. In other cases the tissue has resembled the connective tissue of the allantois, which fact is very suggestive when taken in connection with the case reported by Winckel from a child one day old, in whom the growth must have been congenital. Usually the cells are triangular or spindle-shaped, and prolongations run from them into the surrounding substance. Cells resembling the plasma-cells were described by Clado, but it is questionable whether these were identical with the plasma-cells of Waldeyer. In a growth recently examined by one of us the majority of the cells were filled with large basophilic granulations: about them, however, no cell-outline could be detected, and there were no fibrillary prolongations from the cells, whose nuclei were pale and presented in sharp outline one or more well-stained nucleoli.

The blood-vessels are very abundant, the capillary network being particularly well marked. The vessel-walls are, however, except in myxomata mixed with sarcoma, of normal structure, and the surface is usually covered with a thin layer of normal epithelium, but this is often absent in places. Superficial ulceration is rare. Hemorrhages may be seen in any part. The myxomatous tissue does not extend wide of the insertion of the growth or pedicle; there is, therefore, no infiltration and no histological appearances of malignancy. (See Plate 5, Fig. 1.)

Sarcomata.—These are rare growths in the bladder—not more common, probably, than either fibroma or myxoma, with which they are often mixed. In 1892, Albarran collected from the literature 52 cases of primary sarcoma in which the diagnosis was verified by microscopical study, which, it is admitted, was not in all the cases thorough.

The cases have been about equally divided between the sexes. Any age may be affected, but one-third of the cases occur under the tenth year. Any part of the bladder may be affected, the base, trigonum, and posterior wall, according to the statistics, being most vulnerable. The growths are usually multiple; the size varies from that of a walnut to that of an apple, and the cavity of the bladder may be almost obliterated by the mass.

These growths are in their nature sessile: in a few cases there has seemed to have been a tendency to pediculation, but this has never been fully developed. They are intimately attached to the entire bladder-wall, and there is an area of induration about them. The surface is usually smooth, but may be lobulated, and, like any other vesical tumor, may be covered with small villousities. The growth is firm to the touch, and may be uniformly hard or may present areas of softening. The color is dark, and many brown spots testify to the existence of hemorrhages. Small cysts, and even abscesses, have been seen in the interior of the growths.

On section the growth is of a flesh color, and the section may reveal a cyst, a hemorrhage, a spot of calcification, or a pocket of pus. *Sarcomata* are mixed with fibroma, myxoma, chondroma, and angioma, and in such cases the appearances are correspondingly altered.

The induration about the growth is the sign of lateral infiltration. There seem to be several favorite directions of extension: one is along the urethra; this has been most frequently seen in women in whom these growths have presented at the meatus; in no case have the ureters been attacked. Of paravesical extension the anterior direction with involvement of the symphysis, and the posterior with involvement of the sacrum, are the most common, although any part of the bony pelvis may be affected. The prostate and the retroperitoneal lymphatic glands are usually spared, and among the

PLATE 5.

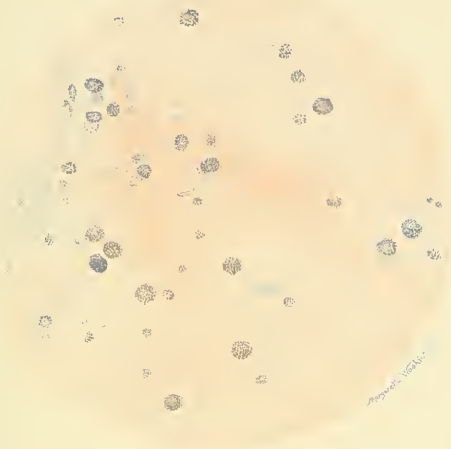


FIG. 1.—Myxoma of the bladder. Mast-cells in great numbers. (Thionine, $\times 500$.)

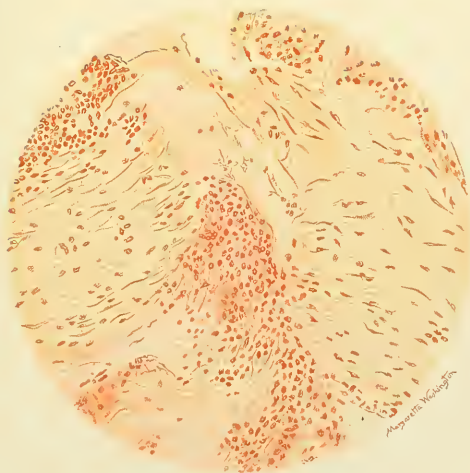


FIG. 2.—Sarcoma of the bladder; infiltration of muscularis. (Neutral red-orange-G, $\times 400$.)

recorded cases the intestines were affected but twice. Extension by metastasis is rare, although secondary growths have been found in the spleen, liver, and lung. Secondary sarcomata of the bladder have been rarely seen as the result either of direct or metastatic extension. Melanotic vesical sarcomata are rare, and are always secondary. (See Plate 5, Fig. 2.)

Microscopically, the sarcomata correspond to many types. Small and large round-celled, spindle-celled, giant-celled, the mixed forms, teleangiectatic, and alveolar sarcomata have all been described in the bladder, and, with the occasional presence of cysts, abscesses, hemorrhages, areas of calcification, and the other neoplastic tissues which may be mixed with them—fibroma, myxoma, and chondroma—this divergence of histology makes the appearances of different growths extremely varying.

The round- and spindle-celled sarcomata are the common forms. The tissue is usually almost entirely cellular, though in various cases more or less fibrous tissue will be found. The cells are irregularly arranged, as a rule, the nuclei stain well, and in the newer portions of the growth are evidences of cell-multiplication. The blood-vessels are usually only channels with a lining of endothelium or even of pure sarcoma-cells: well-developed vessel-walls may, however, be seen in any case of sarcoma. The superficial portion of the growth may be covered with the normal vesical epithelium. In other cases there are minute villousities or patches from which the epithelium has disappeared or where ulceration is present.

In the bladder-wall the infiltration is represented by columns of cells pushing their way between the strands of fibrous tissue or muscle. The mixed tumors present varying appearances in the different cases, but the diagnosis of sarcoma can always be made by the finding of true sarcomatous tissue in some part of the growth. The secondary melanotic growths are characterized by the well-known pigment infiltration.

Enchondroma.—Two cases of primary enchondroma have been recorded (Beraud and Pfenninger), and one of secondary involvement has been reported by Chalvet. The primary growths were very small; the secondary growths extended from an enchondroma of the thigh. A mixed tumor (chondro-myxo-sarcoma) has been described by Shattuck.

Osteoma.—Dupuytren and Middleton have observed cases of osteoma of the bladder-wall (Civiale). In both instances there were symptoms of stone, and both were sounded. In each subject there was found post-mortem an osseous tumor at the base of the bladder. In neither of these cases, however, has the possibility of a calcification or ossification of a fleshy tumor been excluded.

Angioma.—Two cases have been well studied (Langhans and Albarran). In each the mass of cavernous tissue was beside the ureters: Langhans' patient bled to death, and in the other case the hemorrhages were frequent and profuse. The tumors were small and composed of cavernous vessels with very thin walls.

Lipoma.—Three cases have been recorded (Barth and Séc). They consisted of small bodies in the submucosa, which pushed forward the mucous membrane, and were composed of fat.

Lymphadenoma.—One subject of this disease presented a nodule upon the trigonum (Murchison).

C. Heterogeneous Tumors.—The rhabdomyxoma and the chondroma ought strictly to be classed as heterogeneous growths. In the older writings dermoid cysts of the bladder were often mentioned. The phenomenon of pilimiction was well known, but no attempts until recent years have been

made to study the matter and to separate the dermoid cysts of the bladder from those which merely empty into the bladder.

Of the cases recorded, Clado considers that only 8 have been primary in the bladder, but the question is made difficult of decision because extravescical cysts rupture into the bladder through the base, where the primary cysts likewise develop. With one exception the subjects were females. The growths are obviously congenital, but they may defer their clinical appearance until middle life. The site affected has been, as already mentioned, the base, the growth probably springing from the line of embryonal closure. In the case of Martini's, a male infant, there was atresia ani et urethræ; the colon opened into the posterior aspect of the bladder, while about this opening the bladder was the seat of a dermoid growth.

The growths are either pediculated or sessile. Their surfaces are rough, have a cutaneous appearance, and are covered with a greater or less quantity of hair. Cysts are usually present in the growth, but this is not always true. The tumor may be as large as an egg.

On section the heterogeneous nature becomes apparent; there are irregular areas of fat, fibrous tissue, almost fluid or hard as cartilage, and hair, etc. Microscopically, the growths are usually composed in the main of fibrous tissue and fat. Between these tissues, however, are seen pieces of cartilages, epithelium resembling the dermic epithelium, with fairly typical hair-follicles and sebaceous glands. The covering is not an even covering of epithelium, but when well developed the hair and hair-follicles, the papillæ, and the sebaceous glands are more typically developed than in the center of the growth. The bony areas occasionally seen are more probably calcareous than osseous.

The cysts may be very extensive or may be insignificant. Albarran has described several growths of analogous origin under the name of dermoid epitheliomata. These were composed of epithelial cells which resembled the dermic epithelium, and contained pearly bodies; they presented, however, none of the pilous or sebaceous structures. Dermic epitheliomata of the bladder have been previously described by Thompson and Winkel, but their dermic character was not fully demonstrated.

Hydatid Cysts.—These have been not infrequently seen in the bladder-wall. With one exception, however, they have all been paravesical, and will be considered under Paravesical Tumors. In the case of Sauvage, in addition to several abdominal cysts, one was located in the posterior wall of the bladder between the mucous membrane and the muscular layer. This had caused retention of the urine, but later ruptured into the bladder-cavity.

D. Perivesical and Paravesical Tumors.—There are various growths which involve the exterior surface of the bladder. They may be divided upon anatomical considerations into two classes—the perivesical tumors, which involve primarily the bladder-tissue, and the paravesical tumors, which are growths affecting adjacent tissues and involving the bladder organically or functionally.

The *perivesical* tumors will be first considered. In the description of leiomyomata it was noted that some of these growths grew from the muscularis centrifugally, and such a growth is a perivesical tumor (extravesical tumor of Belfield). Only a few such growths have been described. Isolated cases have been described in which perivesical growths were shown to have developed from the urachus (Palailon) and the utriculus prostaticus (Verhaagen).

The other forms of perivesical growths are more or less connected with cystic processes. Several of the reported dermoid cysts have been strictly

perivesical, involving the bladder-tissue, but growing outward. As a rule, however, they have been paravesical growths which have become attached to the bladder.

Another class of cysts somewhat allied to dermoid cysts are the cysts which develop from embryonal remnants. These are situated in the posterior and inferior wall, and are of four classes (Englisch)—those which have developed from the Wolffian duct, from the Müllerian duct, from the utriculus prostaticus, and from the seminal vesicles. The locations of these cysts are not the same: those of the Müllerian and Wolffian ducts are in the posterior median line, and may extend upward some distance, even as far as the kidney (Cornil). They are usually attached to the prostate. The cysts which

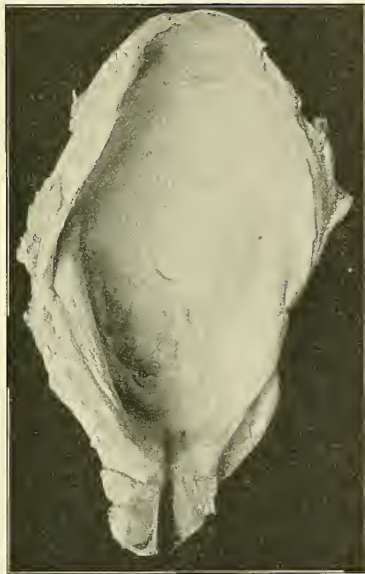


FIG. 115.—Retrovesical cyst with opening into bladder just above the trigone (Wistar Institute of Anatomy, Univ. of Penn.).

arise from the utriculus prostaticus are likewise in the posterior median line and are attached to the base of the prostate. The cysts of the seminal vesicles are latero-posterior, in front of the prostatico-peritoneal aponeurosis, but below the rectovesical sac of the peritoneum. Thus these latter are strictly paravesical cysts; the others are, however, usually incorporated within the bladder-wall. Segond has described a cyst in the posterior wall of the bladder as large as a walnut which had the appearance of a simple epithelial cyst.

The *paravesical* growths are of many varieties, and include both solid and cystic tumors. Under the headings of Carcinoma and Sarcoma some mention has been made of vesical involvement from paravesical growths.

Any malignant disease, especially of the uterus or adnexa, the prostate, the intestines, the rectum, the pelvic bones, or the pelvic connective tissue, may become attached to the bladder and involve it. Any benign tumor of the pelvis or its contents may become attached to the bladder without extension (inflammatory adhesions), and thus produce vesical symptoms.

The majority of the pelvic dermoid cysts are paravesical. These cysts usually originate in the cellular tissue, the rectovesical tissue being the favorite site, although they have been seen to the sides and in front of the bladder. Very rarely an ovarian dermoid cyst becomes attached to the bladder. Dermoid cysts in this locality are often large, and may be so large as to rise into the abdominal cavity. As a rule, they sooner or later evacuate their contents into the bladder. Hydatid cysts likewise usually develop in this region in the paravesical cellular tissue, either posteriorly, anteriorly, or laterally. They may be single or multiple.

The locality of the cyst and its relations to the fasciæ determine its size and its direction of growth. If the cyst begins behind the bladder on account of the rectovesical fascia, it will push the bladder against the pelvis, and as it continues to enlarge it will ascend and grow over it toward the anterior abdominal wall. Cysts developing to the sides of the bladder tend to attach themselves to the pelvis rather than to the bladder. The prevesical cysts ascend toward the umbilicus and attach themselves to the summit of the bladder. As a rule, ovarian cysts do not adhere to the bladder, and affect it only by pressure. The rare coccygeal cyst may involve the posterior vesical wall.

Lesions Secondary to Bladder-tumors.—There are many lesions which are either caused by, complicate, or accompany tumors of the bladder, and these lesions often play an important rôle among the symptoms. The most important of these are the changes in the bladder. The capacity of this organ may be little affected (apart from the bulk of the growth). In some cases the capacity is diminished; in other cases it is increased. The diminution is effected in the same manner as in chronic cystitis; the dilatation is due to retention of urine, but the cause of retention is not always the same.

If the growth be situated just behind the vesical neck, it will cause a partial retention. If the pedicle of the growth is sufficiently long to allow it to be swept into the bladder by the force of the outflowing urine, a similar partial retention will result. In other cases clots of blood or fragments of tissue or calculi hinder micturition and produce dilatation. The dilatation, however, is not solely the result of the impediments to complete evacuation, but is due in part to disease of the vesical wall. In response to the obstruction to the flow of urine a muscular hypertrophy occurs, and secondary to the cystitis, which generally develops, the fibrous tissue of the submucosa hypertrophies. As the case progresses, however, the fibrous hypertrophy overcomes the muscular hypertrophy, the muscular tissue retrogrades, the bladder-wall becomes weakened, and dilatation results. There may be a localized atrophy and thinning of certain areas of the wall. It is obvious that these nutritional disturbances are of prime importance in the development of dilatation.

Retention commonly develops. Following it sooner or later comes microbic infection. There are cases in which septic infection does not occur; in these, however, retention of urine is slight or absent, and the growth has produced little or no congestion of the mucous membrane.

The degree of vesical inflammation varies greatly; simple catarrhal cystitis, ulcerations, membranous cystitis, and suppurative cystitis are most

frequently seen. The tissue of the growth is often more deeply affected by these processes than the bladder-wall. The ulcerations are, as a rule, not extensive, but at times they are large and deep, and particularly when they affect the growth do they lead to marked destruction of tissue. The formation of a membrane is seen as a rule only toward the end of the case. As the infection spreads deeper in the diseased bladder there develops a round-celled infiltration and overgrowth of the fibrous tissue in the submucosa. At times, however, the infection is so virulent that instead of organizing the tissue breaks down, with the production of a mural abscess situated in the submucosa, from whence it may dissect up the mucous membrane or burrow into the deeper tissue. As a result of the chronic irritation the entire thickness of the wall becomes sclerotic, and clumps of round-cells are seen in all the coats.

The inflammation often extends beyond the outer coat, with the production of a pericystitis. This is usually sclerotic in type, appears late in the case, and is characterized by a marked increase in the perivesical connective tissue which may proceed so far as to form adhesions with adjacent organs. In a few cases suppurative pericystitis has been noted: such a formation would usually be the result of a deeper ulceration, but in several of the cases no such macroscopic route of infection could be found. At times the perivesical fat is much increased, and although the increase is usually most marked at the site of the tumor, it may also extend entirely around the bladder.

In regard to the whole question of septic infection in cases of vesical tumors, apart from surgical infection, it must be insisted upon that the prime factors are retention of urine and hemorrhage.

Vesical calculi are present in a goodly number of cases of bladder tumor; the incrustation of a portion of the growth must, however, not be mistaken for a calculus. The stones are usually not of large size, rarely exceeding that of a cherry. They may be single or multiple; are composed partly of urates, but mostly of phosphates, and may be purely phosphatic. Oxalate stones have been found in a few cases. Calculi must be looked upon as secondary formations. It is of course possible for a calculus to coexist with neoplasm, or even antedate it. But the conditions in the infected bladders affected with tumors represent so perfectly the full set of circumstances necessary to the formation of stone that we are compelled to believe them secondary in all cases in which the contrary is not demonstrable.

Outside the bladder the consecutive lesions, apart from extensions of growths which have been considered, are few. Pressure of the tumor may dislodge the sigmoid or the rectum, compress the rectum with the production of a partial occlusion or pronounced hemorrhoids. Pressure may also cause varicocele, and in a certain number of cases a chronic indurative epididymitis has been noted. Prostatic hypertrophy is quite often seen, but whether it is secondary to the vesical growth or the cystitis is difficult to decide. In a few cases there have been metastatic abscesses in various parts of the body.

The ureters are often affected. Apart from ureteral extension, which already has been described, the lesions are those of compression and infection. The common location of growths at the bladder-base explains the frequency of obstructing compression. Whether by involvement of the ureter or by a mechanical blocking of its mouth, the result, hydronephrosis, is the same. It must be borne in mind, however, that independent of ureteral obstruction retention of urine will alone produce a ureteral stagnation with slight dilatation. When to this is added obstruction, the ureteral dilatation becomes marked, and the duct may become as large as the small intestine, with thick fibrous walls. Septic infection naturally ascends from the bladder, and pyo-

uronephrosis results. Ulceration may occur upon the mucous membrane of the ureter, and a pseudo-membrane may form, but this is rare. The ureteral lesions are usually bilateral, although usually more pronounced upon one side; rarely only one ureter has been affected. The ureters are often dislodged by the growth, and may be pushed far to one side.

The lesions of the kidneys depend to a large extent upon the involvement of the ureters. Whenever the ureter is compressed hydronephrosis must ensue, which becomes hydro-pyonephrosis when infection ascends to the pelvis. When, however, as rarely happens, the ureter is obliterated by the growth, hydronephrosis does not occur, nor suppuration unless it pre-existed: the kidney simply atrophies as it would following ligation of the ureter. Even when the ureters are not obstructed the kidneys present some contraction with thickening of the capsule, and, microscopically, a mixed nephritis, with the interstitial process usually predominating. The conditions, however, vary: in some cases the parenchymatous degeneration may be marked, in others the kidneys resemble those seen in primary interstitial nephritis.

Whenever a pyonephrosis exists there are apt to be areas of suppuration in the kidney. Usually the suppuration attacks the pyramids, but cortical abscesses are also seen. Naturally the organ becomes cystic, and the typical surgical kidney may be seen, but a degeneration so pronounced is unusual. The left kidney is involved oftener than the right, but this must be regarded as accidental. The renal lesions are seen three times oftener with malignant than with benign tumors; as a rule they are badly diseased in all subjects dead of malignant vesical neoplasm.

Symptoms of Vesical Neoplasm.—Since the most important symptoms and signs of bladder-tumors are those directly referable to the urinary tract, these will be first considered.

Hematuria is probably the most important symptom. It is exceptional for any vesical tumor not to bleed at some period of its existence, though a few such cases have been described. Bleeding is often the first symptom; according to Clado's tabulation, it is always the first symptom in the benign growths excepting in papillomata, in which it inaugurates the symptomatology in 90 per cent. of cases; 80 per cent. of sarcoma are first revealed by hematuria; and it is the first sign in 75 per cent. of carcinomata.

The quantity and circumstances of the bleeding vary greatly. As a rule it is intermittent, though in some cases the urine is never free from blood for months at a time. The accident is usually apparently causeless and spontaneous. In a notable number of cases, however, it has been brought on by fatigue, injury, exertion, obstinate constipation, or straining at stool. The attack may occur at any hour, often during the morning. The recumbent position does not protect against hemorrhage; indeed the contrary holds true. At the commencement of the attack the bleeding is often profuse; usually it diminishes after a few hours, following which there is a period when the urine is only faintly tinged with blood. After this succession of symptoms the course of the hemorrhage is apt to be irregular. Very often the cessation of bleeding is as sudden as its onset, all traces disappearing from the urine for days, weeks, or months at a time. Or a few cells may be constantly present, with now and then an irregular slight exacerbation. Sooner or later, it may be on the next day or not for ten years, comes another severe attack.

Although the hematuria of bladder-tumors is liable to be very capricious, still when a series of cases are taken together it will be obvious that the attacks gradually become more frequent. In some cases, hemorrhage once established, the blood never disappears, but is always present in moderate

amount, and there are irregular periods of marked increase in the flow: such cases are rare, and the subjects soon become profoundly anemic.

The degrees of the hemorrhage in different cases or at different times in the same case deserve a more detailed description. The urine rarely presents any sign beyond the spectroscopic absorption bands, which in the case of these hematuria are usually those of oxyhemoglobin, although if cystitis be present in severe degree the fetid alkaline urine may show the bands of methemoglobin. Under the microscope the cells may be quite numerous. The usual degree of bleeding between attacks is sufficient to color the urine faintly, and it is often quite dark. Small clots may be present even after moderate hemorrhage. Not uncommonly large clots are formed which may pass the urethra or may obstruct it. A large clot usually appears at the close of a profuse hemorrhage, and may mark its termination. In other cases large clots are gradually formed by minute hemorrhages upon the growth, become in some way dislodged, and are then voided. The actual quantity of blood lost in an acute attack may aggregate a number of fluid-ounces.

The anatomical causes of the bleeding vary; the excessive vascularity of the growths and the delicate structure of the capillaries and their terminal loops predispose to hemorrhage. It is further favored by the alterations of the mucous membrane apart from the tumor, the formation of vascular villosities, and the development of cystitis. Ulceration, when not due to mortification, may also cause hemorrhage.

The frequency or degree of bleeding bears no relation to the size of the growth, nor is there a definite relation between the frequency and degree of bleeding and the variety of tumor. As a rule to which there are many exceptions, it may be said that the more soft and vascular and the less fibrous a growth is the more it bleeds. Thus angiomas and papillomas cause the freest bleeding, fibromas and myomas the least. The form of the growth also affects the amount of hemorrhage somewhat: sessile and infiltrating growths bleed less than pediculated ones. Other important factors influencing hemorrhage are the movements of the bladder, particularly its contractions in micturition. During an active contraction the venous return is partially obstructed, and the congestion of the membrane is thereby increased; moreover, the surface of the tumor may be injured by the pressure of the opposite wall. The extreme irregularity of the bleeding, however, shows the limited influence of functional activity of the bladder.

Cessation of bleeding, except when it is the result of pure congestion, is accomplished by occlusion of the bleeding vessel by clotting and thrombosis. Toward the close of many cases bleeding stops entirely, and this may be due to gangrene of the growth or degeneration of the pedicle, aided quite materially by the feeble circulation of the cachectic subjects.

Disturbances in the act of micturition are almost constant. Retention is a common symptom; it is usually partial, but a few instances of complete retention, with such distention of the bladder that its summit reached the level of the umbilicus, have been reported. The causes of retention are clots, pieces of tissue, or the tumor itself, which may be so seated as partially to block the vesical outlet, or may possess so long a pedicle that it can act as a ball valve. There is a rare spasmodic retention. The degree and consistency of clotting depend not only upon the amount of bleeding, but also upon the quantity of urine in the bladder and its acidity at the time of bleeding: the greater the quantity of urine, the less active is the process of clotting. The entire bladder-cavity has been filled with a solid clot. It is not necessary for

clots to be large in order to cause retention, and this is especially true in old subjects whose bladder-walls are atonic.

Retention is usually temporary and intermittent. It is accompanied by pain, colic, a burning in the urethra, and an intense desire to micturate. As a rule the vesical detrusors, aided by the abdominal muscles, are able to expel the obstructing clot or fragment of tissue.

Incontinence of urine is rare in vesical neoplasm. It may, however, be produced either by the abolition of the function of the sphincter from involvement by the growth, a condition sometimes seen in women, or by extensive ulceration and destruction of the neck of the bladder, exceptionally occurring in men. Retention with incontinence is commoner than true incontinence, and is caused by an imperfect plugging of the vesical neck, preventing the sphincter from acting efficiently.

Frequency of micturition is another almost constant symptom, being present in many cases from the first onset of symptoms, while in others it appears only late in the case. It must be borne in mind, however, that the frequent urination truly symptomatic of tumor is painless, while the frequency of cystitis is accompanied by pain and the other symptoms of dysuria: the presence in the bladder of clots or pieces of tissue will also produce painful frequency.

The degree of the simple frequency varies in different cases and at different times in the same case. Usually the subjects urinate a dozen times in the twenty-four hours, quite often a score of times daily, and the act may become as frequently repeated as once every quarter hour. Exceptionally this symptom antedates hematuria; it usually appears with the first hemorrhage, but does not pass away with it. It is most marked in the tumors of the vesical neck.

Several cases of anuria have been described. It is, however, very doubtful, independent of the question of calculus or renal lesion, whether these were true instances of total suppression of the secretion.

Pain is very variable. Thompson laid great stress upon it, while Guyon maintains that, if cystitis and retention of urine be excluded, it is so often absent, and when present so variable in nature and intensity, that it does not constitute an important symptom. Pediculated growths cause less pain than those which are sessile or infiltrated; pain is most pronounced in tumors of the vesical neck.

Upon the occurrence of hemorrhage pain is nearly always present: there is an ache in the hypogastrium, a burning along the urethra, and if clots cause obstruction the suffering becomes severe and colicky. The pains of cystitis and retention are those which accompany these conditions when they develop independently of neoplasm. When the tumor has grown through the bladder-wall and attacked surrounding tissues a deep pelvic pain is common. By irritation or pressure of the lumbar branches neuralgoid pains of the areas of distribution may be produced, and severe sciatica has been caused by growth into the sacro-sciatic foramen.

The constitutional symptoms of uncomplicated bladder-tumors are usually mild. Unless the hemorrhages are severe and frequent the general health may remain long unimpaired. Profuse and frequent loss of blood will, however, cause rapid and pronounced anemia, evidenced by the characteristic appearance and symptoms. An examination of the blood will show a moderate oligocythemia, with perhaps some poikilocytosis, a more pronounced oligochromemia, and directly following the hemorrhages a moderate leukocytosis.

Typical cancerous cachexia, such as is seen in gastric and other internal

carcinomata, is very rare in vesical cancer. The most important constitutional disturbances are due to cystitis and renal disease. There is, however, a toxic influence in malignant tumors due to an undetermined metabolic poison, produced or aroused by the neoplasm; and while this is present late in all the cases of malignant tumors, it is not possible to determine how much of the constitutional conditions is due to it and how much to septic and uremic intoxication.

Complications.—The most important of these is cystitis. Its pathology has been described elsewhere. It may occur early, and is the initial symptom in 25 per cent. of cancers, 33 per cent. of sarcomata, and in 10 per cent. of papillomata; it never inaugurates the symptomatology of other benign growths. In the benign cases it may be deferred until late. The advent of cystitis is largely influenced by hemorrhage and retention of urine; it causes painful and frequent micturition with tenesmus, the constitutional symptoms of an internal inflammation, as irregular fever with chills, and altered conditions of the urine. Late in the case the subjects may pass from septic intoxication into a low typhoid state, with the mental and functional derangement seen in the latter condition. In a few cases cystitis has been of the fulminant type and rapidly fatal. Usually the symptoms of cystitis are local and urinary, although that condition no doubt plays an important rôle in the gradual loss of strength.

Extension of infection to the ureter and pelvis of the kidney may be evinced by acute or subacute symptoms. Pains appear in the loins, of a dull nature, often colicky, and radiating into the genitalia. Fever is usually present, is irregular, may be hectic, and chills are common. Hydronephrosis or pyonephrosis promptly produces a tumor in the loin with its characteristic physical signs. As a rule, the symptoms of ureteritis and pyelitis are subacute. In these, as in any case of pyelitis or pyelonephrosis, a pararenal abscess is possible.

The kidneys are sooner or later affected in all cases of vesical tumor, and renal symptoms often dominate the closing period of the disease. Acute nephritis may be either parenchymatous or suppurative. In either case there will be oliguria and the other urinary signs of an acute nephritis (*vide* Urology). Fever will usually be present, more irregular in the suppurating form, and accompanied by chills. The gastric derangements are marked, and the mental and circulatory symptoms of acute nephritis are well developed.

The cases of simple acute nephritis usually pass into a chronic condition, but the subjects may develop severe acute uremia and die. In the septic cases the majority quickly pass into a low state of septic intoxication and die: some, however, survive the initial onset and develop chronic surgical kidney. The chronic nephritis may present either the parenchymatous or the interstitial type. Following an acute attack, the full train of symptoms of parenchymatous nephritis may develop—oliguria, dropsy, either general or local, anemia with the alabaster complexion, gastro-intestinal derangements, cardiac and respiratory distress, retinitis, chronic or acute uræmia, etc. More common is the interstitial form, in which the symptoms of renal insufficiency are less marked than the circulatory disturbances—cardiac hypertrophy, arterio-sclerosis, increased tension of the pulse, dyspnea, cerebral and digestive disturbances, etc. Chronic or acute uremia will appear in these cases sooner or later; uremia, in fact, is the actual cause of death in very many cases. Secondary metastatic deposits are often found post-mortem, but they occur so late in the case and are usually of such small size that they do not produce symptoms. If present, symptoms would obviously vary with the site affected, and need not be further discussed.

The secondary carcinoma of the bladder likewise presents few symptoms. As a rule, the growth is a mural infiltration, so that hematuria does not occur. Where there is perforation of the wall, as is sometimes seen in the pelvic cancers which have involved all the tissues, this would cause definite symptoms which would vary according to whether the perforation were into the peritoneal cavity, the pelvic cellular tissue, or rectum or vagina. Such phenomena are important in the consideration of the question of operation for extra-vesical cancer, but they are not important in vesical surgery.

Prognosis.—The duration of cases of bladder-tumor depends upon the site affected, the variety of growth present, the clinical course, and the occurrence of cystitis and nephritis. Tumors of the base, particularly those of the neck, are earliest fatal. Malignant tumors of the neck are usually fatal one year from the appearance of symptoms; rarely a case will go on to the second year, while a few do not survive over six months. The malignant tumors are usually fatal within two years even when situated in the less vulnerable parts of the bladder; there seems to be no difference in the duration of the carcinomata and the sarcomata. Extension beyond the bladder shortens the duration.

The benign tumors are in themselves quite compatible with long life: indeed, in several carefully observed subjects they existed ten, twenty, or even more years. The course of papilloma is largely determined by the hemorrhages and the complications: when the first are severe and frequent the duration is often not longer than is that of cancer, while even in the case of a papilloma which does not bleed the location of the growth may be such as to favor cystitis or obstruction of the ureter, with consequent nephritis, so that they may thus prove rapidly fatal. Hemorrhage and infection and obstruction are so likely to develop, even in benign growths, that these always must be regarded as dangerous. There are a very few cases (Ultzmann, Reverdin) in which spontaneous cure has been effected by the detachment of pediculated growths and their expulsion with the urine.

The causes of death are varied. Rarely profuse hemorrhage has been the direct cause. In the cachectic debility which follows prolonged hemorrhage the system is vulnerable, and any intercurrent disease may prove fatal. Many fatalities have been due to nephritis, a less number to septic infection. The toxic influence of malignant growths is undoubted, but it is important as a demoralizer of systemic resistance rather than as a direct cause of death.

The urinary conditions in bladder-tumor are important. The total quantity of urine is rarely affected by the tumor itself. In a few cases a simple polyuria has been noted. Oliguria is the rule as soon as a notable degree of renal complication exists, unless this be of the interstitial type with cardiac hypertrophy, when polyuria develops. A sudden oliguria suggests obstruction of one ureter, which later may be removed, being then followed by a temporary polyuria.

The color of the urine is often altered by the blood: it varies from a pale pink to a dark brown. If cystitis be present, the urine will be whitish and opalescent, with a heavy deposit of pus, phosphates, and detritus. Clots of blood and threads of mucus are common, and pieces of tissue of microscopic size have been found. The odor of the urine is normal, unless cystitis exists, when it is more or less offensive; late in the case it may be gangrenous. The specific gravity will correspond to the metabolic conditions of the patient: it will in the particular case be diminished if cystitis or nephritis exists, but the presence of blood naturally raises it. The reaction will be normal until

cystitis occurs, when alkalinity becomes established. If much blood be present, its alkalinity will obviously neutralize the natural acidity.

The chemical examination is of importance in considering the question of the renal conditions. Whenever there is hematuria there is necessarily albuminuria present. To determine in an individual case whether the albumin is simply that of the blood in the urine or whether it is of kidney origin two methods are available: In the liquor sanguinis, as is well known, globulins exist in excess of serum-albumin, the ratio varying from $2\frac{1}{2}$ to $1\frac{1}{2}$:1. In the albuminuria due to hematuria the ratio of the globulin to the serum-albumin will be the same. In renal albuminuria, for reasons which are not clear, the serum-albumin markedly exceeds the globulin, usually in the ratio of 12 to 18:1. This is true of every renal albuminuria, except that of amyloid disease and a few cases of very severe acute glomerulo-nephritis, which are characterized by a high proportion of the globulin, so that there the ratio drops from 12 to 16:1 down to 4 to $1\frac{1}{2}$:1. In a given case, should the quantities of serum-albumin and of globulin be quantitatively estimated (amyloid kidney being excluded), if the serum-albumin-globulin ratio approaches the ratio characteristic of renal albuminuria, renal lesion is surely indicated; should the ratio be low, as 2 to 5:1, a mixed albuminuria would be suggested; should the proportion of globulin equal or exceed the proportion of serum-albumin, the diagnosis of a blood-albuminuria is almost positive. A second method is that of Goldberg: The red cells are counted from a well-mixed specimen of the twenty-four hours' urine in a Thoma-Zeiss hemocytometer. The percentage of albumin in the filtered urine is then determined by Esbach's method. If there be no more than 3000 blood-cells in the c.mm. of urine, and the urine give a reaction of albumin with nitric acid, the albuminuria is of renal origin, since that quantity of blood will not give such an albumin reaction.

In a pure hematuric albuminuria the weighed quantity of albumin in that amount of urine which contains the number of red blood-cells present in 1 c.mm. of the patient's blood will not exceed the proteid in the plasma of 1 c.mm. of blood, which is, even in anemias, not over 100 milligrams. Assuming that in hemorrhage the cells and plasma extrude in their circulatory proportions, and that the red cells have not given up proteid to the urine, any further amount of albumin would be of renal origin. This latter method has given useful clinical results in a limited number of cases, but has not yet been confirmed by operations or autopsies.

The urine should be carefully tested during the intervals when hematuria is absent, as an albumin reaction then indicates renal disease.

If cystitis be present, matters will be more complicated. To determine, in the absence of hematuria, whether an albumin reaction depends solely upon the pus or partly upon a renal condition, a small quantity of the twenty-four hours' urine, into which the pus has been intimately mixed, should be mixed with an equal volume of $\frac{1}{2}$ per cent. solution of acetic acid, colored with methyl-violet, and the pus-cells counted upon the ruled slide of a Thoma-Zeiss hemocytometer. With another specimen of the filtered urine the albumin is estimated in Esbach's albuminometer: 100,000 pus-cells in the c.mm. correspond to 1 per cent. of albumin, and a relative excess of pus of albumin would imply a renal albuminuria.

Sugar is only accidentally present in the urine of these cases. Sulphuretted hydrogen is found in the urine of cases with a communication into the alimentary tract: it is furthermore present in severe cystitis independent of fistula.

The potassium salts are in excess whenever blood or pus is present and when decomposition of the tissue is going on. Under the latter circumstances the aromatic sulphates are also in excess.

The *sediment* is of great importance. The blood from vesical hemorrhages is usually mixed with the urine. Small clots are common. The blood-cells in fresh urine of proper saline concentration are usually well preserved and more or less crenated. In cystitis, however, the cells are often and markedly fragmented. The pus-cells are usually of the type of neutrophilic polymorphous leukocytes.

Epithelial cells from the bladder mucous membrane will be present in cases of cystitis: those of the superficial layers are small cylindrical cells of polygonal form, while those from the deeper strata are more oval and have long processes. In ureteritis and pyelitis epithelial cells would be desquamated, but they cannot be differentiated from the vesical cells. The cells are usually much degenerated. Renal epithelium may be present if the kidneys be severely affected. These are quite small polycylindrical cells with proportionately large nuclei, and are seen in all stages of degeneration.

Particles of the growth are not infrequently seen. If any particles passed be large enough, they should be put through the formal steps of fixation, dehydration, and imbedding in celloidin and stained; in this way a positive diagnosis can usually be made. Usually the particles are not large enough for this, and the sediment must be examined as such or may be smeared upon cover-glasses, fixed, and stained. Small villi of papillomata, the tiny central stalk covered with epithelium, are not infrequently seen: unfortunately, it cannot be told whether such filaments come from a papilloma or a simple mucous villosity, but we know that they are more often voided from neoplasms than from simply inflamed bladders. They must not be confounded with hyaline casts or fibers of fibrin to which cells have adhered.

Large layers of epithelium are sometimes seen, and these may come either from growths or from simple inflammation. Rather larger masses of tissue are sometimes passed: as a rule, from malignant growths. Isolated cells seen in the urine do not often furnish much definite information. If, however, many epithelial cells are present which are neither cylindrical nor polycylindrical, but are polymorphous and very irregular, the presence of a cancer is suggested.

Urinary casts are common. Even without definite renal complications hyaline casts may be present, due to anemia, malnutrition, etc. They are almost always found when pyelitis has become established and in interstitial nephritis. Whenever the renal tubules are affected, blood and leukocytic casts (in acute stages) and pale and dark granular casts are added to the hyaline casts.

The salts of the urine are simply the normal salts until cystitis develops, when a marked precipitation of the phosphates occurs. These salts often cling to the organic matters. Ultzmann believes that calcium oxalate is particularly excessive in the urine of cases in which the growth is necrosing.

Crystals of hematoidin are often seen in bloody urine of alkaline reaction: they are dissolved by acids and respond to Gmelin's test. In the rare cases of melanotic sarcoma of the bladder the pigment has been seen in the urine. It is, however, a question whether in extra-vesical melanotic sarcoma the pigment cannot be loaded into the blood and excreted by the kidneys.

Diagnosis.—This is founded upon the symptoms already detailed and upon direct examination.

The diagnostic symptoms are sudden, apparently causeless, profuse hemor-

rhages, recurring with increasing frequency and greatly aggravated by urethral exploration and the passage of fragments of neoplasm. Tough, coagulated fibrin or blood-clot so closely simulates fragments of neoplasm that a microscopic examination is necessary to determine the structure of the suspected body.

Direct examination is accomplished by palpation, sounding, cystoscopy, and cystotomy.

Palpation should enable the surgeon to detect all malignant infiltrating growths, except in unusually fat patients. Myxomatous and non-infiltrating growths cannot be detected in this way. It is always desirable fully to relax the patient by ether before beginning examination for vesical tumors. When the symptoms already detailed lead the surgeon to suspect strongly the presence of a growth, preparations for its removal should be made before conducting the examination, since, except the more advanced cases, this operation is always advisable and should be performed as soon as the diagnosis is assured. The patient should be etherized, his consent having been first obtained to operate in case a growth is found: the surgeon then proceeds to make his examination, the perineum, the suprapubic region, and the genitalia having been previously carefully disinfected.

Examination by rectal palpation is best left to an assistant who has acquired manual dexterity by experience. With the patient supine, knees flexed, and shoulders slightly elevated, the index and middle fingers of the right hand are passed into the rectum, while the fingers of the left hand press the bladder downward from above the pubis. The prostate, seminal vesicles, the ampullæ of the vasa, the base of the bladder, and a portion of its posterior wall can be felt distinctly. After introducing a catheter and drawing off all the urine, the bladder can be pressed down from above, so that practically all of its substance is within reach of all the rectal fingers. If distinct induration is felt, this indicates either stone or vesical tumor. Stone may be usually differentiated by its mobility and its harder feel. If no induration can be felt beyond a vague, semi-solid thickening, or if no departure from normal is perceptible, the surgeon next proceeds to examine the interior of the bladder with the cystoscope. The method of using this instrument is detailed elsewhere. It is sufficient to state here that it can render service only when the urethra is sufficiently patulous to allow it to be introduced into the bladder, and when this viscus is able to retain at least three or four ounces of fluid which will remain fairly clear for at least one or two minutes.

The cystoscope is best sterilized by formalin vapor. It is then dipped into a weak solution of silver nitrate or mercuric chloride or in sterilized normal saline solution to remove the irritating formalin from its surface, is lubricated with glycerin, the lamp is turned on to see that it is burning brightly, and the optical apparatus is examined lest it should have become clouded or defective. The current having been turned off, the instrument is introduced into the bladder. When vesical tumor is present, it usually happens that the fluid which has been injected, preferably normal saline or boric-acid solution, is opaque with blood. It should be remembered that the best medium with which the bladder can be filled is clear urine. Hence when the rectal examination is made, if the urine is free from blood, it is well to avoid emptying the bladder, the patient being etherized at a time when it is probable that this viscus contains at least four to six ounces.

It is particularly in examination for vesical tumors that the irrigating cystoscope will be found serviceable. The introduction of the instrument

may occasion sufficient bleeding entirely to obscure the view. This may be transitory, and if bloody urine is allowed to escape through the irrigating tube and is quickly replaced by normal saline solution, a satisfactory examination may be conducted before sufficient blood has escaped to render this fluid turbid. If, after two or three efforts to fill the bladder with liquid sufficiently clear to permit examination, free bleeding persists, the attempt should be given up, the surgeon then contenting himself with an endeavor to find and inspect the ureteral orifice and watch for one or two jets of urine. If the jet from each side comes out clear into the turbid fluid, this will at once establish the vesical origin of hemorrhage. The cystoscope should then be at once withdrawn and the bladder further explored by suprapubic cystotomy.

Even when the conditions are favorable for cystoscopic examination considerable experience is required in placing the instrument so that the vesical walls are clearly seen, and in interpreting properly the conditions observed. There are a number of rules given in regard to the position in which the cystoscope should be held and the method of using it so that the entire bladder can be examined. The writers consider these of little service. The best possible teacher is experience. This should be gained, first, on phantom bladders, next on cadavera, next on sexual hypochondriacs, who are benefited by all forms of instrumentation, and finally on patients who present symptoms of vesical lesions. The cystoscopic appearances of the normal and diseased bladder are given at length under a special heading. The surgeon should remember that the rugæ of the imperfectly distended bladder may closely simulate polypoid growths, that the surface of nearly all tumors becomes papillomatous, that tubercular infiltration and ulceration may be extremely difficult to distinguish from neoplasm, that the normal projection of the ureteral orifice may be mistaken for a polyp. Moreover, vesical growths in the presence of cystitis may become encrusted with phosphatic deposit, thus presenting the exact appearance of stones. If scraped with the tip of an instrument, this deposit will be loosened. Submucous hemorrhages, such as are common in hemorrhagic cystitis, may form gelatinous rounded elevations very like papillomata, only to be distinguished from them by the hemorrhagic stains and blotches of the surrounding mucous membrane.

The cystoscope is utterly useless in the hands of one who has no experience in its use, excepting in the diagnosis of the long, fringed papillomata, which present a perfectly typical and unmistakable picture. When employed by the surgeon who has so familiarized himself with it that he is able to appreciate the size of bodies and their position, it is of the greatest service, often saving patients from useless operations by determining, for instance, the renal origin of a hemorrhage which is supposed to be cystic. The writers believe that the cystoscope should never be used upon patients suffering from vesical neoplasm in whom cystitis has not developed, excepting just before operation.

When the cystoscope fails because it is impossible to introduce it or because it is impossible to keep the bladder moderately filled with a clear fluid, diagnosis may be established by either perineal or suprapubic cystotomy.

In choosing between these two operations the surgeon should select the latter, since if a tumor is found he is then in position to proceed at once to remove it. Some growths are accessible and removable through a perineal opening. The operator is, however, compelled to work in the dark, and cannot be sure that every portion of the neoplasm has been taken away, and

there is danger of extensively injuring the vesical walls. Suprapubic incision renders the intravesical cavity accessible both to touch and sight.

Treatment.—*Palliative treatment* of tumors of the bladder is limited to the relief of hemorrhage and the control of pain. This treatment is often required because patients are reluctant to submit to operation—more often because by the time the diagnosis is assured infiltration has extended so widely that radical operation is no longer possible. The general treatment of hematuria is that appropriate to the relief of vesical congestion; medicinal treatment is of little service, though ergot or ergotin, gallic acid, and hydrastis are usually given. Direct local treatment may be conducted by hot injections of alum four drams to the pint, fluid extract of hydrastis two ounces to the pint, or acetanilid two drams to the pint.

In the absence of cystitis moderate retention caused by clots is best left to itself. Should, however, vesical tension become pronounced, the clot should be aspirated by means of a large catheter and suction syringe or by the evacuating tubes and aspirator employed in litholapaxy.

If bleeding is persistent and is not benefited by injections or irrigations, continuous catheterization is indicated. If this is unsuccessful because of constantly recurring obstruction of the catheter by clots, perineal or suprapubic cystotomy, with the insertion of a large tube, is advisable. Should this means fail to arrest bleeding, and should life be threatened by its continuance, suprapubic cystotomy should be performed: the bladder should be secured to the parietal opening by sutures, and, a drainage-tube having been carried to the region of the ureters, the bladder should be firmly packed with gauze.

Pain dependent upon cystitis is best remedied by mild antiseptic irrigations. If it is persistent and severe, opium and belladonna suppositories are required.

The *operative treatment* of tumors of the bladder consists in their complete removal through a suprapubic opening.

The incision into the bladder is conducted as in suprapubic cystotomy for the removal of stone.

The surgeon should be provided with a catheter which can easily be passed into the bladder; an eight-ounce syringe, the end of which fits into the lumen of the catheter; two retractors; one glass vaginal speculum; crushing, cutting, and avulsion forceps; a wire écraseur; a Paquelin cauterizer; knives, long straight and curved scissors, hemostatic forceps, tenacula, straight and curved needles, a needle-holder, and a grooved director. The rectal bag may be omitted; its use, however, elevates the bladder and renders the operation somewhat easier. It is well lubricated with glycerin, passed into the rectum, and distended with not over six ounces of water when there is no reason for believing that the bladder has become weakened by a long, severe, lasting cystitis. Six to eight ounces of water are injected into this viscus through a long rubber catheter. In place of water, air is sometimes used, and answers as well. A four-inch incision is then made, beginning slightly below the upper border of the pubis and passing upward in the middle line. The skin, superficial and deep fascia are cut through between the recti muscles if possible; if the incision falls to one side, it should be deepened through the fibers of the rectus until the fascia forming the anterior wall of the prevesical space is opened, exposing the prevesical fat. The finger is then passed down behind the pubis with its pulp toward the bladder, and is hooked upward, dragging with it the peritoneum and its underlying fat. This tissue should not be torn, but should be cut

through with a knife or scissors, the bleeding points being secured as they are divided. Every effort should be made to preserve its vitality, since a common and often fatal complication of suprapubic cystotomy is purulent infiltration of this tissue. The firm white wall of the bladder having been exposed, the knife is thrust through it and a cut two inches long is made. The finger is then introduced and a manual exploration of the vesical cavity is made. If this shows absence of tumor, the bladder is dried with a syringe attached to a catheter and sponges on sponge-holders; the patient is put in the Trendelenburg position, and by means of a headlight mirror the vesical cavity is carefully explored, the incision being enlarged if necessary, and the vaginal speculum being employed as a caisson if bleeding obscures the view; that is, the speculum is passed through the vesical opening, as suggested by Fenwick, until its end lies in contact with the vesical mucosa. The portion of mucosa thus included is dried with a sponge, and can then be readily illuminated by the electric headlight and inspected direct. By moving this caisson from place to place the greater part of the bladder can be explored.

If the tumor is found, the borders of the bladder-wound are secured to the skin by three temporary sutures, one applied on each side and one above at the upper extremity of the vesical wound. By means of retractors the abdominal opening is then held widely open, and the surgeon proceeds to the removal of the growth. If there is still insufficient room, the attachment of one or both recti muscles is divided and the bladder opening is enlarged to the extent required, care being taken in cutting upward not to enter the general peritoneal cavity. Myomata and adenomata are enucleated.

Small polypoid growths are seized in forceps, drawn forward, an elliptical incision is made about the base with a knife, and the entire outgrowth, together with its attached base, is removed. The resulting wound is closed by catgut sutures, which are carried to the bottom of the wound. If the growth is pedicled, but so large that it prevents the proper treatment of the base, the *écraseur* is thrown about it and the bulk of the tumor is removed. The base is then treated as already-described.

When the tumor is infiltrating—*i. e.* malignant—attempts to remove it by the curette or the cautery are futile. The portion of the bladder upon which the growth is seated should be entirely extirpated: since this requires more room for its proper performance than excision of pedicled growths, the attachments of the recti muscles will usually require division. In the treatment of tumors which are known to be malignant it is well to employ the Trendelenburg incision. This is a transverse cut four inches long, slightly convex downward, and it is carried along the upper border of the symphysis. The attachments of the recti muscles are divided, and the prevesical space and the bladder are both opened by a transverse incision; the bladder-wound should be as large as that of the parietes, and should be temporarily sutured to the latter. This incision renders the subsequent steps of the operation comparatively easy, but it is objectionable because of the likelihood of hernia subsequently developing.

Helferich, finding that the suprapubic incision, even though transverse, does not always give sufficient room for intravesical operations, particularly when the bladder-base is involved in the malignant growth, has proposed irregular resection of the pubis as a means of rendering the operative region more accessible. A transverse cut is made along the upper border of the symphysis, care being taken to avoid the spermatic cord. External to the pubic spine on either side the periosteum is detached, and by means of a

chisel and mallet the central portion of the bone is cut away. This cut does not involve the obturator foramen, and hence does not affect the continuity of the pelvic girdle. The mid portion of the pubic bones thus loosened, together with the soft parts attached, is lifted upward, thus exposing the anterior surface of the bladder; a similar exposure may be accomplished by symphysiotomy. Helferich's subpubic route to the bladder cannot be recommended.

Excepting the trigonum and ureteral region resection of the entire bladder is practicable. When the neoplasm is limited to the extra-peritoneal portion of the bladder-wall the resection is made from within outward. The lateral walls of this viscus may be readily rendered extra-peritoneal by stripping up the peritoneum. In performing an operation for extensive resection of the vesical walls the anterior and lateral surfaces of the bladder are freed by a finger passed behind the pubis, and the entire infiltrated area, together with a certain amount of apparently healthy bladder-tissue, is cut away with scissors. The bleeding may be free, but is readily checked by clamps. The defect is closed by sutures placed either vertically or transversely according to the position of the resection.

When the trigonum and *bas fond* are infiltrated, curative operation is practically impossible. It is true that the ureters may be separated and implanted into the rectum and the greater portion of the malignant growth removed. Implantation of the divided ureters is practically always followed by an ascending nephritis, and by the time patients with malignant tumors in this position present themselves for operation involvement of neighboring lymphatic glands will already have taken place. We believe that under such circumstances the operation, even if immediately successful, materially shortens the period of life.

When the malignant infiltration has involved not only the bladder-walls, but the overlying peritoneum, a peritoneo-vesical resection is indicated. This is best performed as outlined by Clado: Through the ordinary suprapubic cystotomy wound the tumor is first separated, and as much of a pedicle as possible is formed. By means of fingers placed behind the tumor an effort is made to double the wall upon itself; this will appose the peritoneal surfaces just beyond the line of resection. The whole turned-in mass is then seized in a long pair of forceps. The bladder is then tamponed with sterile gauze, the cystotomy wound is partly closed, laparotomy is performed, and by means of a Lembert suture the two peritoneal surfaces, held in apposition by the long curved forceps, are permanently secured in position; a double line of these sutures may be applied. The abdominal wound is then closed, the vesical wound is again opened, the tumor is cut away, the pedicle being seized with smaller forceps placed on the sound tissue. The long forceps is removed, the bleeding points are secured, and the mucous membrane is brought together by a continuous or interrupted catgut suture.

Complete resection of the bladder for extensive malignant growth has always been fatal in the male. Clado and Pawlik have each reported one successful case in women. Pawlik freed the ureters from the bladder attachment and stitched them into the vagina, later removing the entire bladder. Catheters were then passed into the urethra through the ureters and the vagina was closed externally. After several operations the patient had an artificial bladder which could retain twelve ounces. A final report of the case was made two years after operation.

When but one ureteral orifice is involved and there is a chance for total removal of the infiltration, the ureter may be exposed by an opening through

the bladder-wall, freed, and after resection of the infiltration and closing of the resulting wound may be implanted into the bladder.

Operative treatment of bladder-tumors may be briefly summarized as follows: (1) Tumors of the bladder, even those that are manifestly benign, should be subjected to operation as soon as their presence is definitely determined. (2) Whatever the position of the tumor, it should be reached by suprapubic cystotomy. (3) Pedicled and apparently benign tumors should be removed by cutting through the mucous membrane about the base of the pedicle with the scissors or a knife, the resulting wound being closed by catgut sutures. The galvano-cautery or wire *écraseur* should be used for the purpose of removing the bulk of the tumor and thus allowing the surgeon more readily to deal properly with the base. (4) Sessile and infiltrating growths of the upper and anterior lateral walls of the bladder should be removed by resecting the portions of the bladder-wall in which these growths are placed. This resection should be made extra-peritoneal by stripping up the peritoneal investment of the bladder. The resulting vesical defect should be closed by a double row of catgut sutures, the first row approximating the mucous membrane; the second including the muscular and fibrous investment. (5) Infiltrating growths involving the peritoneal investment of the bladder should be resected in accordance with the method described by Clado. (6) Malignant growths involving the trigonum and ureteral orifices may be removed, the ureters being divided above the point of infiltration and implanted into the colon or the bladder: the technique is difficult, the operation exhausting, the mortality high, recurrence is almost certain, and even should the cancer be entirely removed the patient is likely to perish of ascending nephritis. (7) After removal of a vesical neoplasm the suprapubic opening should be closed by a double line of catgut sutures, a continuous stitch approximating the mucous membrane, and a second accurately bringing together the cut edges of the fibrous and muscular coats. The prevesical space should be drained, except in those rare cases in which there has not been a pre-existing cystitis. Under these circumstances the abdominal wound should be completely closed, since there is reason for believing that the bladder-suture is much more likely to hold when this course is followed. (8) When the intravesical operation has not been extensive, the bladder should be drained by continuous catheterization. When there is left an extensive raw surface, as when an attempt has been made to remove vesical tumors of the base, the bladder should be drained through a perineal opening. If suprapubic drainage is practised, Guyon's double tube should be employed.

Many surgeons prefer always to drain the bladder through the suprapubic opening. Guyon states that with his tubes drainage is so perfect that the dressings and the gauze packing of the suprapubic region remain dry, and need not be changed for several days. The bladder-wound having been closed, the prevesical space is lightly packed with sterile gauze, the abdominal opening is closed by stitches, excepting at its lower portion, and the gauze dressing is applied and secured in place by adhesive straps or an abdominal binder or a double spica of the groin. The patient is placed on his back in the bed; the drainage-tube, whether it be perineal, urethral, or suprapubic, is carried into a urinal half filled with antiseptic solution, and the bladder is washed every four hours with dilute antiseptic solution, nitrate of silver 1:4000 or boric acid.

When suprapubic drainage is usually practised without closing the bladder tightly around the tube, the dressings become soaked with urine in a few minutes. Unless special precautions are taken to avoid this, the skin becomes

inflamed and intensely painful. This complication is best averted either by avoiding suprapubic drainage or by suturing the vesical wall so tightly that the tube fits and allows no leakage about it. If no sutures are applied to the bladder-wound, the patient's skin should be thickly coated with ointment of zinc oxide made stiff by adding four drams of finely powdered zinc oxide to the ounce of ointment. The patient is placed on an oakum pillow enclosed in gauze; large wads of absorbent cotton and sterile gauze are placed about the bladder-wound and are changed every two hours; the gauze packing employed in the prevesical space is changed twice daily, the space being carefully irrigated each time.

The vesical opening usually closes in two or three weeks; the drainage-tube is removed about the fifth or seventh day.

VESICAL CALCULUS.

BY FRANCIS S. WATSON, M. D.

Formation of Stone.—The relative frequency of the primary occurrence of stone in the kidney and bladder is variously estimated: Heller, for example, makes the proportion that of 100 in the former to 1 in the latter; this disproportion is considered by most authors to be too great. It is undoubtedly true that almost all stones having uric-acid nuclei originate in the kidney.

Stone will not form primarily in the normal bladder; that is to say, in a bladder which empties itself freely and completely, whose mucous membrane is not inflamed, whose muscular apparatus has undergone no pathological change, and where there is no obstruction to urination present in the urethra, such as stricture or an exceedingly narrow meatus. It follows, therefore, that the largest number of stones in the bladders of patients under forty years of age, and of women—the latter because of their short urethræ—originate in the kidney, whereas in elderly men—owing to the loss of expulsive power, obstructive prostatic disease, residual urine, changes in the form of the bladder, and the frequent occurrence of alkaline decomposition of the urine—the larger number originate in the bladder.

Sir Henry Thompson calls attention to the relatively great frequency of stone in old men: of 993 male patients—adults and children—operated upon by him, 639 were between the ages of fifty-one and seventy years; of these it is fair to assume that the stones were formed primarily in the bladder in the large majority of cases. Clinical evidence also supports this view, for in most of the cases of old men evidence of renal calculus is absent, whereas it is frequently present with younger patients and women.

Uitzmann's view with regard to the manner of stone-formation is as follows: that it takes place by a process of actual crystallization similar to that occurring in geological formations. This theory is not generally accepted, and is contradicted by the demonstration of the presence of a colloid framework which favors the aggregation and firm adhesion of particles of the urinary salts. The work of Rainey, Ord, and Carter shows that certain salts in the presence of a colloid material, such as gum or albumin, do not form crystals, but certain bodies which Carter calls submorphous, having the peculiarity of adhering not only to adjacent surfaces, but also to each other in laminar series. Such a colloid substance is furnished by the mucus formed in the urinary passages under irritating conditions: through its influence the crystals which exist in the urines of certain individuals modify their form, become spheroidal, and coalesce, giving rise to a concretion which is the starting-point of the stone, the subsequent growth of which is continued in more or less regular concentric layers according to the law of molecular coalescence referred to above.

The chemical nature of the layers varies, and is largely determined by the character and chemical reaction of the urine, which changes from time to time, at one time being acid, at another alkaline. Owing to this alternation of layers a laminated appearance is often presented upon section of a stone: a section will show, for example, a layer of uric acid, then of urates, then of phosphates, the latter being deposited under the influence of the alkaline decomposition of the urine in the bladder; if the urine becomes clear and acid again, as it often does, especially in the earlier stages of the malady, another layer of uric acid will be formed outside of the phosphatic one. Figs. 116 and 117, from Ultzmann, illustrate these formations well.

One plausible explanation of these periodic returns of the bladder to a healthier condition with the accompanying changes in the urine is to be found in the fact that the phosphatic layer deposited while the urine is alkaline is smoother than the one previously formed, and therefore less irritating to the mucous membrane.

This alternation of chemically different layers is also due to the periodic

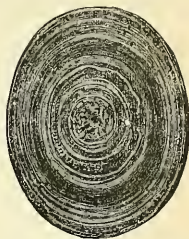


FIG. 116.—Laminated appearance of stone from the deposit of alternate layers (Ultzmann).

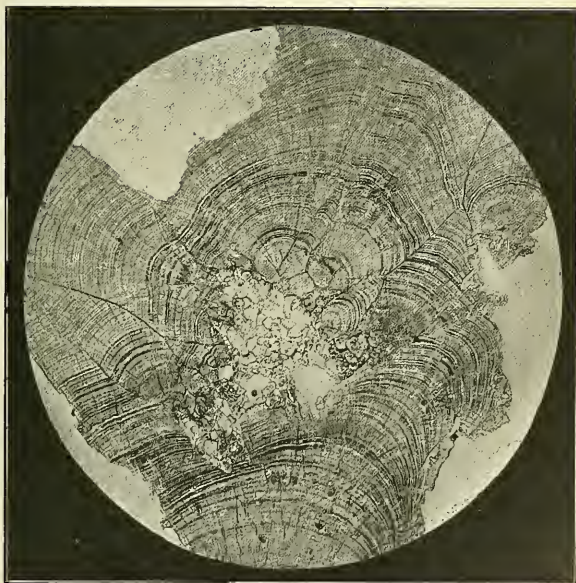


FIG. 117.—Finely-laminated stone of oxalate of lime (Ultzmann).

changes in the urinary salts that are commonly observed. In the writer's experience the most frequent change is that from oxalate of lime to the

amorphous phosphates and back again: this particular form of phosphatic deposit is that which, when it is persistent and excessive, is one of the more conspicuous symptoms of the condition to which the name of phosphaturia has been given. In this disease the urine is already neutral or alkaline when secreted in the kidneys. The condition is quite distinct from that of the alkaline decomposition of the urine in the bladder, which is due to local causes, and in which the large clear crystals of the ammonio-magnesian or triple phosphates are seen.

Stones may be classified, according to the salts predominating in their composition, as follows:

- (1) Uric acid and acid urates;
- (2) Oxalate of lime;
- (3) Phosphatic;
- (4) Cystine.

Stones of indigo, urostealith, and xanthin have been reported, but are of the greatest rarity. The relative frequency of different stones in Sir Henry Thompson's collection is as follows:

Stones from Male Adults.

Uric acid	551
Uric acid and phosphate	92
Oxalate	34
Oxalate and urate	35
Oxalate and phosphate	15
Phosphates	244
Cystine	3
Total	975

Calculi from Fourteen Female Patients.

Uric acid	10
Uric acid and phosphate	2
Phosphate	2
Total	14

From Male Children.

Uric acid	10
Urate and phosphate	3
Oxalate	2
Phosphate	1
Total	16

The conditions of the bladder which favor formation of stone are— inability of the bladder to empty itself wholly, of which the most common example is that seen in connection with prostatic hypertrophy: here the lower part of the viscus is also frequently depressed into the pouch-like form known as the *bas fond*, containing a greater or less quantity of stagnant urine, called the residual urine, which is particularly prone to undergo alkaline fermentation; and in this medium the phosphatic salts, especially the crystals of the triple phosphates, are readily precipitated, and, being caught in mucus, form the nucleus of the stone, sometimes very rapidly, the character of the stone as it increases in size depending, as has already been described, upon the subsequent alternations of the urine from alkaline to acid reaction, or to its remaining, which is often the case, continuously alkaline. The amorphous phosphates do not form stone in the bladder so often or so rapidly as the triple phosphates do, perhaps because of their less sharp and more rounded form and smaller size. The variation in the propensity of

different bladders to form stone is very great, even under local conditions that seem very similar: of two elderly men, for example, with chronic cystitis, and alkaline urines containing precipitates of the triple phosphates, one will form stone in a few weeks; the other will go on for years without doing so. The same is true of other crystalline precipitates: this is not because of the failure of the crystals to be precipitated in the bladder, in many instances at any rate, for the author has carefully verified this statement in a considerable number of cases.

Another condition of the bladder which gives rise to encysted stone sometimes is that of diverticula: these may be said, in some of the more extreme examples, to form separate miniature bladders, in which the conditions are favorable to urinary stagnation and decomposition, and consequently to the formation of stone, which in this case is shut off from the main chamber of the bladder, and is often almost entirely covered over with the inner lining of the bladder-wall, and so often escapes detection by the sound.

Nuclei.—According to Keyes, 90 per cent. of all stones have uric-acid nuclei; of the remaining 10 per cent., foreign substances, phosphatic concretions or oxalate of lime, and blood-clots form the nuclei. If it is true that such uric-acid nuclei are formed in the kidney, it would make the proportion of stones of primary renal origin larger than Ultzmann and others consider it to be.

Foreign substances of the greatest variety have been found as the nuclei



FIG. 118.—Mouth-piece of a pipe found in the bladder of a man (Harrison).

of stones: they are frequently introduced into the urethra by people of perverted sexual feeling, especially by women. Bullets, bits of catheters, of pencils, etc. have been noted. Harrison reports the case of a man in whose bladder the mouth-piece of a pipe was discovered, the patient declaring that he had swallowed it by the mouth some time before; and there are other instances in the literature in which foreign bodies have entered the bladder from the bowel by a process of ulceration. The accompanying figures are



FIG. 119.—Needle armed with a knob of sealing-wax (Harrison).

examples of some of the extraneous substances which have made the nuclei for vesical calculi (Figs. 118–123).

Consistency, Shape, External Appearance, etc.—The oxalate-of-lime calculus is the hardest, often dark in color, varying from gray to almost black, of more or less spherical form; the external surface is often studded with nodules (Fig. 124), whence it derives its name of mulberry calculus. Occasionally the surface presents numerous sharp projections resembling minute arrow-heads.

The *pure uric-acid stones* are the softest, are yellow, red, or brown in color, and generally present a smooth surface.

Phosphate and *urate stones* stand between the first and second in consistency; the former in color vary from gray to white; the latter are yellowish or reddish.

The Form.—When solitary and freely movable in the bladder the form of stones is characteristic, varying from round to oval; it is determined also by its chemical composition: a pure urate stone has usually a long oval, the pure oxalate a more spherical shape, while a mixed stone of urates and oxalates will incline to the form characteristic of the predominating crystals. The form of stone is modified also by certain local conditions: multiple stones, for example, are faceted; stones lying in diverticula take very curious shapes.

A long, oval stone with an oxalate surface will always be found to have a large nucleus of uric acid or urates, while one which is spherical will have no such nucleus or a very small one. Stones composed wholly of triple phosphates or amorphous phosphates have the form of a long oval, like that of the pure urates,

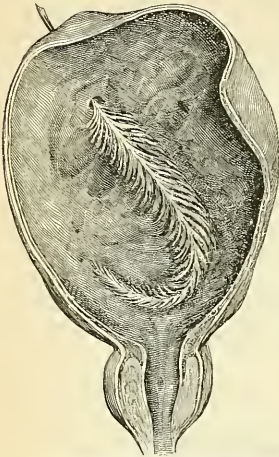


FIG. 120.—Spikelet of meadow foxtail covered with phosphatic deposit (Harrison).



FIG. 121.—Needle more than half covered with a deposit of lithic acid (Harrison).

but they are rare; ordinarily, stones with an outer layer of phosphates have large nuclei of urates or oxalates and have no specially characteristic form.

Spontaneous Fracture of Stone.—The subject of spontaneous fracture of stone has been treated by few writers (Ord, Debout d'Estrées, Fenwick, etc.).

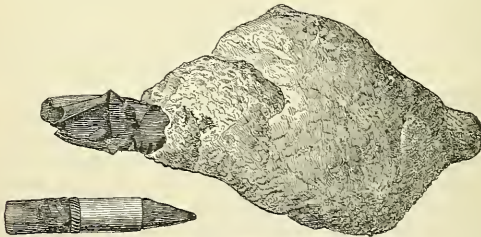


FIG. 122.—Stone formed around a penholder (Harrison).

This phenomenon is of rare occurrence. It has happened to the writer to meet with two examples of it: in both instances the specimens were found post-mortem. The first observation was published some years ago. In that case the patient, who was eighty years of age, had had no bladder-symptoms up to the time of his death. The bladder contained fifty-nine stones of pure uric acid of about the size of large peas, and a considerable quantity of stone detritus; the larger fragments had all undergone spontaneous fracture in one

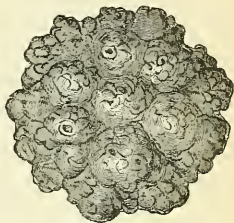
or both of two ways—either by radial cleavage from the center to the periphery or by splitting in concentric laminae. (See Plate 6.) The second case was that of a gentleman who had suffered for many years from stone. At the autopsy the bladder was found to contain six stones, four of which were large; five of the stones lay free in the bladder, their surfaces smooth and faceted; the sixth (Fig. 125) was held in a diverticulum near the summit of



FIG. 123.—Stone formed about a bit of bougie as a nucleus (Debout d'Estrées).



FIG. 124.—Mulberry calculus (Utzmann).



the bladder: its smaller portion, projecting into the bladder (*a*, Fig. 125), was faceted in the same manner as the other stones; the portion lying in the diverticulum (*b*, Fig. 125), which was that part of the stone spontaneously fractured, about the size of a pigeon's egg, was broken into three fragments (*c*, *d*, *e*, Fig. 126) which could be so accurately fitted together as to leave no doubt that they originally constituted that part of the stone. The dark lines on the oval end (*b*, Fig. 125) indicate the lines of division between the fragments; the fragments are here glued together in order to show the original form of the stone before it was fractured.



FIG. 125.—Watson's case of spontaneous fracture of vesical calculi.



FIG. 126.—Watson's case of spontaneous fracture of vesical calculi.

The two theories advanced to explain the occurrence of spontaneous fracture are those of mechanical force and of chemical action. The writer's second case shows that the fracture may take place in the absence of the first of these agents, since the fracture was located in that part of the stone which lay within the diverticulum, and was consequently protected from

any mechanical force capable of producing it, while that part which projected into the cavity of the viscus and was subjected to such force was not fractured. The two parts of the stone have the same chemical composition. The patient had never introduced anything but a soft-rubber catheter into the bladder.

The work of Ord and Rainey, already quoted, suggests an explanation of the phenomenon of spontaneous fracture. They found that spheres of carbonate of lime which had formed in solutions of gum, split radially and dis-

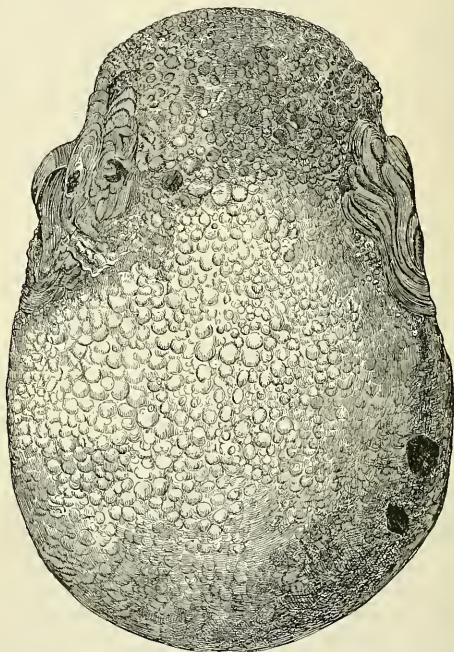
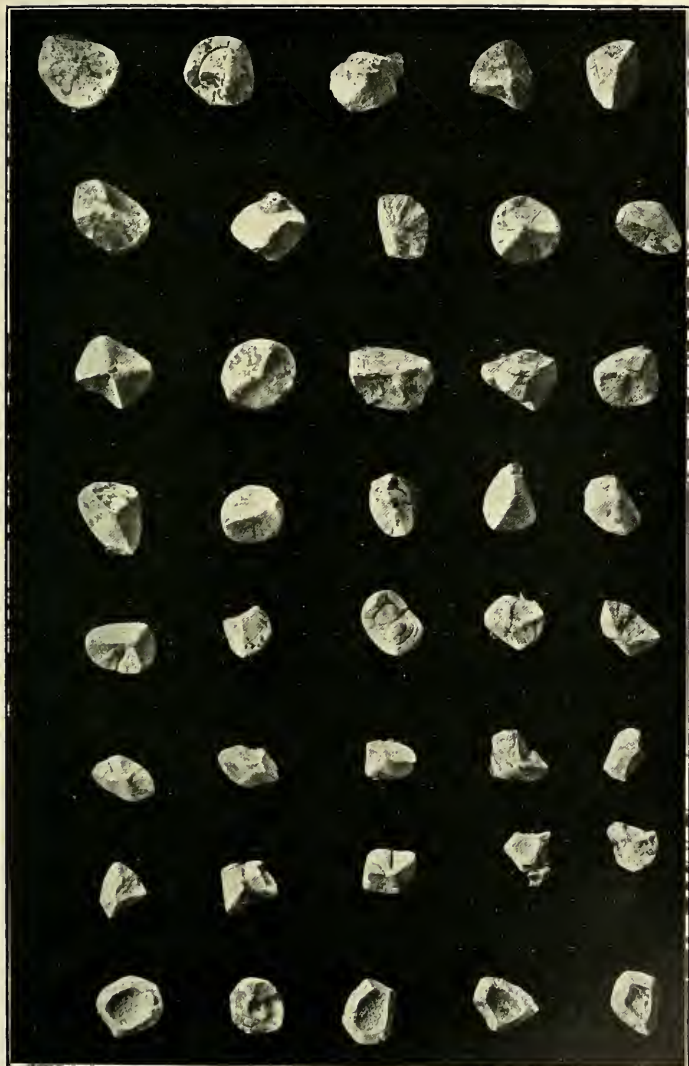


FIG. 127.—Stone weighing fourteen ounces, removed by Sir Henry Thompson.

integrated if placed in a solution of different specific gravity. This suggests that urinary calculi may split similarly under the influence of varying specific gravities and reaction of the urine. It is probable that the colloid framework in which the stone is formed swells by imbibition and thus causes the fracture. Dr. Debout d'Estrées of Contrexeville has seen several examples of spontaneous fracture of stone in patients who were undergoing the treatment at the springs: the sudden influence of the alkaline waters in these cases may be taken as an indication in support of the same theory as that offered by Ord.

Number and Size.—Stones usually occur singly, but large numbers are sometimes found. Multiple calculi generally originate in the kidney, and,

PLATE 6.



Fragments of spontaneously fractured calculi from the bladder.

passing into the bladder, constitute the nuclei of separate stones. There are rarely more than five or six stones found, but cases have been reported in which three or four hundred small calculi have been met with. Cabot¹ reports an interesting observation of a patient of his from whose bladder he washed out repeatedly, at short intervals, a large number of small calculi of curious form.

In size there is great variation. Sir Henry Thompson in the *Lancet* of July, 1885, reports 4 cases of large stones removed by him by the high operation, and gives a tables of 5 additional ones of remarkable size removed by operation in England. The weights of the four stones removed by Sir Henry are as follows: 1, Nearly 3 ounces; 2, 1½ ounces; 3, 14 ounces (Fig. 127); 4, 1½ ounces.

Sir Henry refers in the same communication to a uric-acid stone in St. Thomas's Hospital Museum which was removed from the bladder of Sir Thomas Adams, post-mortem, in 1672, as the largest he had ever seen of that nature; also to a phosphatic mass of 46 ounces removed post-mortem, after an unsuccessful attempt to do so during life, from the bladder of Sir Walter Ogilvie. Milton reports as the largest stone ever removed successfully one weighing 34½ ounces, which he succeeded in extracting by a laparotomy and suprapubic cystotomy, the bladder being opened by an extensive incision through its peritoneal investment.

The following table contains 19 examples of stones weighing more than 12 ounces :

	Ounces.		
1. Preston	51		
2. Cline	46	Operation.	Death.
3. Earle	44		
4. Uytterhoeven	40	"	"
5. Verduc	39		
6. Milton	34½	"	Recovery.
7. Despres	32	"	Death.
8. Deguise	31	"	"
9. St. Thomas's Hospital	25	"	"
10. Vitellius	22	"	
11. Fattor	20	"	Recovery.
12. Dunlap	20	"	"
13. Multanowski	18	"	Death.
14. Cheselden	17	"	"
15. Astley Cooper	16	"	Recovery.
16. Harmer	15	"	"
17. Thompson	14	"	"
18. Mayo	14	"	"
19. Dalrymple	13	"	Death.

Causation.—Of the two conditions which contribute to the formation of stone in the bladder, the first—viz. local conditions in the urinary tract—has been dealt with under the heading of "Formation." The second concerns certain general states of the body which may be included under the name of diatheses. Of these gout and rheumatism are the most frequent, the most important, and the best defined. The other general etiological factors besides these are the influence of race, dwelling, locality, diet, and habits of living.

The negro of the United States is said to be almost exempt from stone, while the natives of certain parts of India and Egypt are very prone to it. In the eastern part of this country stone is comparatively rare, while it is much more common in Ohio, Kentucky, Tennessee, and Alabama.

¹ *Op. cit.*

The assertion that the prevalence of stone in certain localities is due to the presence of large quantities of lime salts in the drinking-water is not borne out, because of the equally marked absence of the disease in other parts of the same districts which are supplied with the same water; moreover, calculous disease is met with in places which have no such waters at all. Any pure water, like distilled water, for example, tends to increase the quantity of urine, to cleanse the urinary passages of mucus, and to keep the urinary salts in solution; to this extent, therefore, drinking-water exercises a certain influence in the prevention of stone in the localities in which such water exists.

Heredity plays a certain rôle in calculous disease, and there are numerous examples of families in which successive generations have been afflicted with it.

The influence of *climate* seems to be entirely indeterminate, since we find stone to be prevalent among people living under the most varying climatic conditions.

Diet.—There is a general agreement that diet has a very decided effect in promoting or diminishing the tendency of individuals to form stone; thus the excessive, and in some individuals the moderate, use of wines and liquors, especially the fermented or much sweetened ones, and also a diet containing a large proportion of nitrogenous food, favor stone-formation. This is particularly true of those who lead a sedentary life. With a certain proportion of people this combination is productive of gout, one of the many manifestations of which disease is the appearance in the urine of a large quantity of uric acid or the urates. If under these conditions the urine becomes sufficiently concentrated or the amount of uric acid is excessive, a precipitation of its crystals may take place within the urinary passages, and the irritation due to their presence, producing the colloid material already referred to as the medium in which calculus forms, we thus have the two most important factors favoring stone formation.

Cadge has pointed out that in Norfolk, where stone is common amongst the children of the poor, there is great deficiency of good milk, and attributes an important part in the frequent occurrence of stone cases there to this fact. Harrison, quoting Plowright, lays stress on the rôle played by the presence or absence of salt in the dietary in the formation of stone, and draws the following conclusions from a series of observations made with reference to this point:

- (a) That the presence of salt greatly increases the solubility of uric acid;
- (b) That salt by increasing the thirst ensures the ingestion of a larger amount of water and a corresponding amount in the increase of urine;
- (c) That by keeping the colloids equally diffused salt tends to prevent the aggregation of the crystalline salts of the urine into concretions.

Recently Surgeon-captain A. E. Roberts¹ presents some interesting observations upon the geographical distribution of stone in India with reference to the diet: The relative prevalence of the disease is estimated from the records of the operations for stone annually throughout the country, an annual average of the number being calculated from the number occurring in several years, as follows (see table on p. 419):

“1. In British India, then, every year no less than 3041 calculi are removed from the bladders of the natives, or, rather, 3041 operations for the removal of as many (and more) stones are performed, and of this total nearly one-half occur in the Punjab. 2. The next point to note is that the

¹ *Lancet*, Feb. 9, 1895, p. 31.

Area.	Proportion of population eating rice.	Rates of calculus operations per mille of population.	Population in millions.	Average annual operations.	Remarks.
1. Punjab	$\frac{1}{10}$	0.078	19	1482	Numbers raised by Behar. None known.
2. N. W. P. and Ondh	$\frac{1}{11}$	0.021	45	925	
3. Bombay	$\frac{1}{11}$	0.017	16 $\frac{1}{2}$	283	
4. Central Provinces	$\frac{1}{11}$	0.011	9	112	
5. Bengal Proper	$\frac{1}{11}$	0.0034	69	218	
6. Madras	$\frac{1}{11}$	0.0067	31	21	
7. Assam	$\frac{1}{11}$	Nil	4 $\frac{3}{4}$	Nil	

Total annual average operations for India, 3041.

order of calculus prevalence is in inverse ratio to the population eating rice as its staple food upon each area. 3. Where practically the whole population lives on rice as its staple food calculus disappears, as in Assam. 4. As we leave the coast-areas and mount ever higher above the sea-level toward the interior calculus increases in its prevalence. Though Bombay stands third on the list, its coast-area is very limited, the rice-eating population is small, and the calculus-rate represents the high-lying millet region of the Deccan. We place a double contrast in view in the above sketch—a contrast between the sea-coast and the interior. What we here set ourselves to show is that vesical calculus in India follows as a result of the factors involved in this double contrast. A very interesting battle-drama is constantly going on in the upper layers of the soil—a fight between carbonic and silicic acids for the possession of the bases sodium and potassium—and the result is that the sea accumulates all the sodic chloride, while the soil inland is robbed of this salt and contains little else than potassium salts (Bunge). Now the amount of NaCl in any organism corresponds and varies with the amount in the environment. 1. Inland populations are, to a certain extent, battling with an unfavorable environment as regards the absence of the necessary salt in which they originally developed: this also serves to explain the unconquerable desire which the great majority of people exhibit for salt in their food. 2. It explains the necessity for a liberal allowance of salt to children, our ‘embryological ancestors,’ if we may so call them, and the consequence of its deprivation will be the more apparent in pathological effects. The offices which common salt performs include—(a) the construction of organs; (b) it is the chief factor in the formation of gastric juice; (c) it dissolves ‘globulins;’ (d) the nitrogenous products of metabolism cannot be eliminated by the kidneys in the absence of chlorides.

“The people who take salt, though differing in every other respect, are all characterized by a vegetable diet. In the same way, those who do not use any salt at all are all alike in taking purely animal food. We have also seen that this urgent necessity for salt in a vegetable diet depends upon the eliminating action of the excess of potash salts, and if various food-stuffs are compared in respect of this potash constituent, it will be found that the proportion of potassium to sodium is highest in the very food-staples on which the vast bulk of the Indian population is supported—that is to say, highest in all the common Indian food-stuffs save rice.

“Now, the most important Indian diet-stuffs—i. e. the cereals and leguminosæ, not rice—yield urine which is as acid as that due to a meat diet under normal conditions of digestion, because they are rich in albumin and phosphates and in calculus. The evil factors are, as we have shown, (1) the

great amount of albumin, and (2) the poverty of bases (due in great extent to deficiency of the common salt necessary), which are able to neutralize the uric and sulphuric acids formed from albumin.

“One more point as regards the liability of children to calculus: The amount of kidney excretion per kilogram of body-weight is far greater in children than in adults. Parker¹ gives the following statement:

	In children.	In male adults.	Excess in children per kilogram.
Water	59 c.c.	23 c.c.	36 c.c.
Urea	0.973 gram.	0.500 gram.	0.473 gram.
Urea and volatile salt	0.279 “	0.151 “	0.128 “
Chlorine	0.308 “	0.106 “	0.202 “

Hence in children the amount of chlorine is three times greater than in adults (note also the excess of nitrogenous products), and hence the special necessity of extra NaCl and the special liability to concretions in children. Again, NaCl acts as an absorbent, not only of crystalloids, but of colloids, fibrin, mucin, and albumin. Bence Jones first showed the solvent action of NaCl on urate of ammonium; and this is also the case with uric acid: 1 part of uric acid requires 8000 parts of water to dissolve at the body-temperature, whereas the addition of $\frac{1}{2}$ per cent. of NaCl doubles its solubility, and 2 per cent. of NaCl quadruples its solubility (Plowright).

“Perfectly healthy urine should show no appreciable deposit: when it becomes concentrated (as it is liable to do in natives, for reasons given), uric acid is thrown down as a urate. This may occur within the bladder, and the presence of a solid body in any part of the urinary tract favors deposition greatly. Dr. Goodhart has put it on record that the specially farinaceous feeders among children are those addicted to passing uric acid in abundance. Lastly, Hirsch, in his great work, *Geographical and Historical Pathology*, remarks on the mystery of the excessive prevalence of stone in the tropics, while gout is practically unknown. Now, Dr. Haig—to whom I return thanks for much kindly personal help—has shown that the excretion of uric acid is greatly influenced by the comparative alkalinity or acidity of the blood, and that the amount of acidity may be made to vary within very considerable limits by the kind of food and by the process of digestion (as we have seen), as well as by the use of drugs. Uric acid in an acid blood tends to get stored in the spleen and joints, but when the blood is rendered alkaline (as we have seen it by deficiency of NaCl and excess of K), uric acid is dissolved out and excreted. We have, then, (1) greater tendency to formation of uric acid in natives, with excess of albuminates and their deficient metabolisms; and (2) very complete elimination of this uric acid by alkaline blood (due primarily to deficiency of common salt) as far as the bladder. The obvious result is that gout must be a very rare disease among the natives, because the alkaline blood-stream never permits storage of the uric acid in the system or the joints. Sir W. Roberts draws attention to the effect of sleep and long daily fasts in increasing the amount of uric acid excreted; and these are assuredly factors in far greater play among natives in India, with their fast from evening to mid-day and their somnolent habits, than in Europe. The very common affection of enlarged spleen is another factor in the excessive excretion of uric acid. Pettenkofer found the normal average to be 0.872, while in the case of enlarged spleen it rose to 1.424 parts in 1000. A case of a boy of sixteen years of age is recorded who excreted 18.28 grains daily,

¹ *Physiological and Pathological Chemistry.*

while his normal average should be about 6 grains. We have, then, perhaps an excessive production of uric acid by the factors at work just described, and certainly far more complete elimination of it from the body and tissues by the alkaline blood-stream as far as the bladder. What, then, causes its deposition here? I do not think we can at present detail with certainty the steps in the process, which are doubtless varying and complicated. One important factor, perhaps, is the neutralization of the acid sodium phosphate (the uric-acid solvent) by the aromatic sulphates; and we know that the alkaline bases are diminished which go to neutralize the sulphuric and uric acids. My chief object to-day has been to draw attention to some important dietetic considerations underlying calculus-formation in India. More intimate and sustained observation of the chemistry of the excreta may perhaps avail to clear up doubtful points and piece together the scattered fragments of our little knowledge, and I hope in a fuller paper to throw some light on this important problem."

In the condition known as phosphaturia the salts are precipitated in an amorphous form as a fine powder. This manifestation is associated with anemia, with certain functional diseases of the brain and spinal cord, sexual excess, overwork of the brain. The author has observed two or three examples of temporary phosphaturia lasting from three to eight weeks, recurring invariably during times of hard study while preparing for examinations, in individuals in whom the phenomenon was never observed at any other time.

In true phosphaturia the urine is alkaline when formed in the kidney; this, rather than an increase in the quantity of the phosphates, is the essential feature of this condition. The alkalinity is due to the fixed alkalies and not to ammonia, which is absent.

Ultzmann¹ states that it is due to carbonate of sodium or to carbonates or phosphates of lime and magnesia. The phosphate of lime is generally amorphous, or else has the form of beautiful translucent rosettes composed of minute needle-like crystals: these needles appear also singly or in pairs crossed at an obtuse angle, and resembling a pair of rapiers; the carbonate of lime appears as a white amorphous substance or else in mulberry-like groups of minute highly refracting crystals.

The distinctly crystalline forms appear only in such urines as are made artificially alkaline by fixed alkalies, such as are produced, for example, by the ingestion of certain mineral waters in large quantities or by long-continued vegetable diet.

In a subject having a true phosphatic diathesis the phosphates appear in the urine in spite of an almost exclusive diet of animal food, and generally have the form of the amorphous phosphates and carbonates of lime. The appearance of the phosphatic sediment is very capricious, coming and going from day to day and oftentimes in the same day.

The sediment may be present for a very long time without giving rise to stone-formation. The bladder is generally rendered very irritable by the presence of the sediment.

Oxaluria.—Much contradictory evidence is offered as to whether oxalic acid exists in the normal urine or not. Ultzmann² thinks that it does not, or at most in very small quantities, and that it never appears in combination with the lime salt as oxalate of lime in the normal urine: if such crystals are found in the urinary sediment in large quantities and persistently, they constitute a pathological condition called oxaluria or the oxalic-acid diathesis.

The author's observations coincide with this view, and he has always seen

¹ *Op. cit.*

² *Op. cit.*

a well-defined group of symptoms associated with the presence of oxalate-of-lime crystals if the latter are abundant and persistent, and the subsidence of these symptoms as constantly accompanying the disappearance of the crystals.

Whether oxaluria is simply a manifestation of certain general disorders, or, on the contrary, the group of symptoms referred to results from oxalie-poisoning, is not determined; both views are held.

Oxaluria occurs most frequently among poor and ill-nourished people, but it is met with in all classes, and is often persistent under the best conditions of living and treatment. Damp dwellings and low-lying districts are said to favor its production. Cases observed by the author, which have been numerous, have been almost all amongst people living in the best hygienic conditions, and he has met but very few of them amongst hospital patients. Oxaluria may be artificially produced by the ingestion of articles of food which contain it, such as tomatoes, sorrel, and certain fruits.

Oxalate of lime appears in the urine in the form of large and small octahedral crystals; the latter are frequently gathered together into small concretions, and are difficult to recognize as octahedrons because of their minute size. These crystals are highly refracting. The small octahedrons are thought by some to indicate that they have been formed within the urinary passages, while the large ones are thought to be formed only after the evacuation of the urine.

More rarely the crystals take the forms of dumbbells, of ovoid disks, and occasionally of long quadrates.

Cystinuria.—In rare cases cystine crystals are seen in the urine. They have the form of hexagonal plates and are colorless. Stone forms very rapidly from these crystals. Its rarity is seen from the following quotations: Beneke in 649 vesical calculi found $\frac{3}{4}$ of cystine; Ivanchich found 1 cystine stone in 300; Ultzmann states that in such urines uric acid exists in very small quantities or not at all.

The length of time during which a patient may have deposited a crystalline sediment in the urine while it is within the urinary passages, before stone is formed, varies greatly, and chiefly in accordance with the conditions of the bladder which favor or are unfavorable to stone-formation, as has already been described under the heading of "Formation."

Age.—With regard to age Sir Henry Thompson's statements are of much interest. The following are taken from his introduction to the *Catalogue of the Collection of Calculi in the Bladder* (1893), which represents his total experience in the removal of vesical calculi from the first case in 1857 up to April, 1893, the number being 1007. He remarks upon the relative frequency and the relative rarity of calculous disease in children as compared with its prevalence in later life. It is usually asserted that stone occurs most frequently at the two extremes of life, but, as Sir Henry points out, this inference was drawn from tables of operation and collections of calculi made during the earlier part of the century, before the frequency of stone in elderly men was recognized, and when it was frequently overlooked; and therefore the conclusions are erroneous. He considers that the largest proportion of cases in male adults occurs between the ages of fifty and seventy—that it is rarest between the ages of fifteen and twenty-five.

In the eighth edition of his clinical lectures on *Diseases of the Urinary Organs* (1888) he dwells upon the rarity of stone in children of well-to-do families, and its relative frequency in those of the poor, as will be seen in the table below, which includes the total number of his patients under sixteen years of age up to 1893. There are but 16 of these, and but 3 of these were

private patients. He quotes Sir William Ferguson as having told him that in his entire experience he never received but one fee for operating upon a child for stone in the bladder. As Sir Henry says, rich people who are self-indulgent, who take but little exercise, and eat and drink largely are those who late in life are prone to stone, but the children of these people rarely have it, while with the poor and ill-nourished the reverse is true. The following table from Sir Henry Thompson's catalogue shows age with reference to frequency of stone :

	Below 16 years.	16 to 24 years.	25 to 50 years.	51 to 70 years.	Above 70 years.	Total.
In the hospital	13	5	22	56	4	100
In private	3	8	93	583	206	893
Total	16	13	115	639	210	993

Symptoms and Diagnosis.—The two cardinal symptoms of stone in the bladder are pain and hematuria.

Pain is a very constant symptom. For a variable period it is usually preceded by bladder irritability, which expresses itself by increased frequency of urination; this is most marked during the daytime while the patient is moving about, and serves to distinguish it from the same symptom arising from prostatic hypertrophy, in which it is most conspicuous during the night. This sort of bladder irritability is not always to be distinguished from that arising from the presence of the crystals of the various urinary salts previous to the actual formation of stone. *Reflex* bladder irritability is frequently due to the presence of calculus in the kidney, and it is a common error to overlook the renal condition and to attribute the symptom to the bladder itself in these cases. It is also true that the urine may be normal with a stone in the kidney for considerable periods of time; this the writer has observed in 5 cases. On the other hand, there may be no pain or bladder irritability when there is a stone in the bladder; this fact is especially noticeable in some cases of stone in connection with prostatic hypertrophy, in which a stone with a smooth surface becomes lodged behind the jutting intravesical portions of the enlarged gland in a deep *bas fond*, and is not pushed against the sensitive vesical neck as the urine flows out of the bladder. Stones which are retained in diverticula are sometimes painless also.

The two characteristic features of the pain due to stone are—that its greatest intensity is at the end of the act of urination, as the stone is grasped by the bladder and pushed against the sensitive vesical orifice, and that it is increased by exercise and motion, especially such as jolting over a rough road or riding. The degree of pain varies greatly, but is often intense. It is most severe in children and young people; one often sees the patient shrink from urinating, whimpering as the urine begins to flow, and uttering loud cries as the stream comes to an end.

The character of the pain from stone is that of an intensified desire to urinate: it is usually most marked at the head of the penis and along the urethra; sometimes it takes the form of a dull ache in the perineum and about the anus, causing straining at stool; at other times it has a more radiating character, shooting down the thighs; it rarely, however, has the extensive radiating, lancinating sensations seen in cases of cancer of the neck of the bladder or of the prostate.

Pain from stone differs from that associated with renal or bladder tuber-

culosis in that the latter is most pronounced when the bladder is full, and is not so noticeably augmented by exercise.

A small stone with an irregular surface often causes more pain than a much larger one which has the contrary characteristic.

Periods of comparative or entire freedom from pain occur in some instances: they are perhaps due to the changes in the surface of the stone following upon chemical changes in the urine. Thus a period of immunity from pain might succeed one of suffering because of the deposition of a layer of phosphates upon one of oxalate of lime. The condition of the bladder itself has also much to do with the degree of pain experienced: the thin-walled, atonied bladders, for example, suffer much less than those having thick walls and small capacities.

Blood.—Blood is rarely absent from the urine in cases of vesical calculus, though sometimes it appears only microscopically; usually it is in sufficient quantities to tinge the urine pink, and often enough to form clots of considerable size: these have no regular form, such as those which originate in the kidney sometimes have, but are irregular and have the appearance of freshly formed coagula.

Hemorrhage from the bladder in cases of stone is rarely so profuse as that seen in connection with most cases of tumor of the bladder and in occasional examples of prostatic hypertrophy, in which very profuse bleeding may occur from an ulcerated surface of a third lobe rising abruptly in the prostatic urethra that may have been injured in the first instance by the passage of an instrument. The hemorrhage from tuberculous disease is usually less than that from stone, and, as with pain, it is less noticeably increased by exercise. With calculus the blood often appears as a few bright drops at the end of urination, corresponding to the time of greatest pain.

The quantity of blood and the degree of pain are generally determined by the character of the surface and the contour of the stone.

Stoppage of the Stream.—Sudden stoppage of the stream, which is mentioned as a frequent symptom of stone, is, according to Sir Henry Thompson, one of the rarest; it sometimes occurs, and is due to the spasmodic closing of the voluntary muscles of urination when a small stone is forced into the vesical orifice.

Priapism is an occasional symptom.

The Urine.—The urine, besides the usual characteristics of cystitis, presents some significant features which are of service in making the diagnosis. The most important of these is the presence for a greater or less time previous of crystals in the urinary sediment. Cabot has called attention to the significance of the sudden disappearance of a brick-dust sediment that has been present for some time, as indicating the time of actual formation of stone in the bladder.

Ultzmann considers that the presence of the rarer forms of the crystals of oxalate of lime and of uric acid—the dumbbells and long quadrates of the former, and the large, long, sharp-pointed ones of the latter—indicate the danger of immediate formation of stone.

A very suggestive sign of the presence of stone when blood is present in the urine in microscopic quantities only, is its increase after the patient has been moving about through the day, as shown by two examinations, one made in the morning and one at the end of the day.

Cystitis.—The time at which a vesical calculus produces cystitis varies in different cases: the urine may remain clear for a very considerable time

after a stone has formed in the bladder; this is particularly true with pure uric-acid stones.

Detection of Stone.—The two conditions most frequently mistaken for stone in the bladder are renal calculus and tubercular disease of the kidneys, bladder, prostate, or seminal vesicles. Examination of the bladder decides the question definitely in almost all cases; and this is conducted in one of the following ways, according to the nature of the individual case:

(1) By sounding; (2) by rectal touch; (3) by the use of the evacuating pump; (4) by digital exploration; (5) by the cystoscope.

The most common way of detecting stone is by sounding, which consists in passing into the bladder through the urethra an instrument of appropriate form—the stone-searcher—the operator seeking to touch the stone with the tip. Various forms of this instrument have been devised. Its essentials are—that it shall have a short beak, permitting easy rotation within the bladder; that the curve of the beak shall have a form that will most readily pass through the deep urethra in cases of prostatic enlargement; and that the shaft should be of a size that permits free rotation in the urethra—No. 16 of the French scale. Such an instrument is that shown in Fig. 128. A



FIG. 128.—Thompson's latest stone-searcher.

smaller searcher should be used for children, one having a caliber of 10 (French scale).

Some surgeons prefer to use a searcher made of soft metal, which they can bend into any form they wish to facilitate its passage into the bladder; the soft metal, however, has the disadvantage of giving a less definite sensation to the fingers. Thompson's searcher has a flat handle like that of the urethral steel sound, so that the position of the tip in the bladder can be seen; it has also a corrugated collar which aids in rotating the instrument. Another form is that of a hollow searcher which allows of withdrawal or injection of water through it, so that the amount of fluid in the bladder can be varied without removing the searcher.

A small lithotrite is an excellent searcher: if the stone is seized by it and the instrument is then rotated, the presence of multiple calculi can be determined, the one held in the lithotrite striking against the others as it is moved from side to side. Moreover, if the lithotrite is used as a searcher, the operation can be proceeded with at once if appropriate. An idea of the size of the stone is often correctly obtained also.

In sounding the following precautions should be observed: The patient should be kept quiet during the day on which the sounding is done, and should be confined to bed for, at any rate, twenty-four hours if any of the following conditions are present: viz. cystitis, prostatic hypertrophy, renal disease, or the condition called by Sir Andrew Clark renal inadequacy, by which is meant a state indicated by a fairly well-defined group of symptoms, often seen in old men in connection with prostatic enlargement—viz. thirst, dry, coated tongue, flatulence, and malaise, a low specific gravity being often the only evidence of disease of the kidney furnished by the urine. A lack of these precautions may perhaps result fatally for the patient. The patient

should not be examined in the physician's office and then sent away. It is true that no serious consequences will follow in most cases when such a course is pursued, but occasionally the physician will have cause to regret having done it.

The administration of an anesthetic will depend on circumstances. With elderly men, especially with those who have become used to passing a catheter because of prostatic enlargement, and whose urethræ are not sensitive, it will rarely be necessary, whereas with children it is usually better to give it.

The surgeon should be equally able to pass the searcher from either side of the patient. If he stands on the patient's right, the right, which is the most practised hand with most operators, naturally manipulates the instrument. The instrument should be held lightly between the thumb and fore finger and rotated gently from side to side; if there is a deep pouch,

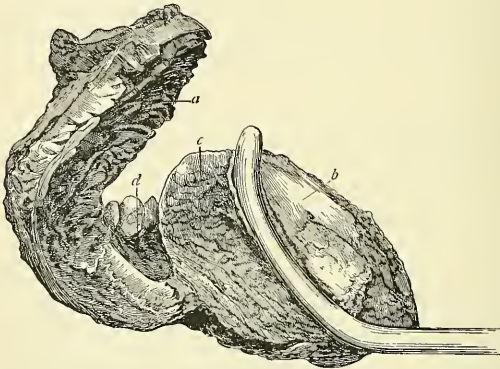


FIG. 129.—A perpendicular section through the bladder, median enlargement of the prostate and elongation of prostatic urethra; *a*, greatly thickened bladder-wall; *b*, left lateral lobe of prostate; *c*, middle prostatic lobe; *d*, bas fond of interior of bladder, with small stone occupying it behind the hypertrophied middle lobe (Watson).

such as is present behind the projecting portions of an hypertrophied prostate, the beak of the searcher must be turned completely over in order to explore it; when this is done the shaft should be depressed between the legs of the patient. Small stones in this pouch are frequently overlooked through failure to do this. The stone will be more easily detected under these conditions if the pelvis is raised so as to roll it out of this pouch; it is of equal advantage to keep this position during the operation of lithotripsy. This point will be referred to again when speaking of the operation.

The presence of a stone can be demonstrated to an audience by attaching a bit of thin board having the form of a sounding-board to the end of the staff, thereby increasing the sound of the impact of the tip upon the stone, so that it is easily heard at some distance. A stethoscope may be of service to the surgeon himself.

The bladder when sounding for stone should contain about four to six ounces of fluid: a bladder with small contents is difficult to examine, because the movements of the searcher are restricted, and if the mucous membrane is

not made smooth by sufficient distention, a small stone may escape detection by being caught in its folds. If the urine is clear, there is no objection to sounding the bladder with its natural contents, but if a cystitis be present, the bladder should be carefully washed out and injected with a warm boracic-acid solution.

Sources of Error in Sounding.—Stones lying in a deep *bas fond* behind an

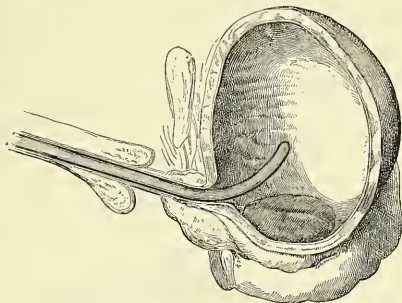


FIG. 130.—Calculus behind prostate (Coulson).

enlarged prostate that projects prominently into the bladder are frequently not detected by the searcher (Figs. 129 and 130).

Failure to enter the bladder, the operator believing that he has done so, while in reality the tip of his searcher is being moved about in a capacious and elongated prostatic urethra, such as is sometimes met with in cases of prostatic enlargement, is another reason for the failure to find a stone. This space is in such cases large enough to allow of partial rotary movements of

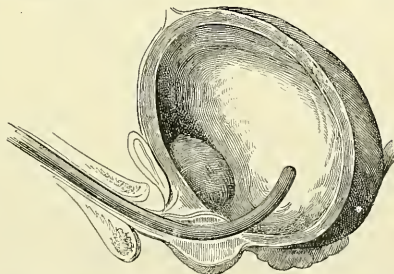


FIG. 131.—Bladder with calculus behind the pubes (Coulson).

the tip of the instrument, giving the sense to the fingers as if it were moving over the surface of a small, contracted bladder.

Hard, prominent trabeculae, especially if they are covered with a phosphatic incrustation, give a very deceptive sense, closely resembling that imparted by a stone: in this condition, however, the sound feels as though it were being moved over the surface of the bladder, and there is no feeling of its being in contact with a loose, movable body. The stone may lie behind the symphysis pubis (Fig. 131) and thus escape detection.

A stone is sometimes covered with mucus, and then gives no characteristic touch to the searcher. Encysted stone may be impossible to detect by the searcher (Fig. 132).

An excellent instrument for finding small stones is the evacuating tube. If the tip is placed in the most dependent part of the bladder and a current of water made to circulate by the pump, the stone is brought by the return flow sharply against the tip of the tube, with the characteristic click which is unmistakable: care should be taken to exclude all air from the tube, else the passage of bubbles in it may be mistaken for the touch of a stone. The sucking of the bladder-wall into the mouth of the tube is also likely to be mistaken for stone by novices.

In women and children stone may often be detected by bimanual examination, and it has happened to the writer recently to discover a stone in a man while examining an enlarged prostate by rectum by the sensation of ballotement, the stone being thrown sharply upward by the tip of the fore finger, and received again upon it as it fell to the bottom of the bladder, giving a perfectly characteristic feeling in so doing.

The *cystoscope* is of value in finding encysted stone or stones disguised

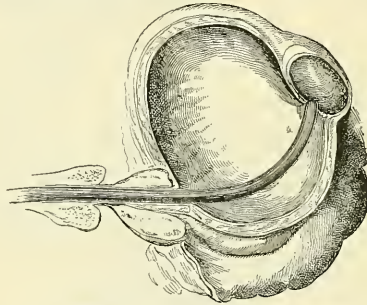


FIG. 132.—Bladder with an encysted calculus (Coulson).

by a covering of mucus, or very small stones that have escaped detection by the searcher.

Digital Exploration.—There remains as a final resource digital exploration, as proposed by Sir Henry Thompson, conducted through the male perineum or in women through the dilated urethra, the dilatation being accomplished by the passage of successively increasing-sized metal dilators until the fore finger can be entered; the meatus should be cut previously. In men the posterior urethra is similarly dilated before the finger is inserted. With the tip of the index finger in the bladder the interior of the organ can be explored, and this examination is aided by pressing the fingers of the other hand well down above the symphysis and moving the bladder about with them over the tip of the examining finger; in this way the surface of the organ is made to pass over the finger rather than the latter over it. This examination cannot be properly carried out if the pelvis has a very narrow outlet, if there is ankylosis of the hip-joint, or if there is a great prolongation of the prostatic urethra owing to prostatic hypertrophy.

Suprapubic cystotomy may be substituted for the perineal operation for the purpose of exploration when the above-mentioned obstacles to the suc-

cessful execution of the latter are present, and when there remains a strong suspicion of the presence of stone. It has the advantage of allowing a more thorough examination, in which the eye aids the sense of touch. When done for this purpose the incision into the bladder should be large enough only to admit the fore finger easily; it may be enlarged afterward if the requirements of the case demand it. It is rarely called for, however.

Treatment.—The treatment of vesical calculus is divided into—(1) General, (2) Local, and (3) Operative. The former includes the preventive and solvent treatment.

Preventive treatment consists in the adoption of the measures which experience has shown to be of value in overcoming the tendency to form crystalline sediments in the urine, which has already been described under the name of Diatheses. This part of the treatment is one of the most vexed questions in medicine, and it still remains a subject of discussion and widely differing opinion, in spite of the practice of innumerable systems, stone-cures, experiments in the chemical and physiological laboratories, mineral springs, etc. etc., upon which many writers base various methods of treatment and give assurances of being able to prevent stone-formation. The author humbly confesses his own inability to secure such fortunate results as are described by them in a certain proportion at least of his own cases which he has submitted to the regimens prescribed, and has sometimes seen stone form in the kidneys or the bladders of patients who have for long periods scrupulously followed the directions given them, and in whom there has, despite all the ingenuity of the writer, continued to be a persistent deposit of a crystalline sediment which has finally resulted in the formation of stone. This fact is mentioned in order that the young practitioner may not be misled into thinking that it is a simple matter to overcome a well-pronounced diathesis, for he will often find it one of the most difficult problems in his experience. This has in this vicinity (Boston) seemed to the writer to be especially true of cases of oxaluria and phosphaturia. It is, on the other hand, undoubtedly true that the preventive measures about to be mentioned prevail against stone-formation in many cases, and the patients who show an inveterate habit of depositing crystalline sediment in the urine while it is still within the urinary tract in spite of intelligent treatment, are fortunately in the minority. The following are examples of the latter class:

Two cases of persistent phosphaturia, of six and eight years' duration respectively, both patients being under observation during almost all the time; both have passed phosphatic masses from the kidneys, and one of them has had already a small vesical calculus. In these cases, as is usual, the amorphous phosphates could generally be kept in solution within the urinary passages by the administration of dilute phosphoric acid, but no method of treatment was of permanent benefit; and the same has been true of 3 cases of oxaluria and 2 of uric-acid diathesis. A noticeable feature with these patients has been the inability to increase the quantities of urine when, as frequently happened, they became scanty. One of the patients with oxaluria and both of those with uric-acid deposits formed vesical calculi. These patients were under observation for from four to nine years, and during these periods were constantly under the preventive treatment of one sort or another that seemed best adapted to their especial conditions. It does not, however, come within the scope of this article to speak at length of the urinary diatheses, so that only the more important points concerning the preventive treatment which involve them will be referred to.

The principal objects sought in the preventive treatment are—to over-

come the systemic defective processes of assimilation and tissue-metamorphosis of which the urinary diatheses are one manifestation, to combat the local conditions of the bladder already described which favor stone-formation, and to keep the crystalline deposits in solution while in the urinary passages.

The treatment may accordingly be divided as follows: 1. Dietetic and hygienic measures, including exercise, baths, climate, etc. 2. The treatment of cystitis, emptying the bladder, restoring the caliber of the urethra when required, etc. 3. Diluting the urine and changing its chemical character by drugs and the use of certain mineral waters.

The largest number of cases of stone are of the uric-acid class.

The tendency to form uric-acid deposits in the urine is much more frequent after than before middle life. If it manifests itself decidedly at an earlier period, it usually indicates a strong hereditary influence, and suggests that the patient is likely to suffer from its consequences unless he follows a strict regimen to overcome it and it is correspondingly obstinate in resisting treatment.

Sir Henry Thompson assigns to faulty action of the liver and intestinal tract the chief responsibility in the production of gout, of which the uric-acid diathesis is one manifestation. He does not pretend to explain in precisely what this faulty action consists, but explains the familiar group of symptoms which are its expression as the result of deficient excretory action of the bowels. These symptoms are—headache, nausea, depression, flatulence, acid fermentation of the stomach contents, irritability, neuralgic pains in the back and limbs.

The treatment should be directed to stimulating the secretory function of the primæ viæ without depressing the vital powers. This end is best attained, he thinks, by the prolonged use of certain mineral waters containing a considerable quantity of sulphate of sodium and magnesia. Of these waters he gives preference to Hunyadi Janos and Friedrichshall, taken on rising in the morning in moderate doses and with the addition of hot water. Carlsbad waters should be reserved for robust, plethoric patients and avoided by nervous, delicate ones. The Carlsbad treatment, he thinks, is best carried out at home rather than at the springs, provided the regulations that are enforced at the latter are observed. He condemns the use of diuretic drugs and alkaline medicines administered apart from the mineral waters.

With regard to diet there is a general agreement that the great restriction of animal food formerly recommended is a mistake. The more easily digested meats should be selected, and eaten only roasted or broiled. All canned or preserved meats, fried meats, tongue, ham, veal, pork, turkey, corned beef, smoked beef, and fried, canned, potted, dried, or smoked fish, are to be avoided. Highly-spiced sauces, peppers, salad dressings, fatty foods also should be reduced. Sugar, syrups, and sweets of all kinds are generally held to be especially injurious and should be reduced to a minimum or wholly forbidden;¹ saccharine pellets may be used as a substitute for sugar in tea

¹ A recent article in the *Lancet* by Professor Harley of London contains some interesting observations in connection with this question. How is it, he asks, if sugar be so active an agent in the production of gout, that gout is scarcely, if at all, to be found amongst the women of the Eastern harems or the negroes of the South of the United States, both of these classes of people being in the habit of consuming very large quantities of sugar, and the former class leading very sedentary lives? He further cites a few examples of individuals who as an experiment with reference to this subject took sugar in daily-increasing doses for a considerable period of time, until the amount of seventeen ounces per diem was reached, without being able to produce any gouty symptom whatever. Professor Harley considers that the injurious quality in champagne is not sugar but acetic acid, to which he refers the production of gouty symptoms, and states that this acid exists in relatively large amount in the very dry and brut champagnes especially.

and coffee. Of fruits, the following may be allowed: peaches, oranges, lemons, grape-fruit, and, unless they disagree with the individual patient, as they sometimes do, melons. Vegetables very rich in sugar are to be avoided, such as beets, for example.

The question of drink is even more important than that of food. With few exceptions patients with uric-acid diathesis are better for totally abstaining from all alcoholic drinks. If the patient cannot be persuaded to do this, or if there is any special reason for his taking them, the stimulant should be selected with care and used as sparingly as possible. Generally speaking, the least injurious of the wines or liquors are the good qualities of whiskey or gin; they should be taken with meals and well diluted with water; next to these come the natural, unfortified sherries, which are dry and light, and can now be obtained in this country; light, sound Bordeaux and Rhine wines are suitable to some cases, but to a comparatively small number, so far as the writer has observed. Cider is also suitable for some patients. The most injurious are the beers, porters, either very sweet or brut champagnes, port, burgundy, and madeira.

With regard to exercise, it must be regulated according to the condition of the individual. Sedentary habits should be discarded, and if the patient's muscular force is good he should be urged to engage in the quieter out-door sports, and to remain out doors as many hours as possible daily. Golf is an ideal sport for such patients.

If the patient can do so in a warm, dry climate, one of the best ways to secure plenty of out-door air for him during the warm season is to have him go into camp, sleeping in a tent, preferably in the pine woods and at a moderate altitude. Riding on horseback for vigorous patients often keeps the enemy under control during the whole of their lifetime. The function of the skin should be carefully attended to by regular bathing and friction. For weak persons massage, alcohol and water sponge-baths, and for strong and plethoric ones occasional Turkish baths, are beneficial.

In cases of phosphaturia and oxaluria it is still more important to have the patients in a high, dry climate, and that they should have plenty of out-door life. Cold bathing is, so far as the writer has observed, injurious for these cases, but skin-frictions and alcohol sponge-baths are very beneficial. The anemia so frequently associated with these two conditions should be energetically combated by iron and a nutritious and varied diet. Nervous symptoms are, as has been noted, ordinary accompaniments of oxaluria, and care, worry, and all depressing influences should be, as far as possible, removed from the patient. Tonics are an important part of the preventive treatment of both oxaluria and phosphaturia. The amorphous sediment seen in the urines of phosphaturic patients can almost always be kept in solution by the administration of dilute phosphoric acid, which is best given in 15-minim doses in plain soda-water thrice daily with meals; the bladder irritability due to its presence will be relieved as a consequence, and sometimes there will be no return of the sediment after the drug has been suspended; but more often the benefit is temporary and the phosphatic deposit reappears when the drug is omitted: its value, therefore, is to avert the immediate threatening of stone-formation when the sediment is excessive.

Sir Henry Thompson does not commend a milk diet in cases of uric-acid diathesis. The writer's experience does not accord with this view. In his practice one of the most efficient methods of combating the uric-acid tendency and averting the immediate danger of stone-formation has been the long-continued use of milk diet, especially when combined with Vals water.

The tendency to constipation which milk diet causes with most patients must be guarded against by giving laxatives. Milk should not be taken cold, should be sipped and not swallowed quickly in large quantity; each glass should be diluted one-fourth with Vals water. Two or three quarts of milk are to be taken daily. Broiled fish and dry toast and some sort of light unsweetened biscuits may be added to the milk diet. Milk diet, while nourishing the patient thoroughly, does not supply muscular strength; consequently as much exercise cannot be taken as with a mixed diet, but the patient can be kept out doors quietly, at any rate. The diuretic property of milk is decided, and its effect in lessening bladder irritability is marked. Its use should not be continued uninterruptedly for more than six weeks at any one time.

A diuretic which the writer has found of great value, and has never seen mentioned for this purpose, is the drink made from cocoa-shells—the husk of the cocoa bean which is discarded in the process of preparing it for the finer drinking chocolate and cocoas. The shells when boiled for five minutes should then be strained off or they become bitter; milk and sugar added to this make a very pleasant drink.

In addition to the general measures referred to above, the bladder should be treated locally if there is cystitis or prostatic hypertrophy of such character as to call for the regular use of the catheter. The bladder-washes which in the author's experience are the most beneficial in cases of cystitis are very hot solutions of 4 per cent. boracic acid and of potassium permanganate 1 part to 3000 of water.

Of drugs, a few are decidedly useful: boracic acid and sandalwood oil are excellent when cystitis is present, the former especially freeing the urine of pus and mucus and preventing its decomposition in the bladder. Benzoate of soda frequently allays bladder irritability and increases the quantity of urine. Spirits of turpentine, recommended by Ralph of Oxford, the author has found to be of value in assisting the passage of renal calculus and of uric-acid sand from the kidney.

Solvent Treatment.—Efforts to dissolve stone have been made since time immemorial. In recent years the work of Roberts claims attention. His experiments deal with the solvent power of alkaline carbonates upon uric acid, and rendering the urine alkaline by their administration by mouth, with a view to producing the same effect in the body. He showed outside the body that carbonate of potash in the strength of forty grains to the pint exercised a more powerful solvent action than any other strength of the salt. Next he showed that the ingestion of about forty grains of acetate of potash every three hours rendered the urine as alkaline as an equivalent quantity of the carbonate given in a solution of the strength of fifty grains to the pint. Upon placing uric-acid calculi in urine thus rendered alkaline he found that they dissolve at the rate of about twelve grains in twenty-four hours unless the urine became ammoniacal; if it did, the calculi became encrusted with a layer of mixed phosphates which prevented future solvent action. Roberts's experiments failed to reach the desired goal—viz. the practical means of dissolving stone in the human body, nor has any one as yet demonstrated its feasibility.

Among the later drugs introduced as uric-acid solvents is piperazine, which seems to have more value than most of them. In the writer's experience its action has been very uncertain, sometimes having no effect, at others being followed by the rapid disappearance of uric-acid crystals from the urine in cases in which they had been present constantly for long periods,

and by marked alleviation of many of the symptoms which are associated with the uric-acid diathesis. The dose is ordinarily five grains given thrice daily in water; this may be doubled with benefit, but it should be increased cautiously, for unpleasant symptoms occasionally appear, such as dizziness and prostration.

The lithia salts in some cases seem to exercise a solvent action upon uric-acid crystals in the urine, and are better borne by the stomach than the potash preparations, but by none of these means has stone been successfully dissolved in the bladder, nor have the attempts to accomplish this end by direct action of electricity or chemical agents given better results.

Operative Treatment.—*Historical Sketch.*—*Lithotomy; Lithotrixy.*—References to the cutting operations for stone are found amongst the earlier writings of India. At the time of Hippocrates there was a class of men who operated solely for stone, and this custom has persisted until recent times, the art being handed down from father to son in many instances. Celsus mentions a certain Ammonius who, being unable to remove a stone from the bladder by the cutting operation, crushed it by means of a peculiar instrument. Paulus of Ægina also describes cutting operations. The Arabian and the Latin authors of the Middle Ages speak of the methods of Paulus and warn against their dangers.

Until the seventeenth century the methods of Paulus, Celsus, and Guidonioni were in vogue. In the operation of Celsus a scalpel alone was used. The operator introduced the index and middle fingers into the rectum and grasped the stone with them, and brought it forward against the perineum. A crescentic cut was then made across the perineum between the scrotum and the anus, with the convexity upward and terminating above the tuberosity of the ischium on either side. The soft parts were then divided and the bladder opened by a cut in the line of the original one; the stone was then expressed by the fingers in the rectum; this method was called "cutting on the gripe."

In 1543, Marianus Sanctus de Barletta described another method, since known as Mariani's method: this operation was characterized by the use for the first time of a conductor or guide upon which the cut into the bladder was made. The instrument was passed into the bladder through the urethra and held by an assistant, as is done to-day in performing lateral lithotomy: the cut was diagonal and a little longer than the width of the thumb-nail, and in a direction similar to that now used in the median operation. After dividing the skin the point of the knife was plunged through the soft parts directly down to the conductor. The urethra, and not the bladder, was opened upon it; another instrument resembling a catheter was next introduced through the wound, beside the conductor, into the bladder and the urine withdrawn. This instrument was then taken out, and in its place was passed another consisting of two solid rods called "ductores," and the conductor removed. A dilating instrument was then introduced between the rods, and the wound and the neck of the bladder were dilated; finally, the stone was removed with a pair of forceps between the "ductores." The operation of Marianus was a median one.

The operations of Celsus and of Marianus were called respectively the "apparatus minor" and the "apparatus major." The latter was practised by Pierre Franco, who is also credited with being the originator of the suprapubic operation, which he performed in 1560 on a child in order to extract a stone of the size of a hen's egg which he had failed to remove through the perineal cut. The patient recovered, but Franco did not urge the operation,

and it was lost sight of for a long time; its subsequent reappearance and establishment will be considered under a separate heading, and we will now continue the consideration of the perineal methods.

The perineal methods were practised by priests and laymen as late as the earlier part of this century. The Franciscan monk Frère Jacques (Jacques Beaulieu) is said to have done several thousand perineal operations for stone. Rau, who was a barber, was also a successful operator.

The English surgeon Cheselden was the first to place the lateral perineal operation on a scientific anatomical basis, and the results of his operations were so good that it became popular throughout France, Germany, and England. Cheselden's incision divided the prostate's left lobe entirely.

Le Cat modified Cheselden's incision by limiting it to a partial division of the prostate only, and he entered the bladder by a blunt dissector after having cut through the outer tissues.

Hawkins introduced the cutting gorget at the end of the last century.

With slight modifications modern lateral lithotomy is the same as the

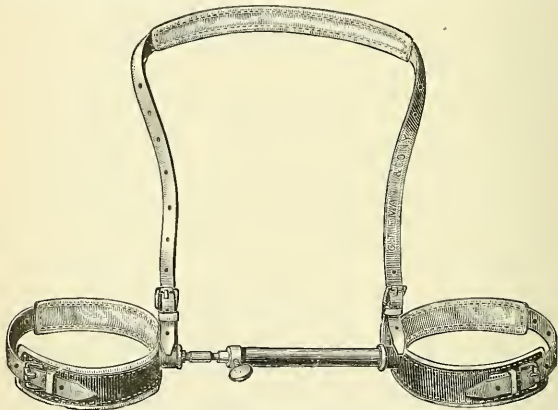


FIG. 133.—Bar to hold the legs, with strap to go over the shoulders.

operation of Cheselden. That surgeon at the end of his career (about 1732) had performed 213 lateral lithotomies with a mortality of 5 per cent.: this favorable result was no doubt due in part to the fact that a large number of his patients were children, 105 of them being under ten years of age.

The modern operation of lateral lithotomy is performed as follows: A full-sized staff having a groove on one side is passed into the bladder, the patient lying on his back. Some operators prefer a staff with a groove in the middle, in which case the assistant who holds the staff should turn the shaft of the instrument so as to bring the groove to the patient's left side. The cut should never be made until the stone at the time of the operation has been felt by the operator, since instances have occurred through lack of this precaution of the bladder having been opened in which there was no stone. The legs are now flexed to about a right angle with the table and each supported under the knee by an assistant; this is a better position than that of sharply flexing the legs on the abdomen, which is the one more usually prac-

tised, and which is generally accomplished by means of a mechanical contrivance having the form of a yoke, of which there are several varieties; that devised by Clover (Fig. 133) is the form usually employed. Fig. 134 illustrates another improved form of this appliance; it is the invention of Dr. F. Tilden Brown of New York, and of which he speaks as follows:

"The main faults in the Clover crutch are the straight bar and the neck-strap. The former seriously invades the operative territory. In urethrotomy it is near enough to the penis to encroach upon some part of the arc which the handle of a sound or grooved staff must traverse to enter or leave the

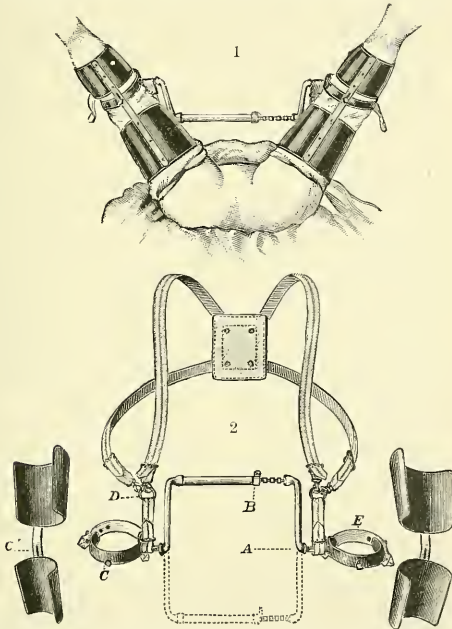


FIG. 134.—1, showing exposure of the perineum and position of the legs with the Brown surgical crutch applied; 2, component parts of the Brown crutch: *A*, point at which the arms of the extension bar swivel in the leg-crutch; *B*, spring pressed upon to close the extension bar; *C*, key on the leg-crutch which engages in the slot *C'* in the leg-rests and locks them together; *D*, the point where the two parts of the apparatus are joined by ring- and snap-catches when the crutch is on and the thighs are flexed; *E*, canvas strap which buttons over when the leg lies in the crutch. Dotted outlines show the position of the extension-bar if turned downward. As only canvas straps and nickeled metal enter into the make-up of the apparatus, it can be washed and sterilized.

urethra. It invariably causes the operator to use undue force and a false lateral position to crowd the handle of the instrument under the bar.

"In operations upon the rectum, perineum, or vagina this straight bar, hung with sterilized cloths, shuts off light from the field of operation and fills the space convenient for instruments.

"The single neck-strap is faulty in that it exerts a considerable pressure upon the vessels and nerves of the neck, the deleterious effects of which are clearly marked in the congested state of the head and the unsatisfactory respiration

during anesthesia. These phenomena are particularly noticeable when the patient is flabby, plethoric, or alcoholic—that is, it intensifies the dangers incidental to the anesthetic state commonly noticed in just such cases.”

The proper position having been secured by these or some similar device, the staff is now made prominent in the perineum, and held steadily in the middle line by an assistant, who also holds the penis and scrotum up on the staff, lifting them up as high as possible so as to stretch the urethra and to pull its bulbous portion upward above the line of the incision, thus avoiding cutting the artery of the bulb. The staff must be kept in one position, and its curve should be hooked up against the under side of the pubic arch. The bladder may be filled with six or eight ounces of water or be left empty, according to the preference of the operator.”

The incision recommended by Sir Henry Thompson is described by him thus: “It begins about an inch and a half in front of the anus and a third of an inch to the (patient’s) left of the raphé; from this point it is carried obliquely across the perineum to terminate near the tuberosity of the ischium. The first part of the cut is to be made deeper than the last part of it. The staff is approached in this first incision, but not exposed; the left index finger is then introduced into the wound, the cellular tissue separated by it, and the staff felt for. A touch or two of the knife will now open a way close down to the staff; the finger-nail is now inserted firmly into its groove on its inner side and well back, so as to avoid the bulb, and at the same time to guard the rectum with the body of the finger; the point of the knife is then pushed into the groove of the staff, the blade being held horizontally by the side of the finger-nail, care being taken that the point actually reaches the bottom of the groove and that it has penetrated all the tissues. The point of the knife is then run steadily on, horizontally, along the groove, always keeping the point of the blade firmly pressed against it, through a portion of the prostate and into the bladder. If there is a large stone present, the cut should be enlarged, more or less as may be needed, by turning the blade a little to one side and cutting lightly as the knife is withdrawn in that direction. The gush of urine attests the entrance of the knife into the bladder. The finger is now passed along the staff and into the bladder; the staff is then withdrawn by the assistant; next the forceps are slid along the finger into the bladder. The blades are then opened widely, one being held firmly down on the bottom of the bladder, and the other reaching to its top; on closing them the stone will usually be found between them. The fore finger, which has been retained in the bladder, adjusts the stone in the blades in such a way as to make its extraction easy. The wound has been dilated by the finger and the forceps, and the stone, firmly held in the blades, is now drawn out through the wound, traction being made in a downward direction and the handles of the forceps being occasionally moved from side to side. If the patient has a very narrow and deep perineum, a gorget with a thin but not a cutting edge may be introduced into the wound, instead of the finger, to facilitate the passage of the forceps and the extraction of the stone. The gorget with a cutting edge has been discarded for the most part. The object of the instrument is to dilate the wound in the bladder by cutting if it has a sharp edge, or by simple pressure if a dull one; the finger and the lithotomy forceps are, however, better means of accomplishing this result.”

Other instruments have been contrived at different times for enlarging the bladder-wound, and even for doing the whole operation, cutting, extracting, and all, mechanically, but they have never found favor, and are not used.

A very serviceable maneuver when opening the urethra on the groove of

the staff, and when prolonging the incision to the bladder, is that of drawing the penis well forward on the shaft of the staff, at the same time raising the staff itself against the pubic arch; this carries the bulb up out of reach of the knife, and it will rarely be wounded if this precaution is observed. Hemorrhage, which may be severe, arises ordinarily from the artery of the bulb or the anterior portion of the venous plexus around the prostate, or in the form of a general oozing from the cut surfaces of the gland; the latter is usually unimportant. The source of the bleeding should be carefully sought, and all arterial branches should be tied; the venous bleeding and the oozing are best stopped by tamponing the wound: for this purpose the most convenient instrument is the "cannula à chemise" (Fig. 135). It is a metal tube with a round end, and one or more holes on its sides near this end to allow the exit of the urine through it from the bladder; just below these holes is a ridge which allows a layer of sterilized gauze in the form of a petticoat to be firmly tied to the tube, over the rest of which it falls. The tube with its petticoat attached is



FIG. 135.—Cannula à chemise.

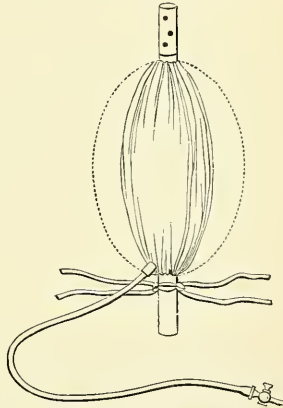


FIG. 136.—Buckston Browne's air-cannula à chemise to control hemorrhage after lithotomy.

passed into the bladder through the wound, and pieces of gauze are then packed up under the petticoat until sufficient pressure has been made to arrest the bleeding.

The best contrivance is that of Buckston Browne (Fig. 136). The advantage of the air-tampon is that the pressure can be gradually lessened, and the instrument withdrawn with much less trouble to both surgeon and patient; it is also more rapidly and readily applied. Ordinarily there is but little hemorrhage; there is, then, no necessity for a drainage-tube, in the bladder at any rate; the outer part of the wound may be packed lightly and a drainage-tube carried through the middle of this dressing to facilitate the passage of the urine for a day or two, after which a simple gauze dressing laid upon the wound and changed as often as it becomes soaked is all that is required.

The bladder-wound in children often heals over in a very short time, sometimes in forty-eight hours; with adults it is frequently prolonged for a considerable time; urinary fistula, however, rarely results.

The seminal duct is liable to be severed in the operation, especially in children, in whom the prostate is not developed, and in whom in consequence all the adjacent parts are closer to the line of incision. This accident may be avoided by making the bladder and prostatic incision more horizontal than the outer cut is. When the injury does occur, sterility and impotence may result; the latter is rare, and the former is probably due to loss of ejaculatory power from injury to the perineal structures and prostate, and not to the inability of the transmission of semen through the seminal ducts or from the opposite testis, although a closure of the former, through their being involved in the cicatrization of the wound and their consequent occlusion, may occur.

Occasionally also incontinence of urine may result from the complete division of both sphincters of the bladder by the lateral perineal incision. Injury to the rectum should not, but now and then does, occur in making the lateral cut. It is doubtful if stricture results from it, though Cabot¹ mentions a case in which he observed such a result, the membranous urethra being narrowed to 25 French, while the rest of the urethra had a caliber of 31.

Some surgeons have attempted to secure union by first intention of the wound after the lateral perineal cut—notably Crichton, who claimed to have succeeded frequently in so doing. Nevertheless, this practice has not found favor, chiefly owing to the danger of urinary infiltration.

Various modifications of the perineal incision have arisen from time to time: these are the bilateral of Dupuytren, modified by Vidal de Cassis into the so-called quadrilateral cut; the medio-bilateral cut of Civiale; Nélaton's and Reliquet's pre-rectal operation; Allarton's median cut; Dolbeau's operation; Buchanan's; Sanson's recto-vesical incision for large stones, etc. Of these, Dupuytren's, Dolbeau's, and Civiale's only will be referred to.

Dupuytren sought to avoid the hemorrhage that is incurred in the lateral operation: this he accomplished by making a crescentic cut across the perineum between the anus and the scrotum, with its convexity upward, and continued through the tissues between the bulb and the rectum until the guide is clearly felt. The membranous urethra is then opened just enough to admit the tip of the two-bladed lithotome, which is then pushed along the groove of the guide into the bladder. As soon as the stone is felt the blades of the lithotome are sprung and the instrument withdrawn, making as it passes outward an oblique incision through each lobe of the prostate. This gives a good-sized space through which to extract the stone.

Civiale's differs from Dupuytren's operation in exchanging the crescentic outer cut for a median one through the raphé: Civiale used a straight, instead of a curved, two-bladed lithotome.

Dolbeau's method consisted in dilating the deep urethra with a special instrument, after opening it in its membranous portion by a median incision on a grooved staff; through this route small stones could be readily extracted, while he crushed the larger ones before extracting them, thus combining lithotrity and lithotomy. In 1888, Reginald Harrison urged the more frequent practice of this operation, especially in cases of old men with enlarged prostates, modifying it in certain respects. Harrison devised a special form of powerful forceps for crushing the stone previous to extraction. He accomplishes the dilatation of the deep urethra by passing through it first the little and then the index finger, after laying open the membranous urethra in the usual way. The blades of these forceps look large, but they will pass without injury into the bladder through a urethra that can be dilated enough

¹ Morrow's *System of Genito-urinary Diseases*.

to admit the index finger. This method has much to recommend it: it secures the rapid fragmentation of the stone, the pieces of which can be quickly removed with an evacuator of a very large caliber; it avoids the danger of wounding a prominent enlargement of the third lobe of the prostate, which may happen with the lithotrite, when used through the whole urethra, even in skilled hands, which is the most dangerous accident at all likely to occur in the course of lithotripsy; it avoids hemorrhage and injury to the seminal ducts, liable to occur in the course of lateral lithotomy; and finally, except in cases in which the prostatic urethra is much elongated, it permits digital exploration of the bladder and the consequent assurance of the removal of the last fragment of stone.

Of all the perineal operations, this one of Harrison and the lateral cut are the best, and, of the two, the former is in the writer's opinion preferable in the class of cases for which it was designed, while for children the latter should be preferred, because the small size of the urethra does not allow the passage of the large, powerful forceps, and because of the uniformly good results attending the lateral operation in children. J. Forbes Keith of Delhi, India, is a strong advocate of the median perineal method, and has further modified it. His plan will be referred to later.

The Suprapubic Operation.—This method originated, as has already been mentioned, with Pierre Franco about 1550 when operating for stone upon a child, and, being unable to extract it through the perineal route, he cut down upon the bladder above the symphysis and succeeded in removing it. The stone was the size of a hen's egg. The patient recovered. Franco repeated the operation several times subsequently, but did not recommend it for ordinary cases. He recognized at once the value of raising the bladder above the symphysis, and partially accomplished it by pushing it upward with two fingers in the rectum. Somewhat later Rousset of Montpellier sought to effect this maneuver by distending the bladder with water.

The operation was not much practised until it was revived by Douglas and Cheselden in England in 1723; between 1758 and 1778 its practice was continued by Frère Côme, who introduced the instrument known as the *sonde à dard*: this was a cannula having the curve of steel sounds such as we use now; a sharp-pointed stylet lay within the cannula, and could be projected beyond its end after it had been passed into the bladder. The anterior wall of the bladder was transfixed by the point of the stylet, and the organ lifted upward and forward against the abdominal wall by it.

Up to 1830 the operation was in vogue, and frequently practised by various surgeons—Dupuytren, Amussat, Souberbielle, etc. Souberbielle performed it 50 times, with a mortality of 22 per cent. In Germany it was generally reserved for cases of very large stones, such as could not be removed through the perineal route. Between 1840 and 1880 the operation steadily declined in popularity, being more dangerous than the perineal ones, and because of the introduction of lithotripsy and its steadily increasing success; but in 1880 it was again revived by the introduction by Petersen of certain modifications and the anatomical demonstrations of Garson of Glasgow. The proposal of Petersen was to raise the bladder out of the pelvis by means of inflating with water a bag previously placed in the rectum, the bladder being also filled with fluid. By this elevation of the bladder the peritoneal reflection on its anterior surface is raised to from two to four or even more finger-breadths above the symphysis, and so escapes being wounded. To this procedure and to the application of aseptic methods the suprapubic operation primarily owes its present popularity.

The technique of the operation by Petersen's method is as follows: The pubic region is shaved and aseptically prepared; a metal catheter is introduced into the bladder and the organ cleansed with boracic-acid irrigation; a rubber bag capable of holding twelve ounces of water is greased, folded upon itself longitudinally, and introduced into the rectum, so that its lower end lies above the internal sphincter, the rubber tube through which it is filled extends externally about five inches. In the adult ten ounces of water, and in children five, are injected into the bladder. A piece of tape is tied around the penis so as to prevent the outflow of water from the bladder. Eight or ten ounces of water are now injected into the bag. Unless the bladder is confined to the symphysis by adhesions or is thick-walled and of small capacity, it will rise under this double injection prominently in the lower part of the abdomen, lifting the peritoneal fold from two to four finger-breadths above the bone (Figs. 137, 138). The bladder may be exposed by either the usual vertical

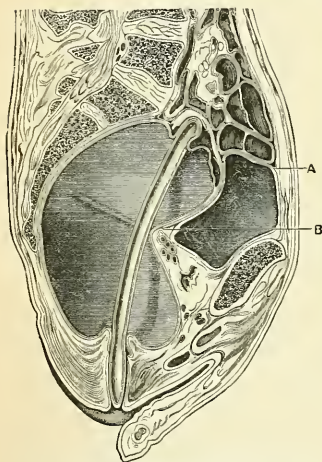


FIG. 137.—Bladder containing six and a half fluidounces: rectum distended with fifteen fluidounces; A and B mark the peritoneal folds.

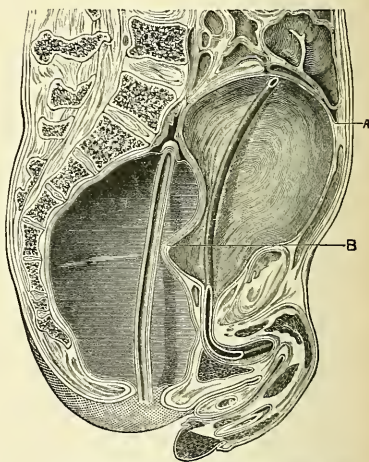


FIG. 138.—Bladder containing fourteen fluidounces: rectum distended with sixteen fluidounces; A and B, folds of peritoneum.

incision between the recti muscles or by a crescentic cut having the center of its convexity a little above the middle of the symphysis, the prevesical space being laid open by deeper incisions through the muscles on the same line, or by a compromise, which the writer prefers, by employing the crescentic cut for the skin and then exposing the prevesical space by the vertical incision, the advantage being that it is very easy to see the line of division between the recti as soon as the skin-flap has been turned up. There is little to recommend the transverse cut into the bladder proposed by Von Antal and referred to above. The prevesical space is recognized at once by its fat-contents; within this lies the peritoneal reflection on the anterior surface of the bladder. At this point there are two ways of proceeding: the fat-layer can either be divided with blunt-pointed scissors, or it can be lifted up from behind the symphysis by the finger. The writer prefers the former, for the reason that

it disturbs the anatomical relations of the prevesical space much less than the latter, especially if the subject be a fat one, for in that case there is always a large quantity of fat the removal of which from its normal position leaves a cavity behind the symphysis in which the urine collects and may subsequently give rise to septic phlegmon.

The only objection to dividing the fat is the danger of wounding the peritoneal fold, but with ordinary care this need never be done. It is readily distinguished by its smooth, glistening surface. Should it be wounded, the opening should be promptly sutured, and no harm need be feared. Beneath the fat-layer lies the bladder. It is recognized by its dull bluish color and by the large veins ramifying over its surface. A tenaculum is now hooked through the bladder-wall as high up on its anterior surface as the peritoneal insertion will permit without injuring it; it must not be passed through the latter. Two stout sutures are next passed through the bladder-wall, one on either side, and held by an assistant, or, better, attached to the edges of the abdominal wound at once or as soon as the bladder is opened. The bladder is then opened vertically by one bold incision in the median line, the cut being longer or shorter according to the size of the stone to be extracted. If the peritoneal fold is inserted too low to allow of a long incision, and yet a large wound is required, the additional space can be gained by incising slightly the edges of the bladder-wound on either side. The contents of the organ flow out at once as soon as the cut is made; the rectal bag may now be emptied and removed. Hemorrhage from the veins on the surface of the bladder is ordinarily unimportant, and generally subsides spontaneously on the removal of the rectal bag.

Some surgeons prefer to elevate the bladder by filling it with air rather than with water (Bristow, etc.), asserting that a better lifting above the symphysis is thus accomplished.

There are certain accidents possible in the performance of the suprapubic operation by the method of Petersen: these are—laceration of the rectum and rupture of the bladder. Soon after its introduction such cases were reported from various sources (Guyon, Dittel, Weinlechner, and others), and in one or two instances these accidents happened when not more than five ounces had been placed in the bladder and in the rectal bag respectively. This is most likely to happen with bladders having thin-walled diverticula and thick, non-distensible coats. The laceration of the rectum is best avoided by using a sausage-shaped bag instead of the more rounded or oval forms. The possibility of rupture of the bladder should always be borne in mind, and guarded against by observing the condition of the bladder in each individual case, and regulating the amount of injection accordingly. The injection should be stopped whenever any undue resistance is felt. This accident will be of rare occurrence if not more than eight or ten ounces are used in the bladder and the rectal bag respectively. Many operators have abandoned Petersen's method, and either cut down on the empty bladder, as was formerly done, or employ the postural method of Trendelenburg, by which the pelvis of the patient is raised and the shoulders are lowered: by this means the bladder is lifted out of the pelvis, following the abdominal viscera as they descend (in the inverted position of the body) toward the diaphragm.

After opening the bladder the removal of the stone is accomplished with forceps. If the stone is very large, it should be crushed, if possible, with suitable forceps and removed piecemeal; the wound of the bladder must be enlarged, and it may be necessary to carry the incision upward through the peritoneal investment; this procedure will be referred to later. The bladder-

wound may be treated in one of two ways: it may be left open or sutured. The former is more frequently practised in France. When the open method is employed, two parallel drainage-tubes are inserted into the bladder, and the bladder-wound is sutured around them; the tubes are led out through an aseptic dressing which covers the wound, and carried to a receptacle in or beneath the bed. If the tubes are properly placed, they siphon out the contents of the bladder and the patient is kept perfectly dry. One tube may be removed about the third day, and the second usually about the tenth to the fourteenth. If there is cystitis, the drainage may often be prolonged with advantage. If the drainage has not been prolonged, the wounds ordinarily heal without difficulty in from sixteen to twenty-five days, and it is rare to have a fistula persist.

The second method of treating the wounds, that of suture, dates back to Lotzbeck in 1838. He closed the bladder-wound wholly, leaving the sutures hanging out of the abdominal wound at its lower angle, and closing it except at this point. He had entire success in 3 cases.

Many varieties of suture have been devised and used for closing the bladder. The best form is that which will close the wound most securely,

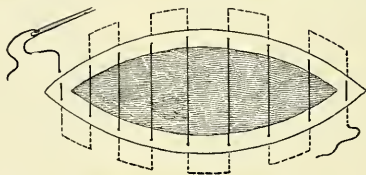


FIG. 139.—Cushing's suture.

and is at the same time capable of being rapidly applied. The writer prefers the right-angle suture of Dr. H. W. Cushing of Boston, which he uses for intestinal wounds (Fig. 139).

The double purse-string form, introduced by Brenner, is also an excellent one (Fig. 140).

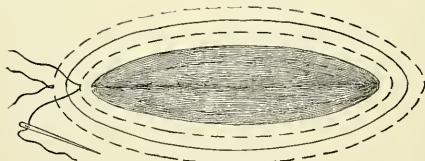


FIG. 140.—Brenner's suture.

Bouley's interrupted suture is a convenient form.

The especial form, however, is of less importance if the two chief desiderata already noted are secured. During the earlier history of bladder-suture, after 1882, it was customary to leave the greater part of the abdominal wound open to avoid the danger of urinary infiltration in case the suture did not hold perfectly, but recently it has been shown that a larger percentage of success follows the complete closure of both the bladder and abdominal wounds.

Dittel¹ in 1894 reported 32 epicystotomies for stone, with a mortality of

¹ *Wiener klinische Wochenschrift*, Nos. 33 et seq.

15 per cent. In 16 of these he employed *total suture*; in 6 only was there a failure of primary union of the wound. He notes the fact that in 12 cases in which he used the *partial suture* only the time of convalescence was shorter than in the 16 others of total suture just referred to.

Zsemacki¹ makes the following recommendations with regard to bladder-suture: (1) The bladder-wound should be entirely closed by silk suture in all cases except in the presence of a foul cystitis and abscess of the pre-vesical space. (2) Tilling's interrupted two-étage suture, one involving the prevesical cellular tissue, is best. (3) The abdominal wound should be closed except at its lower angle, into which a drain or wick should be introduced reaching to the vesical suture. (4) A catheter *à demeure*, arranged so as to act like a siphon, should be left in for at least twelve days after operation in the adult, and for a somewhat shorter period in children. (5) If the bladder suture gives way or suppurations arises, the wound should be at once opened and drained. The following things should be strictly avoided: (1) The use of catgut for closing the vesical wound; (2) a single row of sutures, purse-strings, Ferrier's, or too numerous or too tight sutures; (3) leaving open the muscular wound of the abdominal wall; (4) the use of a catheter *à demeure* with a strongly curved end.

Nikolas V. Solonika in 1889 (at St. Petersburg) analyzed 491 cases of suprapubic cystotomy performed by Russian surgeons between 1823 and 1888. Of these, 486 were for vesical calculus, 62 of them being done in the pre-antiseptic period and 424 in the antiseptic period: the mortality of the former group was 30 per cent., of the latter 11 per cent. The ages of the patients are given in the following table:

Years.	Patients.	Died.	Years.	Patients.	Died.
1 to 5	120	17	35 to 40	5	1
5 " 10	117	10	40 " 45	4	3
10 " 15	43	6	45 " 60	12	3
15 " 20	23	3	60 and upward	11	3
20 " 25	30	5	Not known	35	5
25 " 30	18	1	Total	424	59
30 " 35	6	2			

In 69 cases the vesical wound was totally closed; in 48 only partially; in 6 the edges were stitched to the abdominal wound. The mortality in the cases of total closure was as low as 5.8 per cent., notwithstanding the fact that in 43 per cent. the urine was very considerably changed. In 34.8 per cent. of the cases the wound healed *per primam*, the after-course being either wholly apyretic or nearly so. In 67 of the 69 cases a catheter *à demeure* was employed. Solonika concludes that with but few exceptions the vesical wound should be totally sutured, the best method being the étage-suture of Tilling, and the best material chromicized catgut and a round needle. The abdominal wound should always be closed down to the site of the drainage.

Assenfeldt (Nijni-Novgorod, Russia) reports 102 cases of suprapubic cystotomy performed by himself since 1853: 98 of these patients recovered. The bladder was sutured in all cases in which the urine was normal. Out of 74 of the sutured cases, in which the post-operative course is noted, union by first intention occurred in 20. In 60 cases the patients were under ten years of age; 32 others were under twenty; the remaining 10 were between twenty and thirty. It will be noticed that the large majority of these patients are under twenty-five years of age. The favorable results of suture may be in some measure due to this fact.

¹ St. Petersburg, 1889.

It is interesting to note that Page of Leeds, in a recent number of the *British Medical Journal*, reports 2 cases of suprapubic cystotomy in which union of the bladder-wound by first intention took place, although no sutures were applied and no attempt to secure the immediate closure of the wound was made, beyond omitting all drainage and packing of the wound.

Outside of these special computations, it may be said that surgical opinion to-day favors the use of total suture of both the bladder and abdominal wounds in those cases in which suture is applied at all. But it is divided as to whether the treatment by suture or the open method is the better. The latter should, as a rule, be preferred in cases of old men with prostatic enlargement, and the drainage should often be continued as the best means of treating the cystitis so frequently presented in those cases.

The duration of convalescence under the open method is not, as has been already suggested, much longer, in many instances, than it is by that of total suture, even when the latter is successful. The subject must, however, be still considered to be *sub judice*.

Of the cutting operations there remain to be mentioned the modification of the high incision proposed by Helferich, the subpubic operation of Langenbuch, the method of Neuber by successive operations, and the intraperitoneal method introduced by Rydygier. Of these the last only claims more than passing notice. Rydygier operated by this method in December, 1887, on a thirteen-year-old boy, and with success. In performing it the following steps are observed: The field of operation is made thoroughly aseptic, the bladder thoroughly cleansed, and a large catheter is inserted into it and retained. The bladder is exposed in the usual way. It is then drawn up and fixed to the abdominal wound in such a way that the peritoneal cavity is shut off and that no urine can enter it. The bladder is then opened and the stone removed. The temporary sutures are now removed and the bladder and abdominal wounds are tightly sutured. (It is understood, of course, that the bladder-wound has been made through its peritoneal investment.) This method has been used in several cases for various intravesical conditions. It has been urged by Dr. Frank Harrington of Boston in an interesting article in the *Annals of Surgery*, October, 1893; he reports a case in which he entered the bladder in this way with excellent result. The advantage of operating by this method is that it affords more room. The bladder can be drawn up toward the surface, and sometimes outside the abdominal walls, which permits more thorough and easier manipulations within the organ, and, finally, the chance of union of the wound by first intention, if it is sought, is much greater.

Langenbuch's operation consists in entering the bladder under the pubic arch, between it and the root of the penis. Its proposer thought thus to secure better drainage and a better chance of primary union. Neither claim has been substantiated, and the operation is open to serious objection on the grounds of liability to injury of the blood-vessels of the penis, the greater risk of sepsis, and of its failure to secure any advantage not offered by other methods.

Neuber's method has justly never found favor.

Helferich proposes to make a partial resection of the upper margin of the symphysis pubis in order to gain more room in cases of very large stones, and his method of securing this end might in some very rare conditions recommend itself, but the same object can be better accomplished by Rydygier's intraperitoneal incision just described.

Lithotripsy.—*History.*—According to Ultzmann, this procedure is a very

old one. He quotes Olympios of Athens as having shown that it had been done in the ninth century, and continues as follows: "At any rate, we find places in the biography of the Holy Theophanes which indicate that instruments for crushing stones in the bladder and removing them afterward were introduced through the natural urinary passages. Abulkasis describes instruments by means of which stones could be removed from the bladder and urethra. Benedetti and Sanctorius, in the sixteenth century, also described the crushing of stone in the bladder: the results of the various operations referred to during these periods were in no wise encouraging, and the establishment of lithotripsy did not take place until the present century. The first impulse was given to it by a Bavarian surgeon in Salzburg, by the name of Gruithuisen, in 1813; he proposed, but did not execute on the living subject, the following method of crushing stone in the bladder: A hollow, straight metal tube was to be passed into the bladder through the urethra, carrying within it a loop of wire by which the stone was to be caught up and drawn firmly against the end of the tube, and then split by means of a sharp-pointed stylet pushed in through the tube. In 1817, Fournier of Paris made stone-crushing experiments upon the dead body with instruments of his own construction. In 1818 young Civiale published his work upon lithotripsy, and gave in it his idea of the instruments by which it should be accomplished. In 1819, Elderton, a Scotch surgeon, published a description of a method for crushing stone with a new instrument. In 1822, Amussat attempted to crush a stone in the dead subject by means of forceps of his own construction before a commission of the Academy; he broke the instrument instead. Simultaneously, Leroy d'Etiolles described a new instrument. Thus far, however, there had been only propositions, and on the 13th of January, 1824, for the first time, Civiale actually crushed a stone in the living subject by means of his improved instrument, which was a three-bladed forceps lying within a straight, hollow metal tube, from which the blades could be projected and spread after passing the tube into the bladder. The stone was grasped by these arms, and when firmly caught was perforated by a sharp stylet passed through the tube and between the branches of the forceps: as soon as it was broken the blades of the forceps were loosened and the stone allowed to drop out of them; the pieces were then grasped again and similarly broken. By this exceedingly clumsy mechanism Civiale operated upon 12 cases, being successful in 11 of them. In 1827, Eisenstein, who had studied in France, performed his first lithotripsy in Austria. In 1831, Pirogoff introduced the operation into Russia. Heurteloup first performed it in England at Westminster Hospital, July, 1829. In America the first lithotripsy was done in New York by Dupeyre in 1831, and came rapidly into favor there. It is of interest to know that Sir Henry Thompson possesses the instrument with which Civiale performed his first lithotripsy.

Civiale left the fragments to be passed by the natural expulsion of the bladder. The first improvement of importance in the crushing instrument was devised by Weiss of London very soon after Civiale's first operation, and consisted in a two-bladed instrument made on a plan similar to that of the modern lithotrites. Heurteloup effected the breaking of the stone after it had been caught in the blades of the lithotrite by striking the end of the inner blade with a hammer. The method of breaking with the hammer was soon superseded by that of applying the crushing force by means of a screw, which originated, according to Sir Henry Thompson, with Mr. Hodgson of Birmingham: this was again modified by substituting a rack and pinion, introduced by Sir William Ferguson. The next mechanical

advance was made by Civiale again and Charrière, and was the substitution of a wheel-handle at the instrument attached to a mechanism in the upper part of the shaft, by which the screw power could be changed for a sliding of the blades. Thompson devised the cylindrical handle, and modified the adjustment that governs the change from screw to a sliding



FIG. 141.—Thompson's lithotrite.

motion of the blades, and also employed a fenestrated blade to clear the jaws of the débris, so that the withdrawal of the instrument was obviated (Fig. 141). The jaw of the male blade was variously modified by roughening it,

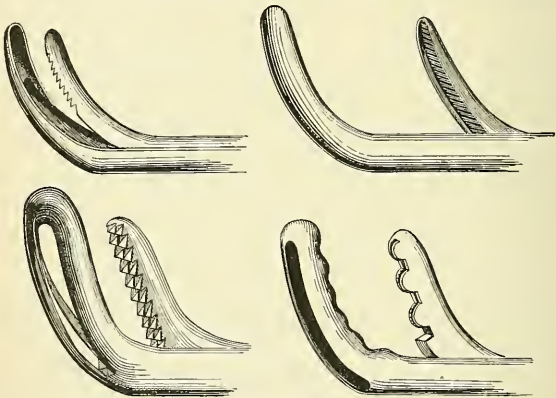


FIG. 142.—Some modifications of the lithotrite blades.

furnishing it with teeth, projections, etc., all designed to improve the grasping power on the stone.

In 1878 there came another important change in the lithotrite, by which

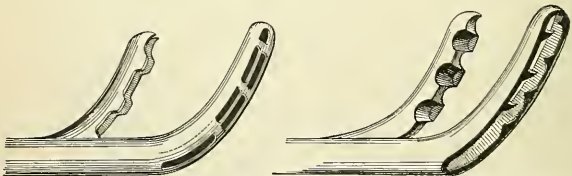


FIG. 143.—Fenestrated blades of Robert and Collin.

FIG. 144.—Fenestrated blades of Roliquet.

the desiderata were embodied in a new form of instrument by Prof. H. J. Bigelow of Boston, which will be described with the account of his operation under a separate heading. With this exception the accompanying figures

represent the more important steps in the subsequent development of the lithotrite.

During the earlier period of lithotripsy there was no attempt to withdraw the crushed fragments from the bladder; they were left to be passed by the natural efforts of expulsion. The amount of crushing and the time occupied in each sitting varied with different surgeons; but there was no attempt on

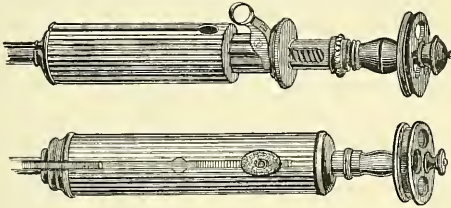


FIG. 145.—Thompson's modifications of the lithotrite handle.

the part of any of them to complete the crushing and to remove the entire débris at one time, until Bigelow promulgated this principle in 1878 under the name of litholapaxy. Previous to this time lithotripsy by frequent short sittings, by which was meant crushing of a small portion of the stone only, and leaving the fragments to be passed naturally or withdrawing them by means of the imperfect evacuators in use up to that time, was taught by Civiale and Nélaton in France, Thompson in England, Dumreicher and Dittel in Austria, and was the generally accepted rule.

The importance of removing the fragments, as far as possible, immediately after the crushing was recognized, however, early in the history of the operation, and was attempted by means of scoop-catheters, etc. The first apparatus for doing this by suction was invented by Sir Philip Crampton of Dublin in 1846; it had the form of a soda-water bottle with a catheter and stop-cock attachment; suction to withdraw the débris was accomplished by exhausting the air from the glass receiver beforehand. Cornay produced suction by means of an exhaust syringe attached to a wash-bottle. In 1865, Clover introduced an evacuator, which was a decided improvement over those that had gone before. Instead of the wash-bottle made of glass, it had a rubber bag attached to its farther end by which the fragments were sucked through the catheter, and a trap to catch them and prevent their return to the bladder with the ingoing stream. Thompson modified this instrument, and up to 1878 he had used the Clover instrument several hundred times. The various modern evacuators are figured later.

Litholapaxy.—In 1878, Bigelow, as has been said, introduced a new method of operating which he termed litholapaxy (*lithos*, stone, and *lapaxis*, evacuation), which revolutionized the operation of lithotripsy, rapidly established itself, and has, up to the present, remained the universally accepted operation. Bigelow's principle was that the stone should be crushed and wholly removed at one sitting under all conditions, he being persuaded that the danger of crushing operations arose from the presence of rough fragments in the bladder, and that prolonged gentle and skilful manipulation of instruments for the purpose of crushing and evacuating risked far less, provided the bladder was absolutely freed from all débris. Otis of New York had already shown the feasibility and importance of using large instruments in

the urethra in another connection, by demonstrating that its normal caliber was much greater than had been thought, and had in this respect prepared the way for the introduction of the large and powerful instruments of Bigelow, to be described presently. To put this principle into successful operation Bigelow devised new forms of instruments. The following are the changes in the lithotrite. The description of the operation of litholapaxy is taken largely from Cabot:¹

Lithotrite.—In order to prevent impaction of the blades by the débris the female blade had formerly been fenestrated; the change made by Bigelow consisted in placing on the male blade a series of inclined planes (Figs. 146

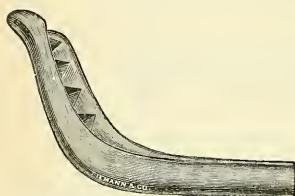


FIG. 146.—Beak of Bigelow's lithotrite (closed).

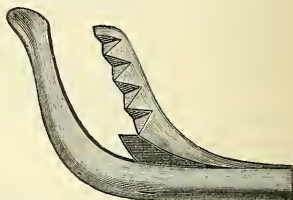


FIG. 147.—Beak of Bigelow's lithotrite (open).

and 147) between the angles of which the detritus is forced out laterally. The rim of the female blade is low to facilitate the escape of the débris. The tip of the female blade was given a peculiar form which rendered its passage through the urethra, and especially over prostatic enlargements, more easy.

The handle of the instrument was supplied with an ingenious mechanism which gives the important advantage to the surgeon of being able to lock and unlock the instrument without change of position of the hands, so that the alternate maneuvers of crushing by screwing and grasping fragments by



FIG. 148.—Handle of Bigelow's lithotrite (closed).

sliding of the blades can be carried out with the greatest facility and accuracy and with the least waste of time. The shape of the handle is also much more



FIG. 149.—Handle of Bigelow's lithotrite (open).

convenient than that of preceding lithotrites (Figs. 148 and 149), as it enables the surgeon to grasp it more firmly and to work with more precision.

The strength of the jaws is greater than that of other lithotrites, and the whole instrument more powerful, so that with the smaller sizes of the instrument stones of almost any degree of hardness can be crushed; for large, hard

¹ *Op. cit.*

stones, however, the fenestrated blade is better, as it cuts through the stone more readily.

Bigelow's lithotrites are made in three sizes, 25, 27, and 31 of the French scale, and for children in smaller sizes (16 French); the fenestrated blade in the latter size is better, because of the less risk of breaking the instrument.

The Evacuator.—The evacuator consists of a tube and elastic bulb, and a receptacle to receive the fragments. The catheter may be either curved or straight. The straight tube offers less resistance to the passage of the fragments, but is not so easy to pass as the curved one. The wing at the upper part of the tube acts as a guide to the position of its mouth in the bladder, and also facilitates the handling of the instrument. The fixed part of the tube connecting the catheter with the rubber bulb extends obliquely upward to the center of the bulb, and is provided with a stop-cock just outside the bulb, while the outer end of the catheter is also fitted with a stop-cock, the advantage of these being that the patient and bedding are kept dry while coupling and uncoupling the catheter and bulb.

The portion of the tube lying within the bulb is perforated with small holes, the total area of which exceeds that of the opening at the end of the tube. The return stream from the bladder brings the fragments which fall

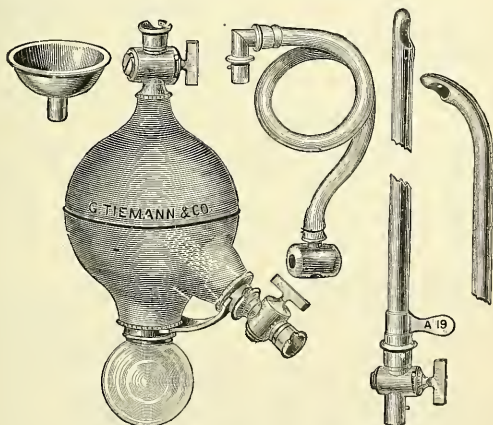


FIG. 150.—Bigelow's latest evacuator.

to the bottom of the receptacle beneath the rubber bulb, the perforated part of the tube permitting the passage of the inflowing current of water, but preventing the return of the stone fragments. If the stone be a large one, the glass receiver will be filled with the débris before the operation is completed, and will require to be emptied: the bayonet catch by which the receiver is attached to the bulb allows of this being done very readily. When it is desired to refill the bulb with water, it is easily done by means of the rubber hose which is attached to the top of the bulb, its other end being immersed in the water to be sucked into the bulb; this hose also provides for the expulsion of air from the apparatus and the easy regulation of the amount of water in the bulb and bladder during evacuation—a matter of great import-

ance, as an over-tense bladder is a source of danger and must be at once relieved, while an empty one interferes greatly with the operation, as the lax walls are drawn into and obstruct the mouth of the tube.

In Bigelow's evacuator, as will be seen, the receiver in which the fragments are caught is at the farthest point of the apparatus from the bladder, and the fragments, once received in it, cannot be again put in circulation and returned to the bladder (Fig. 150). In Thompson's, Guyon's, and

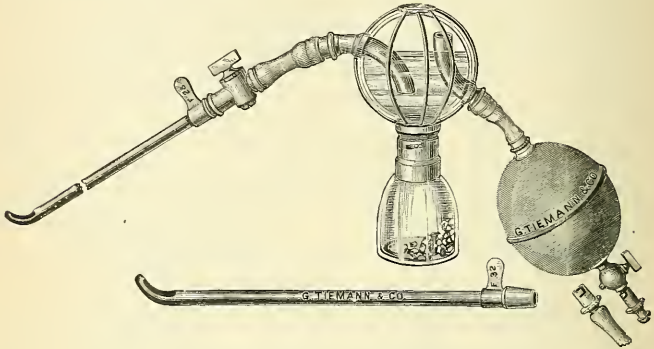


FIG. 151.—Otis's evacuator.

Otis's instruments, on the other hand, the trap is between the bulb and the bladder—the return of the fragments in Thompson's evacuator by a perforated valve at the end of the tube. In both the others there are no valves, the force of gravity being relied upon to separate the débris from the water, the direction of the current assisting in this result (Figs. 150, 151, and 152).

Numerous modifications and a great variety of models of evacuators have

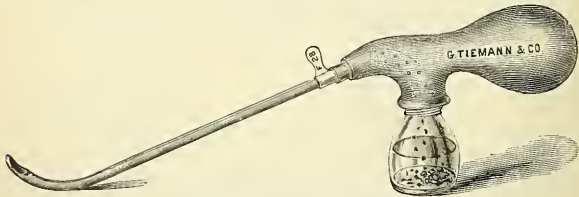


FIG. 152.—Chismore's evacuator.

followed Bigelow's original instrument, but there has been little or no advance made in this direction, in the writer's belief, since the author of modern lithotripsy issued his later instruments, lithotrites and evacuators, though of course any special form of instrument may be found to be more convenient by its inventor.

A somewhat decided innovation was suggested by Dr. O. K. Newell of Boston in 1891, who called attention to the fact that if the penis in its pendulous portion was compressed upon itself, so as to shorten that part of

it, the distance from the meatus to the bladder was reduced to between four and six inches: upon this he rested the assertion that the evacuating tubes and all the lithotrites then in use, including Bigelow's, were too long. The advantage claimed for the shorter tubes was that they would evacuate the débris more rapidly. Dr. Newell demonstrated the feasibility of their use, and the writer has found in practice that they are often of value: it is a mistake, however, to suppose that they are suitable to all cases; they are totally inadequate in the presence of any considerable hypertrophy of the prostate, for they cannot be made to reach the bladder because of the elongation of the deep urethra so commonly associated with that condition. The form of the tip of the tube proposed by Newell is not only of no advantage, but is a dangerous one to use even in skilled hands. The two-way cock between the bulb and the catheter is, in the writer's opinion, a most convenient one, and a decided improvement upon any of the previous forms. Newell's instrument has the further advantage of being very light, a desirable feature when the operation is a long one, as it spares the surgeon's hand much fatigue, and consequently gives it more delicacy and precision. Its weight is $9\frac{1}{4}$ ounces.

The form of the tip of Bigelow's evacuating-tubes is rounded, so that they can be passed through the deep urethra with the least possible risk of injuring it, and the mouth of the tube is so constructed that it receives and directs into the tube the fragments and allows the passage of those of large size (Figs. 151 and 152).

Keyes has introduced a straight tube with an open mouth and fitted with

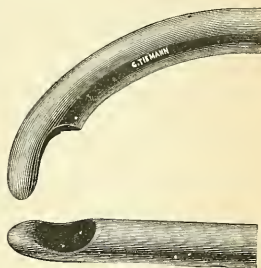


FIG. 153.—Ends of evacuating-tubes.

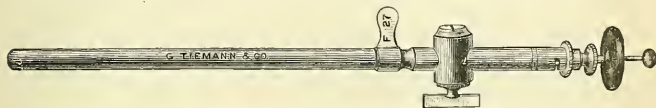


FIG. 154.—Keyes' straight evacuating-tube, with obturator.

an obturator to free the end from fragments if they become impacted in it (Figs. 153 and 154).

Bigelow's Operation of Litholapaxy.—Small stones can ordinarily be crushed and pumped out without causing much pain, so that, in a patient who is not especially sensitive or whose urethra is accustomed to the passage of instruments, no anesthetic may be required or cocaine anesthesia can be employed, a 2 per cent. solution being ordinarily sufficient. This may be injected without fear of toxic effects. The pain of the operation may be decidedly diminished by the application of cocaine to the bladder and urethra, and in this way many stones have been crushed without resorting to general anesthesia. If cocaine is employed, it should be thoroughly applied in a 2 to 4 per cent. solution, the bladder having been previously emptied and washed out. In order to reach all parts of the vesical cavity it must be injected in considerable quantity, and there is, therefore, some danger of toxic effect, especially if the bladder is ulcerated and presents an absorbing surface.

Usually, except in the most trivial cases, it is best to do the operation under general anesthesia, for the relaxation of complete insensibility makes the manipulations much easier and adds greatly to the quickness and thoroughness of the operation. Especially is it important to allay the tendency of the bladder to spasmodic contractions, for not only does this force the water out alongside of the instruments, and so reduces the size of the cavity when room within it is necessary, but it subjects the bladder-walls to a dangerous strain, which, if the urethra is blocked, may lead to their rupture.

The patient, then, being thoroughly anesthetized and the presence of a stone having been established, a large sound may be passed to make sure that there is no stricture or other obstruction in the urethra. If a stricture is found, it may be rapidly dilated with large sounds or divulsed. A narrow meatus is to be cut. The urine should then be drawn with a catheter, the bladder should be washed out, and borax-water or a solution of boracic acid should be introduced in sufficient quantity to distend it, and so keep its walls out of harm's way during the crushing of the stone. From four to six ounces is usually a proper quantity. An elastic rubber tube may then be tied lightly around the penis, close to the corona glandis, to prevent the escape of water alongside of the instrument. This fills the double purpose of keeping a known quantity of water in the bladder and of preventing the wetting of the patient and the bed.

Before each introduction of the instrument the urethra should be filled with liquid vaseline from a syringe, in order to lessen the injurious friction as far as possible.

To introduce the lithotrite properly, the point should be carried with considerable gentleness through the constriction made by the rubber tube, and it then slips without difficulty through the movable urethra. After the beak passes below the pubes the handle should be brought to a vertical position, and the instrument will then drop almost without assistance, by its own weight, until the point rests just in front of the triangular ligament. Traction upon the penis now effaces the depression made by the extremity of the instrument in the bulbous urethra, and if the handle is then brought down gently between the thighs, and at the same time the point is advanced in the axis of the body, the lithotrite usually slips easily into the bladder.

The places where difficulty may be met with in a normal urethra are at the triangular ligament and at the prostate.

The point of the instrument may catch on the upper or lower edge of the comparatively rigid opening of the triangular ligament. If the handle is depressed before the beak of the instrument is carried down as far as it will go toward the rectum, the point is likely to catch against the upper edge of this opening; while, on the other hand, if the instrument is pushed too forcibly toward the sacrum, the lax bulbous urethra is depressed below the aperture and the point catches on the lower margin. Practically, if the instrument catches at the triangular ligament, it should be passed down with the beak hugging first the roof and then the floor of the urethra, and in one or the other of these ways it will usually find its way through. The finger pressing against the convexity of the curve of the instrument in the perineum will often lift the point over the lower margin of the opening when it is catching there.

A similar difficulty may be met with at the opening into the prostate. This happens but rarely, and is to be overcome by the same tactics. In cases of much difficulty the finger introduced into the rectum serves as a good guide, and with it the point of the instrument may be lifted into the prostate

when it is catching on the lower edge. An enlarged prostate is, as a rule, easily passed by the lithotrite, whose short curved beak carries the point along the roof of the canal, where it rarely meets an obstacle.¹

False passages may make the introduction of instruments extremely difficult and dangerous. Even if by long and patient trial they are finally passed and the stone is comminuted and removed, the danger is not then over, for a serious swelling of the urethra is likely to follow, and under these circumstances the passage of a catheter is almost an impossibility.

A single false passage, if its position is accurately made out, may usually be avoided by carrying the instruments along the opposite wall of the urethra at this point. If, however, several of these pockets exist, in which the instruments are caught, it will perhaps be a wiser plan to resort to lithotomy, which, though a more severe operation, has the great advantage of providing certain drainage for the bladder.

If the stone is free, it rests upon the floor of the bladder, and, with the patient in a horizontal position, it is usually found at a point a short distance behind the prostate.

The operation of crushing not only demands considerable skill of manipulation, but it is also greatly assisted by an accurate knowledge of the contour of the bladder, and of the changes in shape which may be impressed upon it by varying conditions of the surrounding organs.

Dr. Bigelow, in preparing his work on litholapaxy, made a careful study of these changes. He says: "We get a useful view of the interior of the bladder by examining in position through an opening in its summit. This part of the organ, with the free and thin posterior wall, is mainly concerned in distention. The floor of the bladder is comparatively firm and flat, and, if the subject is in good condition, adheres to a thick mass of cellular tissue in and near the ischio-rectal fossæ, upon which it rests. This mass is traversed by the rectum variously distended; and this canal in a thin subject may be advantageously filled with air during an operation, to facilitate its indentation by an instrument—reversing, for the operation of lithotripsy, one of the precepts of lithotomy.

"The sigmoid flexure is largely concerned in compressing the bladder behind. The posterior wall of this viscus may be so crowded by the intestines as to become flat or even concave. A horizontal section of the bladder is then transversely oval, flattened between the intestines behind and the pubes in front, each of these indenting it. A well-filled or tense abdomen tends so to shorten the antero-posterior diameter of the bladder that, while a large stone may gravitate backward into that part of the bladder that is compressed by the intestines, carrying the thin wall with it, it is not

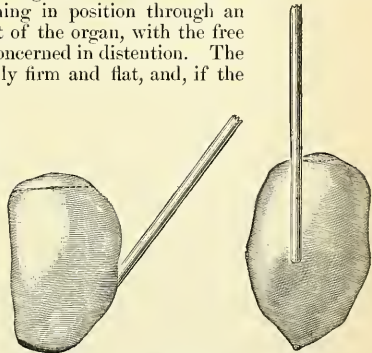


FIG. 155.—Cast of the bladder with an instrument depressing the floor.

¹ Great care should be exercised in passing the instrument through the prostatic urethra, for it is here that the greatest danger of making a false passage occurs, especially if prostatic hypertrophy exists; and, in the writer's experience, injury to the deep urethra is the most serious accident that is at all likely to occur during the operation.

so with a fragment, which, unless the floor be artificially depressed, may lie on one side or the other of the vesical orifice more readily than at some distance behind it."

A rectum filled with feces raises and distorts the floor of the bladder, and so not only makes the search for a stone more difficult, but by resisting the indenting of the floor with instruments adds greatly to the difficulty of crushing. It is for this reason that the bowels should be thoroughly emptied before the operation.

If now the lithotrite be introduced and carried to the bottom of the bladder, its beak will make an indentation in which it will rest. Fig. 155 represents a plaster cast of the bladder with an instrument in this position.

As the stone rolls to the bottom of this funnel-shaped depression it rests on or alongside of the beak, and when the blades are opened it falls over the shoe or female blade, and is therefore seized as the male blade is again closed down.

If this maneuver does not succeed in catching the stone, the blades should be opened in the upright position and then turned over on one side and shut along the floor. Care should be taken to always open the instrument in the upright position, for if it is turned on the side and then opened, the male blade pushes the stone or fragments away, and they are not caught as it is again closed.

If the stone cannot be seized, it may be because it lies in the pouch behind an enlarged prostate, so that the instrument enters the bladder over it. In this case it may be caught by opening the instrument and then turning the blades over so that they point down into the base of the bladder, and shutting them in that position. There is some danger in nipping the bladder-wall by this maneuver, and an easier way of obviating the difficulty is by raising the hips of the patient. This change of position usually rolls the stone out of the post-prostatic pocket into a part of the bladder where it can be easily reached and crushed in the ordinary manner.

When, as rarely happens, the stone is so held in the pouch behind the prostate as not to be easily rolled back, it may usually be displaced by using the closed blades of the lithotrite to pry it out. If this is not successful, it can be pushed up by a finger introduced into the rectum, and if it tends constantly to fall back to a point where it is not accessible, the post-prostatic depression may be effaced by a distended rubber colpenrynter in the rectum, as suggested by Buckston Browne. Mr. Browne met with several cases in which the post-prostatic pocket was a veritable diverticulum beneath an enlarged third lobe, and so concealed the stone that it required a suprabubic operation for its removal.

A stone may be too large to fall into the depression of the instrument, and it is then necessary to depress the handle and so raise the blades before it can be seized. This sensation of having the stone above the sound or lithotrite sometimes leads to the belief that it is attached to the upper bladder-wall, when this is not the fact. In such a case, after the first crushing, the fragments, as they are reduced in size, will be found on the floor of the bladder.

The crushing of the stone should be done as thoroughly as possible at the first introduction of the lithotrite. This saves time and irritation to the urethra, and, with the self-clearing instruments described above, may be accomplished by a little skill and patience in searching for fragments. If the stone is a large one, however, sand and small fragments will presently accumulate and fill up the bottom of the bladder, and then the large fragments lying on top of this débris can no longer fall by gravity into the jaws, and they are

then not easy to find. When this is found to be the case, it is time to use the pump and clear the bladder of the finer portions. The presence of clotted blood or of thick mucus in the bladder has a similar effect in filling up the depression upon the floor and preventing the fragments from falling into the jaws of the lithotrite. Here, again, the pump is called for.

The form of the female blade, with projecting end and width enough to carry its sharp rim away from close contact with the male blade, makes the nipping of the bladder-wall unlikely to occur. This accident is so serious that it should be further guarded against by always, in case of doubt, carrying the blades toward the center of the bladder and slightly rotating them from side to side, to see if they are free, before they are screwed down upon anything that has been seized.

Practically, with the Bigelow instrument, having a floor to the female blade, operating in a moderately distended bladder, the jaws may be safely pressed down toward the trigone, and then opened and shut without any fear of catching the bladder-wall so long as they are kept nearly upright. This maneuver is a valuable one in rapidly reducing the fragments of a soft stone, for no screw-force is required, and the fragments, constantly falling on to the female blade, are comminuted as rapidly as the instrument can be opened and shut.

It must be remembered, however, that if the bladder is so empty as to fall into folds, greater care must be exercised; and also that, if the instrument is turned toward the side wall, it may perhaps catch a fold, and should be closed with caution. A nip from the blade of a non-fenestrated lithotrite does not necessarily produce a serious lesion of the bladder-walls. This accident occasionally happens to every operator without causing troublesome after-effects. But the fenestrated instrument with its scissor-like blades, if shut down closely, cuts out the piece of the bladder-wall included within its jaws. Especial care should therefore be used in the manipulation of this instrument.

There is also another peculiarity in the working of a fenestrated lithotrite which should be borne in mind when one is used. It is this: During the early part of the crushing, when the stone breaks and falls apart in the jaws, it is natural to open the lock and again search for a large fragment without fully screwing down. This is a safe maneuver with a solid instrument, but with a fenestrated one it is important to remember that portions of stone pushed through the female blade will cling to it with some tenacity unless the male blade is thoroughly pushed down through it, and that a rough fragment thus projecting below the blades may do serious injury. Therefore the fenestrated instrument should always be closely shut down on whatever it seizes.

When, finally, no more fragments of any size can be caught, the lithotrite should be firmly screwed together and withdrawn. If there is any difficulty in fully closing it, the jaws may be carried to the center of the bladder, and there with the screw may be opened and shut a few times to work out the impacted stone from between them. This maneuver is of importance, not only on account of the difficulty of drawing out a partially open instrument, but far more because an instrument not wholly freed of débris may have sharp, angular fragments projecting from it which will lacerate the urethra in withdrawal.

We now come to the second part of the operation, the evacuating of the fragments. In selecting the catheter for this a straight tube should be used, if possible, as it not only affords a straighter and easier road for the frag-

ments, but also is more easily turned in the bladder when the operator wishes to direct the orifice toward different portions of the viscus.

While the curved tubes are introduced like an ordinary catheter, the straight tube requires a little manipulation. It should be carried down in a vertical direction until it will go no farther toward the rectum. Then, being brought to a horizontal position, it should be gently pushed upward in the axis of the body. At the moment of bringing the tube down between the thighs pressure should be made over the pubes, pushing the penis downward in order to relax the suspensory ligament. Before advancing the instrument horizontally it is well to withdraw it very slightly in order to disengage its point from the pocket which it is likely to make in the bulbous urethra. When there is a hitch at the triangular ligament or at the prostate, the tube may usually be carried through by rotation in the manner of a corkscrew. As all the obstacles likely to be met in the urethra are on the floor, it is usually sufficient to carry the outer end of the straight tube low down between the thighs in order to enable its point to ride over any obstruction that it meets in the prostate. With care in these regards it passes readily into the bladder. When, owing to any peculiarity of the urethra or prostate, the straight tube does not pass readily, a tube with the point slightly turned up, after the manner of a coudé catheter, may be tried, and if this fails the curved tube may be used as a last choice.

When the tube has entered the bladder its point should be carried gently down toward the base, and it should then be connected with the bulb. On opening communication between them the air contained in the tube will escape into the bulb, and should be driven out through the hose at the top, and its place supplied by water before the operation begins.



FIG. 156.—Straight tube, with the end turned up to facilitate introduction.

When there is much débris, it is well to commence pumping with the point of the tube held a little above the floor of the bladder. During this earlier part of the operation there should be no interval between the compression and expansion of the bulb. The object at this time is to set the fragments whirling, and to catch them while they are suspended. If the end of the tube is buried too deeply in the detritus, it is apt to be clogged at the outset, and the evacuation is thereby considerably hindered. Later, when the fragments are few, the tube is carried to the floor of the bladder, and a few moments should elapse, after pressing the bulb, to give the fragments time to settle into the depression about the end of the tube before the expansion which is to suck them into it. When any particular aspiration brings fragments, the position of the tube should be kept unchanged until they cease to come.

The wedging of a fragment in the tube causes an obstruction which is very noticeable. The compression of the bulb is rendered difficult and its expansion slow. An angular fragment may lodge so that, while it allows the passage of water, it prevents the entrance of other fragments. This condition may be suspected if there is a constant clicking against the tube and still nothing appears in the reservoir. The usual point where fragments wedge is at the mouth of the tube. When one thus becomes fixed, it may be dislodged with a stylet, and this is the safest method of disposing of it, although with care the tube may generally be drawn out with the fragment in it. This procedure, however, is not devoid of danger, for sharp, projecting angles may lacerate the urethra or a bit of stone may remain sticking in the passage.

The tube may also be obstructed by the bladder-wall, which is sometimes sucked into the orifice. The stoppage from this cause is usually not continuous, but the walls flapping against the opening give the instrument a series of jerks which remind one of a fish-bite. When this is felt, the instrument should be moved to another part of the bladder; and, if it then occurs, it shows that the bladder is not sufficiently distended, and water should be added through the hose at the top of the bulb. Pumping should be prolonged until the sand and gravel cease to come. Then the lithotrite should be again introduced and the crushing continued, followed again, as before, by the washing out. Finally, after the stone has been thoroughly crushed, and when for several minutes no fragments appear in the reservoir, it is evident that the evacuation is almost completed; and now begins a very important part of the operation—namely, the search for the last fragments. The tube should be moved to different parts of the bladder, and the orifice should be systematically turned in all directions in order to wash out any side pockets or corners that have been passed over. The pouch behind the prostate should be especially attended to in this way.

Keyes recommends his tube with open end for the washing out of the last fragments. It requires especial care in its manipulation, and its vesical end must be kept close to the neck of the bladder. If introduced too far, it sucks up the posterior bladder-wall uncomfortably; and if drawn out too far, it may bruise the prostate.

It sometimes happens that the last fragment is difficult to find with the lithotrite, and is still a little too large to pass the tube. Great patience is then required in the search for it. I have once or twice succeeded in such a case by drawing the fragment to the tube, and have then dropped it on the floor of the bladder, where the lithotrite readily found it and crushed it.

Chismore has devised a lithotrite (Fig. 157), which seems admirable for the removal of this last fragment. In it the shaft of the male blade is hol-

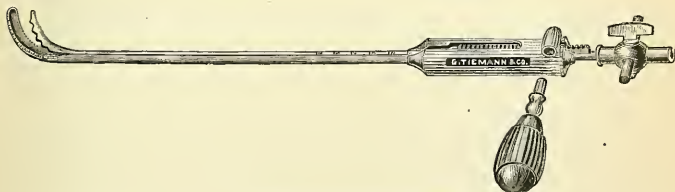


FIG. 157.—Chismore's evacuating lithotrite.

low, the opening being in the heel of the blade. It has an aspirating bottle attached to its upper end, so that when the blades are slightly separated and suction is applied, the fragment is drawn between the jaws and easily crushed on closure of the instrument.

Finally, if after a careful search no more fragments can be obtained and no click of stone against the tube can be elicited, the operation is completed. Before closing, however, it is well to wash out the urethra thoroughly with a catheter of small size, which allows the water to rush out alongside of it. This removes much fine sand, which oozes along the lithotrite and lodges in the canal during the operation. The writer adopted this plan several years ago, and he has found, since putting it in practice, that his patients have suffered less from painful, scalding micturition than formerly.

After-treatment.—If the patient has been able to urinate normally before the operation, little or no after-treatment is required. It is usually well to allow the patient to drink liberally of water, and to keep him quiet for a few days, although this is often not necessary where the stone is small and has not caused much cystitis. When, however, owing to enlargement of the prostate or stricture of the urethra, the bladder has not been able to empty itself, but requires the aid of a catheter, it is often well to fasten the catheter in for the first few days, and thus provide for the drainage of the bladder, and at the same time spare the urethra the irritation of the frequent passing of an instrument. This also may be required when there has been any laceration of the urethra which may lead to swelling and partial closure of the canal.

The cystitis which persists after the removal of the stone should be treated by medication, and, if necessary, by irrigation, as described elsewhere.

It sometimes happens that the bladder becomes partly filled with tenacious muco-pus which does not readily pass with the urine, and which leads to an almost constant desire to micturate, with a sometimes painful tenesmus. This can usually be drawn off through a large, soft catheter, but if this does not succeed, it may require the use of a litholapaxy-pump for its removal.

At the end of ten days or a fortnight the bladder should be washed out with an evacuator to remove any sand or gravel that was left at the time of the operation, and which would serve as a nucleus of a new stone. In a sacculated bladder or where there was much mucus present at the time of the operation fragments will often be found by the secondary pumping, and in some cases the tendency to the formation of phosphatic material is so strong that repeated pumpings at intervals of ten days will continue to remove little calculi until the alkaline tendency of the urine has been overcome.

The operator should not be content until he has had a satisfactory washing with the pump without obtaining calcareous material. As a small catheter can be used for the removal of this fine débris, the operation is comparatively free from pain and can be done without anesthesia.

The operation as just described is the litholapaxy of Bigelow, and it remains to speak of one or two variations of it practised by good operators and liked by them. The changes introduced are mainly in the methods of accomplishing evacuation:

Chismore's evacuating lithotrite has been described, and its usefulness in the search for the last fragment alluded to. It was originally devised for this purpose, but its inventor has gradually pushed his use of it until now he employs it in all his operations from beginning to end. The light rubber aspirator that he has attached to it does not interfere with its manipulation as a lithotrite, and does not have to be removed during the crushing of a soft stone. When more power is needed in the crushing the aspirator is removed and a handle is substituted, which gives a firmer hold and permits of the exercise of more force. When the stone is very hard he uses an extra strong male blade with a lock and screw.

Some operators use the elasticity of the bladder-walls to accomplish the evacuation of the fragments. Guyon introduces the evacuating catheter and lets the fluid in the bladder rush out, bringing what fragments it can with it. He then with a syringe fills the bladder, and again empties it with a rush. After repeating this a number of times and removing as much as possible, he then uses the aspirator to pump out the last fragments.

Keith has recently reported satisfactory results obtained without the use of any aspirator whatever, and seems to have removed many large stones simply by filling and emptying the bladder. He speaks of no cases of rup-

ture of the bladder due to the forcible injection. His practice has been in India, and possibly his patients have been somewhat younger than is the rule among stone-patients in other countries. This would account for his finding sufficient resiliency in their bladders to accomplish evacuation in this fashion. Among old patients with atonied bladders it would not seem possible to expect such results.

I have tried this method in a somewhat modified form after a manner proposed by Dr. F. H. Williams a number of years ago. By means of a two-way cock attached to the end of the catheter it was arranged so that water could be at will run into the bladder, and then run out through a tube over the side of the table. In this way we had a siphon action drawing the fragments from the bladder, in addition to the elasticity of the bladder driving them. The injection of water into the bladder was provided for by a tube connected with the upper opening in the two-way cock and joining it with a raised reservoir. This reservoir was a transparent graduated glass, and thus at each filling of the bladder the operator could see exactly how much water had flowed in, and could judge of the tension by noticing the rapidity of the fall of water in the reservoir. The apparatus was easily and quickly worked by alternately turning the current to and from the bladder.

In the case upon which this was tried the amount of débris was great, and the bladder was dilated and atonied. The clogging of the tube was troublesome, and the outrush was not forcible enough to carry the detritus along in any large amount. After trying this method for a time I substituted the Bigelow evacuator, with the result of a greatly increased rapidity in the removal of the fragments.

Complications which may Arise during Litholapaxy.—Among the accidental conditions which may arise during a litholapaxy may be numbered the following: Hemorrhage, laceration of the urethra, injury of the bladder-walls, impaction of a fragment in the urethra, and clogging, bending, or breaking of the lithotrite.

Hemorrhage.—A slight or moderate amount of bleeding not uncommonly accompanies the operation. It may come from the urethra or bladder. More commonly it is due to the injury done to the congested prostatic urethra, and it is more likely, therefore, to be seen in old men. When the blood comes from the urethra anterior to the prostate, it rarely causes any trouble, and soon ceases. Blood from the prostate runs back into the bladder, and, clotting there, may interfere with the crushing of the stone. It is readily sucked out through the evacuating tubes of ordinary size, and the bleeding usually ceases or diminishes after the first few minutes. If it continues to be troublesome, the injection of hot water (115° F.) may be tried.

The bladder-walls rarely bleed much unless seriously diseased or injured. A hemorrhage of any amount in the vesical cavity leads, therefore, to a strong suspicion of the existence of a tumor, and in such a case the washings from the bladder should be carefully saved and examined for bits of new growth. If these were detached and recognized during the operation, the plan of procedure would naturally be changed and a suprapubic incision would be resorted to. Keyes mentions one case in which, in a bladder not containing a tumor, the loss of blood was so great as to lead to the temporary abandonment of the operation. Subsequently, when the fragments remaining were washed out, there was very little hemorrhage.

In patients of a hemorrhagic diathesis the operation would naturally be approached with a good deal of hesitancy, but I have seen no account of serious trouble from this cause.

Laceration of the urethra may be caused either by the introduction of the instruments or by the withdrawal of them when clogged with projecting sharp fragments. In skilful hands an uninjured urethra ought not to be torn during the introduction of instruments of a proper size. An ulcerated or partly strictured canal may be torn even when due care is exercised. It is a good safeguard against this accident to pass a conical steel sound one or two sizes larger than the lithotrite and tubes. This gently stretches the canal, so that the rougher, pointed instruments are afterward less likely to catch. In the event of having troublesome false passages, either pre-existing or made at the time of the operation, the surgeon may wisely decide to change the plan and do a lithotomy.

The withdrawal of a clogged lithotrite or of a tube holding an impacted fragment may considerably lacerate the urethra. When this occurs the ragged tear offers a favorable surface for septic or urinary infiltration, and this accident adds, therefore, considerably to the danger of the operation. This danger is lessened if the urethra is thoroughly washed out with an aseptic solution at the end of the operation.

Whenever so much injury of the urethra results as to lead to the fear of urinary absorption or of retention from swelling, it is well to fasten in a catheter for the first two or three days. This is especially desirable in a case requiring catheterization or when a long and tortuous prostatic urethra has been thus injured. Usually, with this precaution, lacerations of the urethra do not lead to serious consequences, especially if antiseptic precautions have been carefully observed in the instrumentation and if the urine has been rendered aseptic before the operation.

Injuries of the bladder may be caused by catching the walls in the lithotrite. This may usually be avoided by keeping the bladder moderately distended with water during the crushing, so as to prevent its wall from being thrown into folds which might be caught in the jaws of the instrument. The care in the use of the lithotrite which is necessary to avoid this accident has been described in considering the operation. It is conceivable that in a diverticulated or chambered bladder the female blade of the open instrument might find its way into a pocket or chamber, while the male blade remained in the general cavity, and the intermediate septum would then be caught as the instrument was closed. I have seen bladders in which this might have easily occurred, and have twice during litholapaxy in old men had my instrument so caught and held that I thought it must be thus held in a pocket; and finding, on trying to close it, that a soft resistance was met, I kept the blades partly open, and then, keeping the shaft nearly upright, carried the heel of the instrument close down behind the neck of the bladder, and thus was able to close it. In both cases by operating near the neck of the bladder I was able to finish the crushing and evacuation of the stone. Fortunately, injury of the bladder-walls by nipping is usually followed by no untoward results.

Another accident which may happen to the bladder-walls is the rupture of them during litholapaxy.

Rupture of the Bladder-walls.—This may result either from using the pump when the bladder is too full, or from spasmodic contraction of the bladder when the urethra is blocked with instruments. Great care should be taken, when injecting the bladder before the operation, to notice the degree of resistance which it offers to the entrance of the water. This is especially important if the escape of the water alongside of the instrument is prevented by an elastic band. The force required to rupture an undiseased bladder-

wall is so great that this is very unlikely to occur; but, as many of these bladders are diverticulated in old people, there is considerable danger to the thin-walled diverticulum.

I have had one such case in which a bladder ruptured itself by its own spasmodic contraction when containing but an ounce or two of urine. In this case a laparotomy was done at once. It was found that the rupture had taken place extra-peritoneally on the left side, and the urine had escaped into the cellular tissue up toward the kidney on that side. Drainage was established in the left groin, and the case eventually got well.

Whenever, during litholapaxy, the bladder is affected by violent spasms, the operation should be delayed until the anesthesia is so profound as to put a stop to these. If this is found impossible, it may even be necessary to do a lithotomy rather than run the risk of rupture. When a spasm occurs during the pumping, it can be at once relieved by opening the stop-cock at the top of the bulb and letting out the excess of water.

Impaction of Fragments in the Urethra.—Occasionally, as has been said, fragments lodge firmly in the eye of the evacuating-tube, and the temptation is strong to try to draw them out with the tube. This attempt usually succeeds, but, besides its scratching the urethra, there is danger that the fragment may be dislodged from the tube and remain sticking in some part of the canal. Also, if the bladder is contracting strongly, a fragment may be forced into the urethra at the time of withdrawal of some of the instruments.

The points of usual arrest of fragments are in the prostate, at the triangular ligament, and just behind the meatus. From this last situation fragments are usually removed by incising the meatus and using forceps. A fragment lodged in the prostate may often be pushed back into the bladder with a large, blunt-pointed sound. When the bit of stone lodges in the urethra just anterior to the prostate, it may be very difficult of removal. In a recent case, where a fragment was dropped by the tube in the membranous urethra, I succeeded in pushing it back into the bladder by the following maneuver: Passing a straight tube with a long under lip down to the fragment, I then introduced the finger into the rectum, and, while lifting the bit of stone, worked the lip of the tube under it, so catching it in the mouth of the tube and readily pushing it back into the bladder.

Clogging and Breaking of the Lithotrite.—The strong modern lithotrites of the Bigelow pattern do not easily become clogged. A tough foreign body, as the nucleus of a stone, may, however, resist complete crushing and become entangled in their jaws. I have met one case in which a leather shoe-string formed the nucleus of a stone, and became so fixed in the jaws of the lithotrite as to make a very considerable mass to be drawn out with it. Though the urethra was much rasped by its passage, no ill effects followed. It is conceivable that in some such way the jaws of an instrument might be so held apart that they could not be withdrawn without great violence. Under such circumstances the blades should be carried to the center of the bladder, where there is no danger of catching the walls, and should there be many times opened and shut with the screw in order to gradually grind up or cut through the offending body.

If a lithotrite is tested outside of the bladder on a hard stone, it will be found that its blades are often twisted considerably during the crushing, but, being of well-tempered steel, they spring back into correct shape when the pressure is taken off. With a small instrument suitable for a child this twisting is often very great, and it may happen that the resistance of the

metal is overcome and the jaws are so distorted as to be afterward difficult of withdrawal. Usually, however, they break rather than bend. A number of cases of this accident have been reported. The fracture may occur at the heel of one of the blades or on the shaft of the female blade a short distance above the bend.

This last point is the position of the greatest strain in crushing a large stone, for the obliquity of the blades causes the force against the female blade to act rather downward, so that there is greater leverage exerted upon the shaft above than at the heel of the blade. When a hard stone is encountered, which resists all the force that it seems safe to apply, it is best, after cutting into it somewhat in one diameter, to seize it in a new place. It thus presently becomes weakened and gives way.

The breaking or serious clogging of a lithotrite may oblige a resort to lithotomy. A perineal incision will usually give room enough for the extraction of a broken blade or for the clearing of a clogged instrument. If the perineum is very deep or the prostate large, the suprapubic route will probably be preferable, and in case of a twisted or distorted instrument the high operation gives more room for the exercise of force sufficient to bend the blades back into place.

Complications after Operation.—Hemorrhage rarely causes trouble after litholapaxy, except that in cases requiring the use of a catheter this may be plugged by the clots. It may be necessary to free the bladder by the evacuator if ordinary injections and irrigation fail to bring them away.

Epididymitis occasionally follows an operation in which the prostate has been much irritated. The only case in which I have seen epididymitis follow the operation was one in which the urethra was considerably scratched by a rough fragment which was drawn out in the eye of the evacuating-tube.

Urethritis, Prostatitis, and Cystitis.—Inflammation of the urethra, of the prostate, or of the bladder may follow a litholapaxy. In fact, such conditions existing before the operation may be temporarily aggravated by it. The treatment of them is considered in another part of this work, and does not require special attention here.

Urinary fever is a complication to be occasionally expected, especially in those cases in which the kidneys are greatly affected, and something has been already said in regard to the best prophylactic measures to be taken against it.

Phlebitis.—Rarely, an inflammation may extend from the small venous sinuses about the neck of the bladder to neighboring large trunks. I have had one case in which the left leg was swollen and tense from this cause. The patient was a middle-aged man, who made a good recovery from an operation for the removal of a hard uric-acid calculus of considerable size. Fourteen days afterward he was on the lounge, and the bladder was washed out with the pump without ether. This caused him rather more pain than usual, though no difficulty was experienced in the manipulation. A few hours later he was seized with severe pain in the left leg, which at once began to swell, and ran the ordinary course of a rather extended phlebitis of the femoral vein.

Treatment after Litholapaxy.—After an uncomplicated litholapaxy, in a case with reasonably sound urinary organs, the relief is often immediate and the recovery uneventful. It is well, however, even in such a case, to keep the patient quiet in bed for a few days, as the urinary organs are often slow to show inflammation, and a febrile condition may set in on the second

or third day after a litholapaxy when up to that time everything has seemed to go smoothly.

Usually some pain and febrile reaction follows the operation. Hot applications to the hypogastrum and perineum will do something to relieve the pain. The treatment commenced before the operation to render the urine aseptic may be continued, and for a diuretic the free administration of spring-water is usually sufficient.

If there is a tendency to retention of urine and the bladder empties itself incompletely, the catheter must be used. Mucus and irritating ammoniacal urine must be removed by irrigation with appropriate solutions of borax, permanganate of potash, or nitrate of silver. If there is a tendency to phosphatic deposit, it must be met by injections of dilute nitric acid, and by the occasional use of the evacuator to remove granules too large to be destroyed by solvents.

Other complications must receive appropriate treatment

At the end of ten days or a fortnight, when the irritation caused by the operation has subsided, the evacuator should be used to make sure that there are no retained fragments or sand. At this time, after the mucus has largely disappeared from the urine, it is surprising how easily fragments are removed which escaped the most diligent search at the original operation.

In the *Lancet* of Sept. 22, 1888, Reginald Harrison describes his modification of Dolbeau's perineal lithotripsy, as has already been noted, and again, in the *Lancet* of April 7, 1894, recurs to the subject, reporting 14 cases upon which he operated by this method with entire success, and refers to it as follows: "The name of perineal lithotripsy was given in 1862 by Professor Dolbeau to an operation completed in one sitting, by which the membranous portion of the urethra is opened, the prostate and the neck of the bladder dilated instead of being cut, and a large stone crushed and its fragments immediately evacuated.

"The chief features about the operation I am about to describe are: (1) the mode of obtaining access to the interior of the bladder from the perineum; and (2) the mechanism connected with crushing and evacuating the stone. From a number of experiments I made on the dead subject, as well as from the performance of median cystotomy on the living for various purposes, it seemed unnecessary to do more than make an opening from the perineum into the membranous urethra at the apex of the prostate, on a grooved staff passed along the urethra, sufficient to admit the introduction of Wheelhouse's small tapering gorget, and subsequently the index finger, into the bladder, as for digital exploration or as is done in the boutonnière or Cock's operation: more than this is not necessary. In Dolbeau's operation direct access was obtained by this route, aided by the use of an expanding instrument, by means of which the prostatic urethra and neck of the bladder were dilated. It seemed to me, from some experiments made on the cadaver, that the latter means of dilatation was not only unnecessary, but was open to the objection that, unless used with the greatest care, it was possible to inflict serious damage. Further, I succeeded in demonstrating that by means of crushing-forceps, shaped somewhat like the blades of the lithotrite, and not exceeding by actual measurement in circumference that of an ordinary index finger, sufficient power might be provided to crush and assist in evacuating any stone that would be fairly seized in this way. These forceps are provided with a cutting rib within the blades, and the more powerful instruments are fitted with a movable screw on the handle. The fragments may subsequently be withdrawn by means of aspirator-catheters passed through the wound, or even by

forceps. If care is taken to make the perineal wound correspond in size with the evacuating catheters, which should be of about the size of an ordinary index finger, there is no difficulty in keeping the bladder distended during the necessary manipulations. The chief points in favor of this operation are these: (1) it enables the operator to crush and evacuate large stones in a short space of time; (2) it is attended with a very small risk to life as compared with other operations where any cutting is done, such as lateral or supra-pubic lithotomy, and is well adapted to old and feeble subjects; (3) it permits the operator to wash out the bladder and any pouches connected with it more effectually than by the urethra, as the route is shorter and the evacuating catheters employed are of much larger caliber; (4) the surgeon can usually ascertain, either by exploration with the finger or by the introduction of forceps into the bladder, that the viscus is cleared of all debris; (5) it enables the surgeon to deal with certain forms of prostatic outgrowth and obstruction, complicated with atony of the bladder, in such a way as not only to facilitate the removal of the stone, but the restoration of the function of micturition; (6) by the subsequent introduction and temporary retention of a soft-rubber drainage-tube states of cystitis due to the retention of urine in pouches and depressions in the bladder-wall are either entirely cured or are permanently improved. To lock up unhealthy ammoniacal urine in a bladder that cannot properly empty itself after a lithotomy is to court the formation or recurrence of a phosphatic stone. Hence it is well suited to some cases of recurrent calculus. I have never known the wound to remain unhealed, except in those instances where, for some reason or other, it has been desired to construct a low-level urethra, as in an instance I have recorded elsewhere. It is well adapted for some cases of stone in the bladder complicated with stricture in the deep urethra, as it enables the surgeon to deal with both at the same time. Nor does it expose the patient to the risk which may be attendant where lithotomy is performed with a weakened or permanently damaged urethra."

Choice of Operation.—No single operative method is applicable to all cases of stone. Each case presents its own special conditions on which the surgeon will base his decision, but, although the conclusions reached by different operators will vary somewhat, there is in the main a fairly general agreement as to the choice of operation.

It would take too much space to follow the numerous discussions of various writers on this subject; the author therefore begs leave to present briefly the more important factors which, in his opinion, determine the choice of method. These arrange themselves as follows:

- I. Mortality;
- II. Permanency of results;
- III. Injury done to the parts;
- IV. The presence of complicating disease;
- V. The condition of the bladder and urethra;
- VI. Size and consistency of the stone (foreign bodies);
- VII. The relative proficiency of the operator in the different methods;
- VIII. The duration of anesthesia.

The *mortality* of all stone operations increases with each decade after puberty, and is much greater after fifty years of age and least under fourteen, as will be seen from the three following tables and estimates from various sources, taken from a compilation by Cabot in 1893:

Suprapubic Lithotomy.

Operator or reporter.	Children.				Adults.				Old men.			
	No. of cases.	Recov-ered.	Died.	Mortal-ity.	No. of cases.	Recov-ered.	Died.	Mortal-ity.	No. of cases.	Recov-ered.	Died.	Mortal-ity.
König . . . . .	..	..	..	..	1	1	..	..	4	..	4	
Werewkin	24	17	7	..	24	24	..	..	..	..	..
Assendelft	78	76	2	..	1	1	..	..	1	1	1	
Cabot . . . . .	..	..	..	..	1	1	..	..	6	5	1	
Tremaine	1	1	..	..	1	1	..	..	8	5	3	
Thompson . . . . .	..	..	..	..	..	..	..	..	..	..	..
Guyon . . . . .	..	..	..	..	..	..	..	..	..	..	..
Mikulicz	3	2	1	..	..	..	..	..	..	..	..
Walker	3	3	..	..	..	..	..	..	..	..	..
Garcia	43	37	6	..	..	..	..	..	..	..	..
Recent foreign	55	42	13	..	..	..	..	..	..	..	..
Recent British	33	33	..	..	..	..	..	..	..	..	..
Total	240	211	29	12%	27	27	..	0%	19	11	8	42.1

Garcia, from a collection of 106 cases of all ages, calculates a death-rate of 24.4 per cent. ; Tuffier, from 120 cases without regard to age, has a death-rate of 27 per cent. ; Dulles found among 231 adults a mortality of 32.4 per cent., while among 132 children there was a death-rate of 21 per cent.

Litholapaxy.

Operator or reporter.	Children.				Adults.				Old men.			
	No. of cases.	Recov-ered.	Died.	Mortal-ity.	No. of cases.	Recov-ered.	Died.	Mortal-ity.	No. of cases.	Recov-ered.	Died.	Mortal-ity.
Freyer . . . . .	..	..	..	..	81	77	4	..	69	68	1	
Keegan	114	110	4	..	10	8	2	..	11	8	3	
Van der Veer . . . . .	..	..	..	..	15	15	..	..	7	7	..	
Kerr . . . . .	..	..	..	..	9	9	..	..	33	31	2	
Cabot ¹ . . . . .	..	..	..	..	34	32	2	..	68	57	9	
Mass. General Hospital	1	1	..	..	..	..	..	..	..	..	..
Total	115	111	4	3.5%	149	141	8	5.3%	188	173	15	8%

Guyon had a mortality of 5.2 per cent. in 647 cases of all ages ; Usigli calculates a mortality of 4 per cent. ; while Tuffier places it at only 3 per cent.

Perineal Lithotomy.

Operator or reporter.	Children.				Adults.				Old men.			
	No. of cases.	Recov-ered.	Died.	Mortal-ity.	No. of cases.	Recov-ered.	Died.	Mortal-ity.	No. of cases.	Recov-ered.	Died.	Mortal-ity.
Freyer	143	143	..	..	..	..	..	..	1	..	1	
Werewkin ²	147	138	9	..	..	..	..	..	1	..	1	
Cabot	3	3	..	..	..	..	..	..	1	..	1	
Mass. General Hospital	16	16	..	..	2	2	..	..	1	..	1	
Carrow	46	44	2	..	76	71	5	..	14	13	1	
Rivington . . . . .	..	..	..	..	1	..	1	..	3	3	..	
Total	355	344	11	3.1%	79	73	6	7.6%	19	16	3	15.7%

¹ One from bronchitis and pneumonia.² Seven fistulae.

Freyer gives the following rates of mortality after lateral lithotomy, arranged according to age; they are calculated from 987 cases occurring during the year 1883 in the Northwest Provinces of India:

Rate of mortality up to 20 years	5.1 per cent.
“ “ “ from 20 to 40 years	10.7 “ “
“ “ “ above 40 “	31.9 “ “

Rosenthal, from a collection of 400 cases, deduces the following rates:

Mortality from 1 to 5 years	3.5 per cent.
“ “ 6 to 11 “	2.1 “ “
“ “ 12 to 16 “	8.4 “ “
“ “ 17 to 29 “	15.7 “ “
“ “ 30 to 66 “	38.8 “ “

From these statistics we see that *in childhood*, judging the results as to mortality only, there is little to choose between lateral lithotomy and litholapaxy. The death-rate in each is but little over 3 per cent. Suprapubic lithotomy is more dangerous, with a death-rate of about 10 per cent. In adult life the death-rates alter somewhat in favor of litholapaxy. As the prostate and urethra enlarge, and the parts about the neck of the bladder become more vascular, the dangers incident to cutting through them increase. On the other hand, the increase in the size of the parts makes the performance of litholapaxy comparatively easy and safe. Suprapubic lithotomy keeps its place as a more dangerous operation than either.

The safety of median perineal lithotripsy, already described, is shown by the experience of Brig. Surgeon J. Forbes Keith of Delhi, India, which will be given later in his own words.

Chismore's remarkable series of 54 cases without a death in patients over fifty years of age, upon whom he operated by a modification of the old method of lithotripsy in repeated short sittings, calls for special attention.

Chismore's method differs from the old way of doing lithotripsy by short sittings in that he employs cocaine anesthesia, and limits the time of each sitting only by the occurrence of any grave symptom, such as exhaustion, bleeding of importance, faintness, etc. As the writer said, after hearing Dr. Chismore's paper in Washington in 1893: "This series of wholly successful cases in elderly men is too striking to be ignored, even though it is in direct contradiction to the unanimous verdict established by the adoption of Bigelow's litholapaxy and abandonment of the old method of repeated short sittings. Chismore's results are not enough to make us turn back from the new lithotripsy, but they are certainly suggestive. The absence of general anesthesia seems to be the element by which to explain this remarkable series of successful cases.

The rate of mortality in old age is overwhelmingly in favor of litholapaxy. While the danger attending all the cutting operations is increased very greatly, the mortality after crushing is very little higher than it is earlier in life. The fourth table and remarks are from a paper by Brig. Surgeon J. Forbes Keith of Delhi, India,¹ entitled "The Complete Abandonment of the Cutting Operations," and has for its chief object the advocacy of perineal litholapaxy, which, as stated, Harrison had already urged in 1888. Forbes Keith, however, introduces a radical modification with regard to the evacuation of the fragments: he proposes to do away in most instances with the evacuating pump, expelling the fragments instead by means of exciting contractions of the bladder by pressure above the symphysis or bimanual

¹ *Lancet*, Sept. 30, 1893.

manipulation. His large experience of favorable results by which he supports this method allows him to speak with authority. He does not class perineal litholapaxy with the cutting operations, probably because of the minimal amount of cutting done. The author thinks his position with regard to the other cutting operations is too extreme, for reasons to be given later. The following remarks and table are taken from J. Forbes Keith's article:

"Amongst lithotomes the first thing noticeable in the table is the enormous difference in the percentage of mortality amongst adults in comparison with that of children, whereas in the extension of the sphere of lithotrixy this contrast gradually but completely disappears; for of the 2 deaths which occurred amongst the 408 cases operated upon since Jan. 1st of this year, one was that of a young man about twenty and the other of a female child about five years of age, so that lithotrixy, according to the table, seems to tend toward an equilibrium of mortality amongst all ages and both sexes. The greater mortality amongst adults during the lithotomy period is assignable to three principal causes: 1. The insanitary state of the hospital, where erysipelas or gangrene, or both, attacked almost every adult who was operated upon, and amongst old men sloughing of the scrotum was common; but I have never seen a child or boy under fifteen years of age attacked by erysipelas after lithotomy. I have noticed an unhealthy discharge from the wound and a little swelling of the lower part of the scrotum, but only for a day or two, and this condition in the child never resisted treatment, as in the adult. The operation was performed in the adult just as well as in the child or boy, and they were both placed afterward under the same conditions. This immunity of children and boys under fifteen years of age must be attributed, therefore, to the fluids which bathe the vigorously developing tissues, forming a complete antidote to parasitic life. 2. Lithotrixy at first absorbed the most favorable cases, leaving the less favorable ones to lithotomy, still laboring under insanitary conditions. 3. The system of operating on all who came to hospital under these conditions would no doubt contribute a certain percentage of mortality, for the weak and infirm would be, theoretically, less able to ward off contagion. With lithotrixy, however, all this is changed. I have never seen erysipelas attack a case of lithotrixy, either urethral or perineal. Its causes of mortality were suppression of urine and peritonitis arising from inferior instruments and my inexperience; for when I at last obtained my new set of lithotrixy instruments I had a hundred cases without a death.

"From the time (1891) when perineal lithotrixy was introduced, together with the other methods described above, mortality began to rapidly decrease, and even to almost disappear, as will be seen on referring to the table. At the end of last year a death occurred, Case No. 569, and in July of this year another took place, No. 970. Excluding from these 15 females, there remain 386 males of all ages. If 172 children and boys under fifteen years of age be deducted, there remain 214 adults who were operated upon in succession without a death; and amongst children and boys under fifteen years I have at present, including the perineal lithotrities, the number of 338, and these are still increasing. The weights of the largest stones which have been successfully removed by the above methods are—73 over one ounce, 17 over two ounces, 8 over three ounces, 3 over four ounces, and 1 over seven ounces. A glance at the table will show the success which attended Keegan's extension of lithotrixy to children and boys under fifteen years of age. The number of operations which have been performed on this class of patients by eight different Indian surgeons is 663, with 18 deaths; the number performed by me, as will be seen from the table, is 503, with 4 deaths—giving a

total of 1166 operations with 22 deaths, or 1.9 per cent.; and if my 106 perineal lithotrities be added, I have performed 609 operations with 4 deaths. There lie in lithotrixy, therefore, an art and a potentiality which invite the enterprising surgeon to cultivate the one and to render practicable with proper instrumentation the possibilities of the other."

Table showing by statistical figures—(1) the abandonment of the cutting operations; (2) the extension of the sphere of lithotrixy; (3) the introduction of perineal lithotrixy; (4) and the comparative rates of mortality of the several operations.

	1889.			1890.			1891.			1892.			1893.			Grand total.		
	No.	Deaths.	Per cent- age.	No.	Deaths.	Per cent- age.	No.	Deaths.	Per cent- age.	No.	Deaths.	Per cent- age.	No.	Deaths.	Per cent- age.	No.	Deaths.	Per cent- age.
<i>Lithotomy.</i>																		
Men	91	14	15.3	54	6	11.0	15	5	33.0	3	1	33.0	..	..	..	163	26	15.9
Children under fifteen.	103	2	1.9	101	1	0.9	..	..	..	..	..	..	..	..	..	204	3	1.4
Women . . . . .	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Total	194	16	8.2	155	7	4.6	15	5	33.0	3	1	33.0	..	..	..	367	29	7.8
<i>Lithotrixy—Urethral.</i>																		
Men	11	2	18.0	50	9	18.0	50	5	10.0	130	3	2.3	208	1	0.4	449	20	4.4
Women	5	..	..	11	..	..	6	..	..	12	..	..	15	1	7.1	49	1	2.0
Children under fifteen.	..	..	..	..	..	..	165	2	1.2	186	2	1.0	152	..	..	503	4	0.7
Total	16	2	18.0	61	9	14.8	221	7	3.2	328	5	1.5	375	2	0.5	1001	25	2.5
<i>Lithotrixy—Perineal.</i>																		
Men . . . . .	..	..	..	..	..	..	40	2	5.0	7	1	14.0	4	..	..	51	3	5.8
Children under fifteen.	..	..	..	..	..	..	39	..	..	38	..	..	29	..	..	106	..	..
Total . . . . .	..	..	..	..	..	..	79	2	2.5	45	1	2.2	33	..	..	157	3	1.9
Grand total	210	18	8.5	216	16	7.4	315	14	4.4	376	7	1.8	408	2	0.5	1525	57	3.7

The relative proficiency of the surgeon in the different operations should have some weight, not in determining what is the best operation for stone in general, but what is the best one for him to select in a given case. Litholapaxy is by far the most delicate and difficult of all the methods, and should not be undertaken by any one who is not thoroughly familiar with the manipulation of instruments in the urethra and bladder. The experience of most surgeons is that of a marked diminution in mortality as they acquire skill in the practice of any operation, but this is strikingly true of litholapaxy: there are some surgeons who, though admirable operators in other fields, never acquire the peculiar dexterity necessary for a successful lithotritist.

Permanency of Result.—There is undoubtedly more liability to recurrence after litholapaxy than after the cutting operations, and this is the chief point of criticism of the operation. It is true that in elderly men with enlarged prostates it is not easy to be sure of removing the last fragments of stone after crushing, and it is quite possible to overlook a small stone in a case of multiple calculi. These objections are overcome in a certain number of cases if perineal lithotrixy be substituted for the usual urethral operation, but even so there will occur a number of cases in which the bladder cannot be examined digitally because of an elongated prostatic urethra due to prostatic hypertrophy; in such cases, therefore, the cutting operations have the advantage.

Injury to the Parts.—Litholapaxy's especial superiority to all other methods lies in the fact that it involves no injury to the parts; next in order in this respect comes perineal lithotrixy, as practised by Harrison and Forbes Keith: in this there is only the minimal injury involved in a perineal section; occasionally a fistula will result. Except for this, there is no injury done of the least consequence.

Lateral lithotomy injures the seminal ducts, which sometimes results in

sterility—a serious drawback before middle life; it also involves often an extensive incision of the prostate or injures the gland by bruising it—sources of grave danger in elderly persons. Occasionally also serious hemorrhage results from the operation.

The suprapubic operation causes no permanent injury, but the disturbance of the anatomical relations of the prevesical space at the time of operation sometimes leads to the serious consequences already described when speaking of the technique of the operation.

IV., V., and VI. may be considered together. The coexistence of *bladder-tumor*, *tuberculosis*, or *severe cystitis* makes it important to lay the bladder open for inspection and operative procedures and subsequent drainage, and in such cases litholapaxy is not to be selected, but the suprapubic route, which gives the opportunity for carrying out those maneuvers. Again, if there is *ankylosis* of the hip-joint in such a position as to interfere with the use of the litholapaxy instruments, the latter operation would not be selected. *Stricture* of the urethra, unless impermeable or requiring a long operation in order to overcome it, is not a contraindication to the performance of litholapaxy; it can be dealt with at the same time that the stone is attacked by divulsing or rapidly dilating it immediately beforehand, without increasing the risks of the operation. If there is a *trabeculated bladder* or if the stone lies in a deep bas fond behind a *projecting prostate*, the outgrowths of which so fill the bladder or shelter the stone that it cannot be readily grasped by the lithotrite, the operation of litholapaxy may become impossible or too difficult to make it wise to attempt. *Encysted stone* necessitates a cutting operation. If under these conditions the suprapubic operation is decided upon, it should not be forgotten that the diverticulum in which the stone lies is very likely to have thin walls, and that, under the force of a large injection, the bladder might readily be ruptured at that point.

The choice of operation may be briefly summarized as follows: Litholapaxy is the operation of choice for the removal of vesical calculus in all except the following conditions: (a) When the stone is too hard to be crushed by the instruments capable of being used through the urethra; when this is the case median perineal lithotripsy with the more powerful lithotrites that can be used in that operation after the manner described by Harrison and Forbes Keith in the case of adults, and lateral perineal lithotomy in patients under puberty, are to be preferred. (b) When the stone is too large to be grasped and successfully crushed or to be removed by the lateral perineal operation without injury. In that case the suprapubic operation, incising the perineum after Rydygier's method if necessary to accomplish the removal without bruising or lacerating, or else by fragmenting the stone if it can be seized by strong forceps and taking it away piecemeal. (c) In elderly patients with prostatic hypertrophy and small contracted bladders or those with deep bas fonds, making it difficult to seize the stone and its fragments, then select the median perineal lithotripsy. (d) When the stone is encysted choose the suprapubic method. (e) When there is a tight or impassable urethral stricture, requiring a long operation to overcome, select the median perineal operation or the suprapubic. (f) When there is ankylosis of the hip-joint in such a position as to embarrass the movements of the litholapaxy instruments and to make lateral lithotomy impossible, the suprapubic operation is then to be chosen. (g) When foreign substances which cannot be crushed with the lithotrite form part of the stone, the cutting operations must be used. (h) In all cases in which litholapaxy would require prolonged anesthesia, and in which it is undesirable, the shorter cutting operations are to be preferred.

DISEASES OF THE URETER.

BY CHRISTIAN FENGER, M. D., WITH THE COLLABORATION OF
S. C. STANTON, M. D.

ANATOMY.

THE ureter is a cylindrical muscular canal, in the living subject probably contracted to some extent, with a rather uniform diameter of 3–4 mm. throughout its entire extent from the pelvis of the kidney to the bladder. It varies in length from 28–34 cm., according to Henle; 25–31 cm., according to Tanquary, cited by Van Hook; and Tanquary states that it never exceeds 38 cm. Luschka gives the length of the ureter as 27 cm., and Kelly states that it varies from 25–30 cm.

Its course is straight or slightly curved as it passes down from the kidney, and its direction is somewhat oblique, toward the median line. The curve described is sigmoid; above the small pelvis the slight convexity is toward the median line, while the pelvic portion is more strongly curved, almost the arc of a circle (Tanquary), with its convexity directed toward the lateral wall of the pelvis until it finally reaches the neck of the bladder, the wall of which it penetrates so obliquely that it runs for $1\frac{1}{2}$ –2 cm. between the muscular and mucous coats (Cabot). In the male it crosses the vas deferens on the posterior wall of the bladder; in woman it crosses the cervix and enters the bladder at a point midway between the meatus urinarius and the cervix.

Kelly gives a most valuable and minute description of the regional anatomy of the ureters. The ureter is divided into an abdominal and a pelvic portion by the bend over the common iliac artery about 3 cm. above the brim of the pelvis. The abdominal portion is 12–15 cm. long; the pelvic portion, 10–12 cm.

1. Abdominal Portion.—The abdominal portion may be divided into three parts—upper, lower, and middle. The upper is the most inaccessible portion for examination where it enters the pelvis of the kidney, as here it lies concealed by the ribs from 4– $4\frac{1}{2}$ cm. from the median line, and at about the same distance posterior to the anterior plane of the vertebral column. The middle part lies from $2\frac{1}{2}$ –3 cm. from the median line on the psoas muscle, and on a plane level with the anterior surface of the vertebral bodies. The ureter crosses the psoas obliquely till it reaches the common iliac artery at or just above its bifurcation, where it is about 3 cm. from the body of the sacrum. The course is thus obliquely downward and inward, with a slight inward convexity, and with always a marked convexity forward, due to its course over the psoas. The ureters lie in the loose cellular tissue back of the peritoneum, partly under the cæcum and the ascending colon on the right and the descending colon and sigmoid flexure on the left side. The abdominal portion of the ureter in its course over the psoas muscle is crossed by the ovarian or spermatic artery and vein, which descend into the pelvis along the outer border of the ureter. At the brim of the pelvis on the right side the ureter lies just behind the peritoneum, where it can be seen with

the ovarian or spermatic vessels. The peritoneum can be incised at this point and the ureter laid bare. On the left side the relations of the ureter to the sigmoid flexure and the rectum depend upon the length of the meso-sigmoid and the variable position over the brim at which the rectum enters the pelvis. Thus in one case the ureter may lie beneath the sigmoid vessels and in another directly behind the intestine. (If we try to expose the left ureter from the right side of the sigmoid mesentery, it is covered by the sigmoid vessels. If we try to expose it from the left surface of the sigmoid mesentery, it is directly below the peritoneum.) After traversing the psoas it crosses the common iliac artery obliquely above or at its bifurcation, and enters the pelvis minor. This is the third or lower part of the abdominal portion.

2. Pelvic Portion.—The pelvic portion of the ureter (see Figs. 158, 159) lies first to the inner side of the internal iliac artery. In woman it is again crossed by the ovarian vein and artery, which pass over its anterior surface and leave it at an acute angle just above the inner border of the iliopsoas. In man the spermatic vessels do not cross the ureter a second time on the way to the inguinal canal, but diverge more and more from it. The ureter now descends to the floor of the pelvis in a forward direction. In woman it is crossed by the uterine artery, which passes over its anterior or upper surface at a right angle on its way inward from the internal iliac to the neck of the uterus. The ureter here passes through the base of the broad ligament along the upper lateral vaginal wall, and finally curves in over the anterior vaginal wall, following its uppermost converging folds, and terminates in the bladder, where the two ureteral orifices are connected by the inter-ureteral ligament.

Hallé and Tanquary have pointed out that in normal subjects the canal is narrowed in three places—namely, (*a*) at a point between 4 and 7 cm. from the pelvis of the kidney; (*b*) at the junction of the pelvic and vesical portions; and (*c*) at the place where it crosses the iliac artery, found in three out of five subjects. These localities correspond with the places where small stones from the kidney have been found to be arrested. The canal is not absolutely uniform in caliber throughout its entire course. When injected it is not of uniform caliber, but is always dilated, spindle-shaped in some places, so much so that the wider portions may be more than double the mean width of 6 mm. (Luschka).

The ureters are located in the retro-peritoneal tissue, surrounded by a layer of loose fat in well-nourished individuals (Luschka).

The wall of the ureter, according to Luschka, is 1 mm. thick and consists of three layers: (*a*) external, consisting of connective tissue rich in plastic fibers; (*b*) a double layer of organic muscular fibers—namely, an external layer of circular fibers and a thicker, internal layer of longitudinal fibers; (*c*) mucous membrane, easy to isolate from the muscular layer, rich in vessels, presenting longitudinal folds in the empty ureter, but perfectly smooth when the ureter is distended. Microscopical examination reveals neither papillæ nor glands. The epithelium is 0.05 mm. thick, and consists of nucleated cells of different shapes—namely, round and polygonal, cone-shaped and cylindrical, so arranged as to fit into each other.

Margarucci made researches regarding the circulation in the ureter from injection of the vessels in dogs. He found that the ureter has an artery on each side coming from the renal artery and running along the wall of the ureter almost to the bladder. From these two main arteries the branches perforate the wall of the ureter to supply the mucosa. If the injection is

made through the hypogastric artery, the vessels of the bladder are filled, but the injection mass goes from the bladder up on the ureter for only a very short distance; consequently the ureter has its own vascular system from the renal artery, and has no important anastomoses with any of the arteries of the surrounding organs. This fact explains the possibility of isolating the ureter for a great distance without causing necrosis. Monari, as a result of injections on the cadaver, found that besides the main ureteral arteries coming from the renal artery, important arterial branches also come from the spermatic arteries, and that the arteries from these two sources supplement each

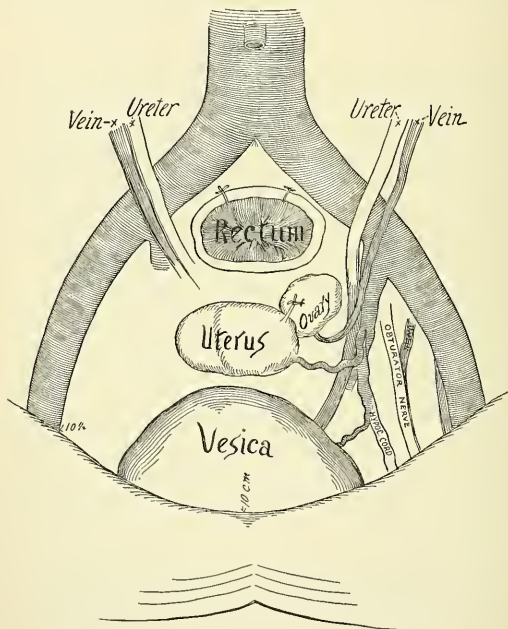


FIG. 158.—Pelvic portion of the ureter from below (Kelly).

other, so that if, as seldom takes place, the branches of the renal arteries are small, the branch from the spermatic artery is extremely well developed. Branches from the vesical arteries extend only to the extreme lower end of the ureter. It is thus evident that the ureter has its own circulation independent of the surrounding organs, which permits of extensive isolation without necrosis.

Glanteny gives an admirable description of the relations of the ureters to the surrounding organs. He thus describes the pelvic portion of the ureter:

The *pelvic portion* consists of an upper parietal and fixed part and a lower visceral and more movable part.

The *parietal part* is covered with peritoneum where it crosses the iliac vessels, lying behind the ileum on the right side and the sigmoid flexure on the left, passes down over the pyramidalis and obturator internus muscles, from which it is separated by the pelvic fascia, and is here crossed by the obturator and umbilical arteries, branches from the hypogastric.

The *visceral part* leaves the lateral wall of the pelvis to pass toward the trigone of the bladder. In man it is crossed on the anterior surface by the vas deferens and deferent artery, and then lies close to the base of the seminal vesicle on its anterior surface, and enters the wall of the bladder above the

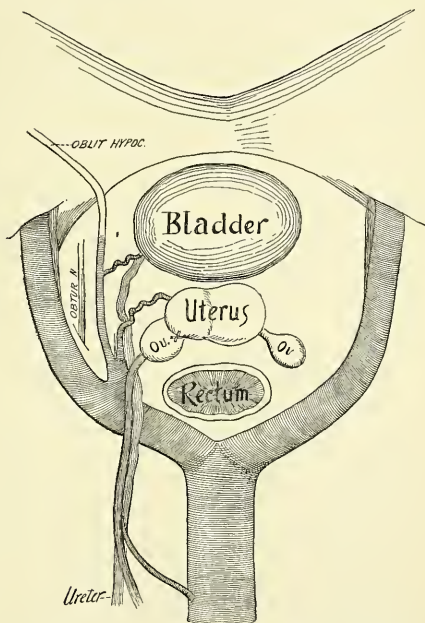


FIG. 159.—Pelvic portion of the ureter from above (Kelly).

prostate. It crosses the wall of the bladder obliquely, running in the wall for 2 cm.

The ureters open into the bladder near each upper corner of the vesical trigone, sometimes at the top of a little round prominence, sometimes on an oval prominence, sometimes in a depression. The distance between the two ureteral openings varies from 2–6 cm.

In passing down from the large to the small pelvis the left ureter lies between the vertebra and the psoas muscle, while on the right side, on account of the inferior vena cava, the ureter is situated a little more laterally.

Surgical Anatomy.—The relation of the ureter to the peritoneum is an important consideration in the surgical anatomy of the ureter. This was first

carefully studied by Cabot, who pointed out that in extra-peritoneal operations, especially in fat subjects, it is extremely difficult to find and recognize the ureter in the deep wound, unless guided, for instance, by the presence of a stone. The ureter is adherent to the peritoneum, and always follows it when it is stripped up from the parts behind. This fact has been occasionally mentioned before by Crampton, Twynam, and others, but the condition was not studied until Cabot made microscopical sections of the ureter and peritoneum, and demonstrated that the ureter is bound to the under surface of the peritoneum by fibrous bands.

Cabot further pointed out that the relation of the ureter to that part of the peritoneum which is adherent to the spine is rather constant, the ureter being situated just external to the line of adhesion. Therefore, when the operator has stripped up the peritoneum and reached this point, he will find the ureter on the stripped-up peritoneum a little external to it. On the left side the distance from the line of adhesion to the ureter is from 1-2 cm., while on the right side the distance is somewhat greater, owing to the outward displacement of the ureter by the interposition of the vena cava inferior between it and the spine.

Monari studied on dogs the question of the extent to which the ureter could be isolated from the surrounding connective tissue without necrosis, and found that isolation for 12-13 cm. did no harm, provided it was carefully brought into contact again with the tissues from which it had been isolated, and at the same time when trans-peritoneal isolation was made covered with a flap of peritoneum. When these precautions were not taken there was danger of necrosis of the wall of the ureter, as was proven by the following experiment: He isolated the ureter, and kept it away from the surrounding tissues by packing a layer of gauze around it. If isolated for a distance of only 6 cm., necrosis and extravasation of urine followed.

As a guide in the palpation of the ureter on the living subject in examination for stone, dilatation or extravasation consequent upon rupture, the following landmarks are given by Tourneur, cited from Tuffier: The course of the abdominal portion of the ureter in the large pelvis corresponds to a vertical line erected upon a point at the junction of the internal and middle thirds of Poupart's ligament. Tourneur considers its direction vertical from the border of the kidney down to the small pelvis, over the brim of which it passes $4\frac{1}{2}$ cm. from the median line. The exact location of this point is the intersection of a horizontal line drawn between the anterior superior iliac spines and a vertical line passing through the pubic spine. At this point, under favorable circumstances, a dilated or tender ureter may be felt by gentle, steady pressure backward upon the abdominal wall until the resistant brim of the pelvis is reached.

The vesical portion of the ureter can be palpated in man through the rectum. Guyon has called attention to the exquisite sensitiveness of this portion of the ureter upon rectal exploration in cases of stone, even when located high up. In woman vaginal examination permits the palpation of the ureter to an extent of 4-7 cm., as it runs in the broad ligament in close relation to the upper wall of the vagina (Cabot).

Access to the ureter is gained by two different routes, the trans-peritoneal and extra-peritoneal.

By means of a median or lateral abdominal incision the entire course of the ureter can be reached with comparative ease, but intra-peritoneal operations upon a ureter wherein the urine is not absolutely aseptic should not be undertaken if an extra-peritoneal operation is possible, on account of the

danger of peritonitis. This is well illustrated by the trans-peritoneal ureterolithotomy performed by Cullingworth, whose patient died from peritonitis.

On the other hand, abdominal examination for diagnostic purposes, to locate a stone or a para-ureteral urinary infiltration following rupture, has been of value when followed by extra-peritoneal operation, as evidenced in the cases of stone operated upon by Hall and Arbuthnot Lane, and in the cases of rupture reported by Page and Allingham.

Extra-peritoneal access to the ureter is technically much more difficult, because of the depth of the wound, but as by it the danger of peritonitis is avoided, it is on the whole preferable. The upper two-thirds of the ureter—that is, the abdominal portion and the portion which extends over the brim of the pelvis—can be reached by a continuation of the ordinary oblique incision for lumbar nephrotomy, from the twelfth rib at the outer border of the erector spinæ down along and 2 cm. anterior to the anterior superior spine of the ilium, and along Poupart's ligament to the outer border of the rectus.

The lumbar portion of the ureter is accessible through any of the varieties of the lumbar incision for access to the kidney. When the kidney is denuded from its adipose capsule, we search for the pelvis and the ureter below its posterior surface. Glantenay gives the advice to rotate the kidney a little around its pedicle by lifting the lower end of the kidney upward and outward, instead of pulling the whole organ into the wound. The ureter must be searched for by separating the loose adipose tissue which surrounds it, and, while it is easy to find a dilated or thickened ureter, it may be difficult to find a normal one.

Cabot thinks it would be possible in a very thin subject with lax abdominal walls or in children (Twynam) to gain access to the ureter down to within an inch or two of its entrance into the bladder by extra-peritoneal incision, but on account of the depth of the wound in this place operation would be difficult.

The lower pelvic portion of the ureter can be reached by the sacral operation—an incision lateral to the sacrum, as proposed by Delbet—or better by Kraske's operation, or the osteoplastic resection of the sacrum, as proposed by Cabot, who made investigations on the cadaver and found ample space for careful inspection and operation. However, Reynier in attempting to extirpate the lower pelvic portion of the ureter through a pararectal incision found the prostate and seminal vesicles easily, but was unable to find the ureter.

The pelvic portion of the ureter may be reached by the rectal, vaginal, perineal, sacral, iliac, and hypogastric routes. Of these only the sacral, iliac, and hypogastric really come into question. Glantenay believes that the sacral route may be preferable to the iliac in women, as it is easier to avoid the uterine artery and as the conditions for drainage are good.

In women the lower pelvic portion of the ureter can be reached through the vagina. Ureteral fistulæ opening into the cervix and vagina have been operated upon, and stones in this portion of the ureter have been removed by Emmet when situated low down close to the vesical orifice, and by Cabot when located higher up in the broad ligament, close to the cervix uteri. Kelly has extirpated the lower pelvic portion of the ureter through a wound in the vaginal vault.

The vesical portion of the ureter can be reached by suprapubic cystotomy.

MALFORMATIONS AND ANOMALIES.

It is well to remember the variations in the upper end of the ureter, as pointed out by Hyrtl. In the first variety there is no pelvis, but the ureter divides into two branches without dilatation at the point of division, each branch having a caliber a little larger than that of the ureter. In the second variety there is a pelvis—that is, a funnel-shaped dilatation at the point of division. The upper portion is the smaller and terminates in three short calyces; the lower and more voluminous portion terminates in four or five calyces. In the third variety there is only half a pelvis—that is, the lower branch divides and is funnel-shaped, forming a narrow pelvis which terminates in one, two, or three short calyces, while the upper is not dilated and extends to the upper portion of the kidney as a continuation of the ureter. The ureter not uncommonly divides far below the kidney, between the kidney and the bladder; sometimes there is no division at all, and two separate ureters enter the bladder.

There is one variation in the point of entrance of the ureters into the bladder which is of especial practical importance—namely, those cases, few in number, in which the ureter, instead of entering the bladder high up or low down, posterior to the sphincter of the urethra, opens into the latter at or near its external orifice, or even into the vagina (Sechevron). This anomaly causes a congenital partial incontinence of urine, for the relief of which operation has been performed with success.

The details of malformations and anomalies of the ureter have been studied by Carl Schwarz, who classifies abnormalities of the ureter as follows:

A. Double Ureter with Normal Termination.—Double ureter with normal termination is rather common (Weigert, 10 per cent.; Boström, 3 per cent.; Poirier, 4 per cent.). The ureters originate from separate pelves, and consequently double ureter means double pelvis. The double ureters either unite before they reach the bladder (incomplete duplication) or reach the bladder separately (complete duplication). The condition is unilateral or bilateral. By separate termination in the bladder the ureter from the upper part of the kidney will enter the bladder lower down than the ureter from the lower part. If one division of the double ureter is or becomes impermeable, atrophy or cystonephrosis of the corresponding territory of the kidney follows.

Visconti describes a case in which the right kidney was double the natural size and had a double ureter, and in which the left kidney was absent. He says that “when there is only one kidney, it is usually right-sided; the left kidney is absent.”

B. Abnormal Termination of the Ureter.—1. Open termination inside of the male genito-urinary organs. The ureter may terminate—

(a) In the bladder, with narrow opening in the territory of the sphincter vesicæ;

(b) In the urethra, always in the prostatic portion, behind or at the side of the caput gallinaginis, usually with a small opening. A small opening signifies stenosis, and is followed by dilatation above. No ureter was ever seen to terminate in man outside of the sphincter urethræ;

(c) In the seminal vesicle, ejaculatory duct, or vas deferens.

As the abnormal termination is almost always so arranged that the passage of the urine is not free, we find the consequences of chronic retention—namely, dilatation of the ureter and pelvis and cystonephrosis. The cyst-

tonephrosis is partial in cases of double ureter, and is always located in the upper portion of the kidney, as the ureter from this portion is the one which has a termination outside of the bladder. When the ureter terminates in the seminal passages, there is usually a localized dilatation of the ureter on or in the wall of the bladder, where it forms a cystic tumor which protrudes into the bladder.

Of 23 cases of open termination inside of the male genito-urinary organs, 10 were of single and 13 of double ureter, which terminated 3 times in the bladder, 10 times in the urethra, and 10 times in the seminal passages.

2. Open termination in the female genito-urinary organs. The ureter may terminate—(a) in the urethra; (b) in the vagina; (c) in the vestibule; (d) in a persistent Gärtner's duct.

The ureter may enter the wall of the bladder in the normal place, but instead of opening in the bladder may pass along in the wall until it finally opens in the urethra, or it may run along over the fornix for some distance before it enters the urethra. In cases of this kind, where no incontinence is found, and where, consequently, some part of the muscular apparatus acts as a sphincter for the ureter, there are always stenosis and dilatation above, either localized, forming a sac close to the bladder, or diffused through the whole territory. This is also sometimes found when the ureter terminates in the vagina and vulva. In 23 collected cases belonging to this class the termination was 5 times in the urethra, 6 times in the vagina, 11 times in the vulva, and once in a persistent Gärtner's duct.

3. Blind termination of the ureter. This usually congenital anomaly is found in single as well as in double ureters, and we have here to consider both the place and the manner of the blind termination, as well as its consequences. The ureter usually terminates in the wall of the bladder, but sometimes in the muscularis and sometimes in the submucosa. On examination of the bladder we find, instead of the ureteral orifice, a flat or rounded cystic, thin-walled tumor which extends out over Lientaud's triangle, and, when large enough, may compress the opening of the other ureter and fill up and close the entrance to the urethra. If this local termination of the abnormal ureter does not protrude into the bladder, it forms a cystic tumor on the outer wall of the bladder, and may form a prominence in the anterior vaginal wall.

As to the consequence of the anomaly in this class of cases, we find local or total uniform sacculated dilatation of the ureter, local or total cystonephrosis, sometimes of enormous size, or we find a small, atrophic, non-dilated kidney. In cases in which the dilated ureter protrudes into the bladder and compresses the urethra or the opposite ureter there will be stasis and dilatation of the other ureter and kidney, and excentric hypertrophy of the bladder. In 23 collected cases 15 were single and 8 double ureters, and in 5 cases death resulted from the consequences of the anomaly.

Orthmann narrates a case of "bifurcation" of the left ureter in a nullipara of twenty-seven years. The "second branch" terminated in a dilated cul-de-sac, forming a tumor of the size of a hen's egg on the anterior wall of the vagina, not communicating with the bladder. The tumor was extirpated.

4. Termination of the ureter in the rectum and cloaca (Schwarz). This anomaly was found only in non-viable fetuses and possesses no practical importance.

For explanation of the anomalies described above it is necessary to recall the embryological development. The ureter originates as a process branching off from the lower end of the Wolffian duct, growing from this point up into

the kidney, and opening, together with the Wolffian duct, into the uro-genital sinus. By dilatation of the latter the two ducts separate, and the ureter comes to be located at a distance anterior to the Wolffian duct, which in man develops into the seminal passages, and in woman is obliterated or leaves a rudiment only, Gärtner's duct. If the ureter does not separate from the Wolffian duct, but remains a branch of the latter, the ureter will terminate in the seminal passages in man, and in woman in Gärtner's duct (one case on record). If the ureter separates from the Wolffian duct, but does not move up into its normal place on Lieutaud's triangle, we will have an abnormal termination low down in the prostatic portion of the urethra. If the ureter separates from the Wolffian duct without opening into a hollow organ, a blind termination results. If the ureter, instead of moving forward into the anterior portion of the cloaca, remains at its original location in the posterior portion, we find the termination of the ureter in the rectum. Double ureters originate either as a double branch from the Wolffian duct or as a single branch which later divides.

Symptoms and Diagnosis.—It is almost impossible to make a diagnosis of an anomalous termination of an ureter in the bladder, seminal vesicles, ejaculatory ducts, and male urethra unless perhaps by means of the cystoscope; and such a diagnosis has not yet been made. On the other hand, it is possible to recognize the abnormal termination of an ureter in the uro-genital system of women, and the ureters with blind terminations. The first of these conditions is characterized by a certain form of incontinence when the ureter terminates on the distal side of the sphincter of the bladder. It is an incontinence—that is, an involuntary, steady dribbling of urine, interrupted at certain intervals by a voluntary discharge of urine; in other words, the urine from the kidney with the abnormal ureteral termination is discharged continually (incontinence), while the urine from the kidney with the normal ureteral termination is discharged voluntarily at the usual intervals. A careful examination of the genital organs reveals a small opening in the vulva, vagina, or urethra from which the urine continually dribbles out. When a probe is passed into this minute opening it passes into a canal which does not communicate with the bladder. In three of the cases on record there was a sacular dilatation of the ureter, from the size of a pigeon's egg to that of a fist, a short distance above its termination. Such a sac might easily be mistaken for a second or double bladder.

The ureters with blind terminations may, if the lower end is dilated to a cyst or sac, be recognized by the protrusion of the sac into the bladder, or even into the female urethra. Digital examination or exploration may reveal their presence. A one-sided hydronephrosis, corresponding to the occluded ureter, will aid in the diagnosis. As yet, however, a correct diagnosis has not been made, but the knowledge of the anomalies above described may make a diagnosis possible in the future.

Treatment.—The abnormal termination of open ureters in the uro-genital apparatus in man will probably never be diagnosed, and consequently not be an object of treatment. The same may be said of open ureters terminating in the rectum, as this anomaly has been found only in non-viable fetuses. On the other hand, the abnormal termination of the ureter in the vulva, vagina, or urethra in woman has already often demanded surgical interference, with the object of curing the incontinence. The operation has for its object the direction of the abnormal ureter into the bladder as near as possible to the normal place, and the exclusion of the distal end of the ureter from the passage of urine.

The following methods have been used or proposed :

(1) *Epicystotomy*—implantation of the ureter in the posterior wall of the bladder and obliteration of the peripheral end. Tuffier performed epicystotomy and inserted a sound in the aberrant ureter, pushing its end so as to make it protrude into the bladder. From here he cut down upon it, making a longitudinal opening into the ureter. He then excised a piece of the peripheral stump, and cauterized the remainder with the Paquelin canterly. The upper end of the ureter was so well fixed in the bladder-wall that no further suturing was needed to secure it. Recovery.

Baum performed suprapubic cystotomy. In the bladder he found the two ureteral openings in their normal place. The third ureter was injected with water, and a dilatation the size of a pigeon's egg showed in the bladder below the opening for the right ureter. He made an incision intending to enucleate the third ureter, divide it transversely, and implant the central end into the bladder. This did not succeed, because the saccular dilatation was too large and thin-walled and the hemorrhage considerable. He then cut out a piece of the sac to make a large round opening into the third ureter, and sutured the margins of the opening with silk. On the distal side of the sac he ligated the third ureter and brought the knot out into the vagina. He then closed the wound in the bladder with a double row of silk sutures. Healing followed in four weeks. Five and a half months later a stone came out; the patient had a ventral hernia. The evacuation of urine remained normal.

(2) *Excision of the distal end of the abnormal ureter*—vaginal implantation of the proximal end into the bladder. The vaginal implantation, as probably the safest method, was chosen by Davenport in the following case: Woman, aged twenty-nine years; incontinence of urine from early childhood, due to malposition of the ureter. Incontinence increased by menstruation and pregnancy. One ureter was found in the vesico-vaginal septum, running forward, its orifice being close to the external orifice of the urethra. Operation for displacement of ureter and implantation of its orifice into the bladder. Recovery.

Baker isolated the peripheral end of the ureter from its termination in the vagina and implanted it into the bladder through an opening 1 inch from the neck of the bladder, suturing the vaginal mucous membrane over it. Recovery.

(3) *Extra-peritoneal isolation of the abnormal ureter and the bladder* through a convex subpubic incision, and resection of the lower border of the symphysis. Through this wound the ureter is isolated and its central end implanted into the bladder. Colzi reports one successful case.

(4) *Uretero-cystostomy*—a communication opening between the bladder and the dilated portion of the abnormal ureter. Wölfler effected this with apparent success by means of a special instrument analogous to or constructed on the plan of Dupuytren's enterotome.

Bois (d'Aurillac) reports the following case: Congenital incontinence of urine, although the bladder acted regularly. Fine canal in left wall of urethra, from which urine continually dribbled. A probe at this point passed into the left ureter. Division with tenotome of wall between ureter and bladder; opening kept open by bougies. Closure of the peripheral end of the ureter was postponed on account of pregnancy.

Criticism of the Methods.—Epicystotomy and implantation of the ureter in the posterior wall of the bladder, although successfully performed by Tuffier and Baum, is a more grave operation than the vaginal implantation. The same may be said of the extra-peritoneal implantation with par-

tial resection of the symphysis, as successfully performed by Colzi. To make a direct communication opening between the dilated ureter and the bladder, as done by Wölfler and Bois, is technically difficult. Thus the operation from the vagina is probably the safest method, and should be first attempted. If unsuccessful, one of the other methods might be resorted to.

Operation for blind termination of the ureters, when this condition can be diagnosed and the sacular dilatation protruding into the bladder causes retention of urine by occluding the posterior opening of the urethra, should be made on the plan of making a large communication opening between the bladder and the sacculated ureter by excising a large portion of the wall of the sac. This may be done in woman through the dilated urethra; in man by suprapubic cystotomy.

EXAMINATION.

Palpation.—1. Palpation through the vagina. Howard Kelly states that the ureter can be palpated through the anterior vaginal wall from its terminus in the bladder to the point where it passes beneath the broad ligament. It can be rolled in the loose connective tissue under the index finger or often bimanually between two fingers, or in advanced pregnancy on the head of the child, like a narrow tape or flattened cord without hardness. It must not be mistaken in this position for the obturator artery and nerve, or the upper border of the levator ani, or fibers of the obturator muscle, or the brim of the obturator foramen. A diseased ureter when nodular and thickened is apt to be mistaken for a cellulitis or adherent ovary.

When the ureter, whether diseased or not, is pressed upon or manipulated by palpation, it is characteristic that the patient complains of an intense desire to urinate. One patient in whom Kelly persisted in making the examination was forced to urinate on his hand.

2. Palpation by the rectum. An enlarged ureter can be palpated up to the brim of the pelvis in both man and woman through the rectum. (Stones have been felt here.) In woman the finger is brought up behind the broad ligament, and the ureter can be followed from this point up over the posterior pelvic wall. As an aid in the palpation of a normal ureter from the vagina and rectum Kelly has introduced a ureteral catheter or bougie and carried it up over the brim of the pelvis, whereby the catheter can be felt and alterations in the caliber of the ureter readily detected.

Kelly's landmark for the upper portion of the pelvic ureter is the internal iliac artery, which can readily be felt per rectum. In some individuals the artery can be palpated up to the common iliac, close along the inner side of which the ureter, if diseased, can be felt. If nothing is felt, it is safe to conclude that the ureter is not enlarged.

3. Palpation through the anterior abdominal wall. From the abdominal wall the ureter can be felt for 5 or 6 cm. from the brim of the pelvis up toward the kidney. A normal ureter can be thus palpated when it contains a catheter, and a diseased ureter when thickened.

4. Abdominal palpation of the ureters by surface landmarks is less satisfactory than palpation from below. Kelly's method consists in locating the promontory of the sacrum by pressure through the abdominal wall, and from this point locating the place where the ureter enters the pelvis—namely, 3–3½ cm. external to and a little below the promontory (see Figs. 160, 161). Here the fingers recognize the location of the common iliac artery, and the ureter which crosses it at this point can be felt when enlarged and when the

abdominal walls are thin. The patient complains of pain, and often of a desire to urinate, when the diseased ureter is touched.

5. Palpation of a thickened pelvic portion of a ureter after incising the vault of the vagina. Through this incision Kelly was able to follow the diseased ureter up to the posterior wall of the pelvis.

6. Palpation of the ureter through an abdominal incision. The ureter can be palpated directly by this means throughout the whole of the abdominal portion, and the upper 4 or 5 cm. of the pelvic portion for the detection of stones, tuberculosis, etc.

1. Various methods have been employed to determine disease of one kidney and presence or functional ability of the other:

Lawson Tait and Thornton: Exploratory laparotomy to determine exist-

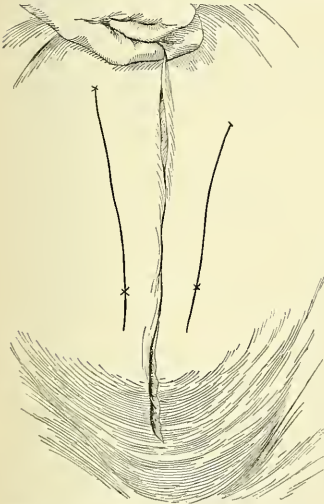


FIG. 160.—Course of ureters on skin of abdomen (Kelly).

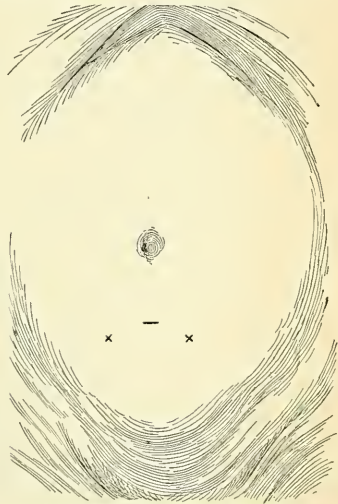


FIG. 161.—Landmarks on the skin for the transit of ureters from abdomen into pelvis (Kelly).

ence, size, etc. of the other kidney in case of nephrectomy. This method is uncertain in fat persons (König).

Fenger: Lumbar exploratory incision for palpation of the other kidney during nephrectomy for malignant disease.

Czerny: Exposure of the ureter by lumbar incision on the diseased side, temporary closure of the ureter, cleansing of the bladder, examination of bladder urine from the other kidney.

Gluck: The same as Czerny, but he gives the patient iodide of potassium. If iodine is found in the urine, the other kidney is present.

Iverson: Suprapubic cystotomy and catheterization of the ureters.

Hegar: In woman laying bare the ureter through an incision in the anterior vaginal fornix and temporary ligature.

Emmet: In woman incision into the bladder from the vagina, and catheterization of the ureters through this opening.

Harrison: Opening the bladder by a perineal section, through which he sees the ureteral opening and introduces a catheter. This method has been practised on cadavers only.

Silbermann: Quicksilver balloon in the bladder to compress the ureter.

Tuchmann: Ureteral forceps shaped like a lithotrite, introduced through the bladder.

Hegar and Sanger: In woman feel the ridge of the ureter through the vaginal fornix and pass a threaded needle around it for temporary ligature.

Ebermann: Compression of the ureter between forceps, one blade in the rectum and the other in the bladder.

Weir: Compression of the ureter from the rectum against the bones of the pelvis.

Sands: Compression of the ureter by the finger in the rectum.

2. To determine the presence of stone or obstruction.

Exploration of the ureter by sound or bougie from the pelvis of the kidney after nephrotomy, pelviotomy, or longitudinal ureterotomy.

Exploration of the ureter from the bladder by ureteral sound or bougie.

Catheterization of the Ureter.—1. *Direct Method.*—Catheterization of the ureter (see Fig. 162) has reached a state of practical usefulness by direct

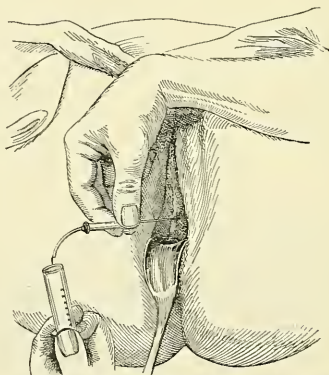


FIG. 162.—Catheterizing the ureters, one catheter (Kelly).

methods, but especially in woman, on account of the ease of access to the vesical opening of the ureter in the female. Pawlik was the first to put this procedure in extensive practice. He has employed it since 1881, using the knee-chest position without inspection of the bladder. Pawlik was followed by Newman, who employed an electric lamp through Simon's tubular speculum. The method has now been made practical chiefly through the arduous work of Howard Kelly in woman and Nitze, Casper, and others in man.

Strictures of the ureter and accumulations of urine above the strictures have been successfully treated in this way by Pawlik and Kelly. Kelly made a diagnosis of stricture low down in the left ureter by catheterization. The patient was catheterized about six times at intervals of ten to twelve days, each catheterization being followed by marked exacerbation of the pain for a few days. The consequence, however, of the repeated catheterizations

was marked relief for several months. The symptoms finally returned, the ureter was opened from the vagina, and a small calculus removed from the ureteral orifice.

Pawlik mentions a case of pyonephrosis from Billroth's clinic in which he introduced into the ureter from the bladder a long elastic catheter with metal point, which passed through a stenosis of the ureter up into a cavity above. The patient had an abdominal fistula, the result of previous nephrotomy, and a probe passed through this fistula would touch the metal tip of the ureteral catheter. On attempting to withdraw the catheter the tip was caught in the stenosis and broken off, and Von Hacker removed it through the abdominal fistula.

Pawlik, cited by Albarran and Lluria, reported 2 cases of pyonephrosis in which this method was employed. In one case cure was effected after thirty soundings of the ureter; in the other the ureter was impermeable and nephrotomy had to be performed.

The treatment of tuberculosis of the bladder has been assisted by permanent catheterization of the ureters by Guyon, cited by Albarran and Lluria, who burned the tuberculous ulcers with the Paquelin cautery, packed with iodoform gauze, and was able to leave the ureteral catheters in place for nine days.

As regards leaving the catheter permanently in the ureter, Pawlik mentions a case of uretero-vaginal fistula in which a catheter was left in for seven days. Force was required to remove it, and it was found to be incrustated with salts.

Weil in a case of uretero-vaginal fistula caused by a pessary was enabled to stop the flow of urine by leaving a tube in the ureter for six days, when pain in the region of the kidney necessitated its removal.

A catheter left in the ureter for some time is apt to cause inflammation of the ureter, just as we find permanent urethral catheterization followed by inflammation of the urethra.

Poirier cautions against leaving a catheter in the ureter. He mentions a case of Segond's of exstrophy of the bladder wherein catheterization caused pyelonephritis, and a case of his own, in the service of Tillaux, in which, thirty-six hours after catheterization of the ureter, obstruction occurred, causing an attack of renal colic. He also cites the experience of Sinitzin, who was never able to allow a sound to remain for more than four hours, and concludes that the harmlessness of the procedure is not altogether beyond question.

Howard Kelly thus details his method of procedure in catheterization of the ureter in woman under direct inspection:

The following instruments are required for examination: A series of ure-



FIG. 163.—Ureteral searcher.

teral dilators, from 5–20 mm. in diameter; cylindrical specula with obturators of the same caliber (Fig. 164); a common head-mirror and lamp; a long,

delicate mouse-tooth forceps; a suction apparatus for completely emptying the bladder; a ureteral searcher (Fig. 163); and a ureteral catheter without handle (Fig. 165).

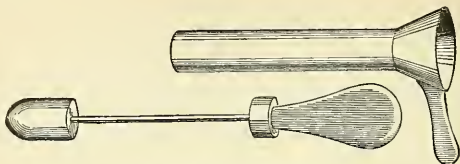


FIG. 164.—Speculum and obturator.

1. *Direct Method.*—The bladder is first emptied by the catheter. In order to determine the proper size of dilator to be used first, a calibrator can be pushed into the urethra and the corresponding dilator chosen. By introducing the dilators as they occur in the series, the average female urethra can easily be dilated up to 12 mm. in diameter, with only a slight external rupture. Kelly has never seen a tear more than 3 mm. in length and $1-1\frac{1}{2}$ mm. in depth, and he has not had to incise the meatus, as Simon did, to avoid extensive rupture. Kelly's metal dilators are double-ended, of a flattened sigmoid shape, each end representing a single dilator in the series. The points are conical. On the flattened area in the middle of each dilator the diameter is marked in millimeters. This also affords a convenient grasp. As soon as a dilatation of 12–15 mm. is reached, a speculum of the same diameter is introduced and its obturator removed.

The hips of the patient are now elevated 20–40 cm. above the level of the table. The specula are $9\frac{1}{2}$ cm. long, and each is provided with a conical mouth to assist in reflecting light into the bladder. The caliber is marked in millimeters on a little handle at the side of the speculum. Either artificial light or direct light from a window is sufficient for the head-mirror. When the obturator is withdrawn and the pelvis sufficiently elevated, the bladder becomes distended with air.

The urine remaining in the bladder is withdrawn by the suction apparatus, and what little urine still remains is removed by absorbent cotton on the forceps. The posterior wall of the air-distended bladder is 2–5 cm. distant from the anterior wall, and presents a whitish background with a network of vessels. The veins are darker in color than the arteries. The larger vessels coming to the surface from the deeper vessels divide stellately and anastomose. By moving the speculum by its handle the entire wall is successively inspected. The interureteric ligament can be seen as a slightly elevated transverse fold, sometimes of a different color. By turning the speculum thirty degrees to one side or the other the ureteral orifice can be

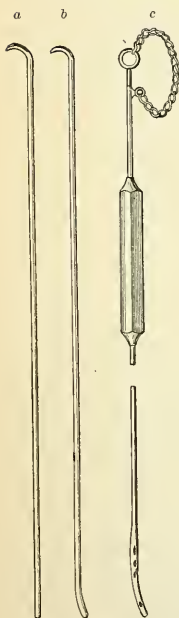


FIG. 165.—*a* and *b*, ureteral catheters without handles, for direct catheterization through speculum; *c*, ureteral catheter with handle sufficiently reduced in size to allow speculum to be withdrawn after catheter is engaged in ureteral orifice.

found and the characteristic jets of urine, normal or pathological, can be seen. The ureteral orifices and their surroundings are not constant in their appearance. Sometimes the orifice appears as a little dimple or little pit, or, in inflammatory cases, as a round hole on a cushioned eminence; at other times as a V with the point directed outward. Again, it may be scarcely visible, appearing as a fine crack in the mucosa, and occasionally is so obscure as to be recognized only by the jet of urine or by a slight difference in the color of the mucosa. Rarely it has the form of a truncated cone with gently sloping sides. The bladder mucosa is usually a little deeper in color around the ureter. Upon direct inspection the ureteral orifice appears to lie nearer the urethra than one would anticipate.

As an aid in locating the ureteral orifice a point is marked on the speculum $5\frac{1}{2}$ cm. from its vesical end, and from this point two lines are drawn



FIG. 166.—Left ureteral orifice exposed and searcher engaged (Kelly).

diverging at an angle of sixty degrees. The speculum is introduced up to the point of the V and turned to right or left until one side of the V is in line with the axis of the body. Then by elevating the speculum until it touches the floor of the bladder the ureteral orifice will usually be seen.

To determine the orifice of the ureter Kelly uses a searcher, a long, delicate probe with a bent handle, which is passed through the speculum into the suspected ureteral orifice, which when found permits the sound to pass up from 2-6 cm. The ureteral catheter is then passed. Kelly's ureteral catheters differ in shape from those of Pawlik in this respect, that they are straighter, and either have no handle or only a small one which will pass readily through a 10-mm. speculum. The catheter may be left in place some minutes or an hour or more. The urine which accumulates in the mean time in the bladder represents the discharge of the opposite kidney. Thus the urine of each kidney may be isolated by using only one catheter.

When the patient is placed in the genu-facial posture a higher degree of distention of the bladder takes place; the interureteric ligament is more sharply seen, but the ureters are not so plainly defined, as they are concealed by the outer extremities of the fold. The genu-facial posture is indispensable in some inflammatory cases when the bladder will not balloon out in the ordinary posture.

The ureters can also be catheterized without distention of the bladder with air—that is, without elevation of the pelvis. To find the ureters requires, however, more experience. The speculum is introduced from 5½–6 cm., and its outer end elevated until the base of the bladder appears, when it is turned thirty degrees to the right or left to find the ureteral orifice. To prevent the residual urine from obscuring the field the speculum is gently pressed against the mucous membrane. It is then only necessary to take up the urine with pledgets of cotton as it flows from the ureter into the speculum.

An anesthetic is not necessary for catheterization of the ureter unless the urethra is to be dilated to No. 14 or 15.

In nervous women it is often better to make a thorough examination first under anesthesia; subsequently a satisfactory illumination of the bladder can be made and the ureters catheterized or local treatment applied through a No. 10 speculum without anesthesia. Anesthesia of the urethra can be effected by a pledget of cotton with 5 per cent. cocaine solution inserted seven minutes beforehand.

The instruments ordinarily required are four specula, Nos. 8, 10, 12, and 14; dilators Nos. 7–16; a long, delicate mouse-tooth forceps; a ureteral searcher; an aluminum applicator; and one ureteral catheter.

Catheterization of the ureters and introduction of bougies have proven of great value in abdominal hysterectomy for carcinoma of the cervix, and in hysteromyomectomy to avoid including the ureters in ligatures or cutting them, as the bougie will make it possible to feel and see the ureter during operation.

For use in the ureter Kelly has had constructed short (30 cm.) ureteral and long (50 cm.) renal catheters made of woven silk, and from 2–3 mm. in diameter. An oval eye is located 2 cm. from the conical end. Elastic bougies of the same size serve for diagnosis of blockades in the ureter, such as stone or stricture. A wire stylet stiffens the catheter during introduction and prevents it from coiling up in the bladder. The instruments are sterilized by boiling in pure water for two minutes, and are kept in sterile glass tubes.

By means of the renal catheter Kelly has been able to make the diagnosis of malignant tumor in the pelvis of a dilated kidney in a woman with a large tumor in the right side of the abdomen. He passed the renal catheter and evacuated 10 c.cm. of urine and some black specks, which upon microscopic examination were found to be pieces of stone. As the large elastic tumor remained, he was enabled to make a diagnosis of malignant tumor complicated with dilatation and some stone-formation.

2. *Indirect Method.*—Only a few years ago Perez stated that catheterization of the ureters was of no importance, as it could be done only by epicystotomy. In one instance catheterization of the ureter up to the healthy kidney in a case of left pyonephrosis in which granular casts were found in the urine, deterred Iversen from performing nephrectomy.

Keen in a case of hematuria and suspected tumor of the bladder performed epicystotomy, but found no tumor. As he was unable to determine from which of the ureteral openings the bloody urine was evacuated, he intro-

duced a catheter through each ureter, and collected the urine separately, as a result of which he ascertained that the hemorrhage was from the left kidney. By means of the cystoscope, invented by Nitze and improved by him and by Oberländer, Otis, Brenner, and Caspar, with attachments for the introduction of ureteral catheters, catheterization of the ureters by this method first became possible, and is now becoming more and more practicable.

Nitze employs the cystoscope, aided by elastic bougies or catheters, which

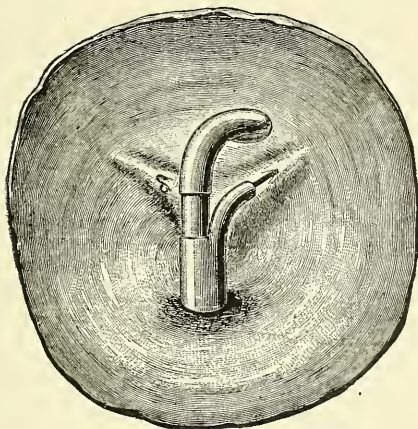


FIG. 167.—Nitze's instrument in use.

can be introduced and left in the ureter after the cystoscope has been removed. His method possesses the further advantage that all instruments can be easily sterilized and that both ureters can be catheterized at one sitting.

He states that the tube must be curved at the end and situated on the upper side of the cystoscope in a removable tube, the curve of which coincides with the bent end of the cystoscope. The ureteral catheter is inserted with the cystoscopic view as a guide. The curved tube permits the intro-



FIG. 168.—Brenner's ureter-cystoscope.

duction of a ureteral catheter even in patients with hypertrophy of the prostate.

Brenner in 1888 modified the Nitze-Leiter cystoscope by incorporating a small tube with the tube of the cystoscope at its lower part (see Fig. 168).

Brown employs the Brenner instrument with the modification of a spring stylet with bent end, and succeeded at Johns Hopkins Hospital in catheterizing the ureter in man in the following two cases :

CASE 1.—Right renal colic in a man of nineteen years, following trauma four years previous, followed by occasional hematuria. May 12, 1894, catheterization of the ureters. The anterior Leiter cystoscope was passed and replaced with the Brenner instrument. The ureteral orifice was found, the ureteral catheter inserted, and 3 or 4 c.cm. of urine collected from each ureter. The urine from the right ureter was cloudy and contained leucocytes; that from the left kidney was practically normal. He thereupon removed the right kidney, in one of the infundibula of which a calculus was found. The patient made a good recovery.

CASE 2.—Left renal colic with hematuria, following trauma from lifting a heavy weight twenty-one years previous. The discharge of a calculus was followed by a cessation of symptoms. Four attacks of renal colic prior to 1886. Since that time constant dull pain in region of left kidney, greater behind than in front, and most intense at the brim of the pelvis. After dilatation of a urethral stricture catheterization of the ureters was done on November 21, 1894, under anesthesia, and 7 c.cm. of urine withdrawn. The urine from the left kidney contained granular and hyaline casts, red blood-corpuscles, epithelial cells, many pus-corpuscles, a small amount of albumin and calcium oxalate. The urine from the right kidney contained a trace of albumin, a few granular and hyaline casts, a few red blood-corpuscles, and occasional leukocytes, and flat and tailed epithelial cells. Non-interference with the calculous left kidney was advised.

Brown considers an enlarged prostate an insuperable bar to catheterization of the male ureter.

A. B. Gaither employs an injection of 2 c.cm. of 4 per cent. solution of cocaine into the deep urethra, and 4 c.cm. of the same into the bladder.

If the ureter is not easily found, it may be located by occasional jets of urine shooting across the window, or jets of blood in case of renal hematuria. The ureter may be inserted at such an angle as to render catheterization impossible. Raising or lowering the patient's legs or increasing or diminishing the fluid in the bladder may aid in finding the ureter. When the ureter is found the stylet is withdrawn and the catheter quickly slipped into the cannula. The tip of the catheter must have a sharp enough bend to engage in the mouth of the ureter, otherwise it slips over it along the bladder-wall. The bend in the catheter is brought about by means of the stylet, which is kept in the catheter for two days and imparts to the latter a corresponding temporary bend. (Nitze's cannula on the cystoscope has the necessary bend and obviates the necessity of the spring stylet.)

When the catheter is pushed into the ureter it can be seen running under the mucous membrane until it leaves the bladder-wall. It is essential for the finding of the ureters and introduction of the catheter that the bladder be capable of holding sufficient fluid (200 c.cm.) to bring the mouths of the ureters into view. Ordinarily it is possible after several attempts to catheterize the ureters, but the operator must necessarily be familiar with cystoscopic examination of the normal bladder, which requires considerable experience.

In chronic nephritis catheterization of the ureters may be of great value for the prognosis: namely, if disease is found to be in one kidney with the other normal or slightly involved, the prognosis is likely to be good, in spite of large quantities of albumin and casts, the patient living for years on the strength of the healthier kidney.

Max Nitze in his interesting article on cystoscopic diagnosis of surgical diseases of the kidney by means of catheterization of the ureters states that cystoscopy teaches us—

1. Whether the bladder is diseased or healthy ;
2. If both kidneys or only one are acting ;
3. It shows us the source of a hematuria from one or the other of the ureters. We see blood or bloody urine pass out with a jet from the ureteral opening on the diseased side, or sometimes a cylindrical clot hanging out of the opening ;
4. Pyuria from one or the other of the ureters if the quantity of pus is considerable.

This author mentions 5 cases of so-called essential bleeding from apparently healthy kidneys, in 4 of which extirpation of the kidney saved the lives of the patients. In 3 cases of malignant tumor of the kidney the cystoscope determined from which kidney the hemorrhage proceeded, and, besides this, that the other kidney was present and excreted clear urine.

In pyuria the cystoscopic picture varies with the amount of pus. When little pus is present, it is seen to come out of the ureter as a darker shadow passing over the bottom of the bladder; or if the pus is abundant, a thick mass mixed with smaller and larger pieces of débris pours out of the ureteral opening. In one of his cases the pus was evacuated like a semi-solid mass, making the impression as if it was pressed out of the ureter like sausage from a sausage-machine.

Lohnstein has made a comparative investigation as to the value of the cystoscopic instruments of Leiter, Otis, Casper, and Nitze-Oberländer. He prefers Casper's instrument, because the disturbing reflexes from the uneven wall of the bladder are less troublesome, since this instrument works with reflected light. Furthermore, this instrument permits the use of a smaller tube on account of the absence of the cooling apparatus, and finally the glow lamp is more easily replaced in this instrument than in any of the others. The details of the cystoscopic view with Casper's instrument appear sharply and clearly defined, so that even a minute exudate can be distinctly seen.

In January 1895, Casper exhibited in the Berlin Medical Society his instrument (Fig. 169), with which he catheterized two men without anesthesia



FIG. 169.—Casper's ureter-cystoscope.

general or local. Below the canal for the optical apparatus was a groove for the ureteral catheter closed by a slide which could be removed after the introduction of the catheter, and the cystoscope then withdrawn, leaving the catheter *in situ*. This canal ends 6 mm. below the prism, and its end is so bent that the catheter comes out at an angle of 45° in the direction of the vesical end of the ureter. The lamp is in the long axis of the instrument, as proposed by Lohnstein. With this instrument he catheterized the ureters in 21 men and 1 woman. One of the men had hypertrophy of the prostate.

It is necessary to have a clear view of the ureteral opening. After washing out, the bladder is filled with 150–200 c.cm. of clear fluid. By slight movements of the end of the instrument in various directions it is possible so to localize the ureteral openings that the end of the catheter must pass in. When this is done the cystoscope is so manipulated that the direction of the ureteral sound corresponds with that of the vesical portion of the ureter. After

this maneuver the catheter is carefully pushed in. In all but 2 cases he was able to insert the catheter without difficulty and without especial inconvenience to the patient. As soon as the catheter is in the vesical end of the ureter, the urine commences to flow, usually at the rate of 8-10 grams in ten minutes. If with the catheter in this position fluid—for instance, boric-acid solution—is injected, colicky pains ensue, but if the catheter is pushed up into or nearly to the pelvis of the kidney, injection of small quantities of fluid causes no pain. The catheterization will not succeed in all cases: sometimes the openings are so small as to be scarcely visible; in other cases they are hidden by pathological swollen folds of vesical mucous membrane or protruding ridges, making it impossible to see them. Such cases are, however, in the minority, and ordinarily the method is applicable and useful.

F. Mainzer states that in Landau's clinic the cystoscopes of Casper and Brenner are used for the catheterization of the ureters in woman. He says it is easier to find the ureteral openings with Casper's instrument, but more difficult to introduce the catheter, while the opposite obtains with Brenner's instrument.

Poirier on injecting a ureter on the cadaver found that the injected mass passed out through the renal vein. At first he thought this was due to rupture from violence. Later he found, on injecting anesthetized dogs, that he could inject one, two, or three 10-c.cm. syringefuls of tepid water into the ureter. The kidney enlarged, and finally the water came out through the renal vein. He deduces that when a stone obliterates the ureter and the urine accumulates above, sufficient pressure may come to force the urine back into the renal vein. He advises that injection of medicaments into the ureter or renal pelvis shall be done without great force, to avoid forcing the liquid into the renal vein.

INJURIES AND WOUNDS OF THE URETER.

Subcutaneous Ruptures.—When these occur by violent direct injury, rupture of the ureter is apt to be accompanied by rupture of the other abdominal organs, the symptoms of which often dominate or mask those of the ureteral rupture. These injuries have been carefully studied by Herbert Page, who collected 10 cases from the literature, to which he added 1 of his own; 5 additional cases have been reported by Le Dentu, making 16 in all. In these cases the traumatism was caused either by a direct blow on the abdomen, such as the kick of a horse (Pye-Smith, Chaput), by a blow in the region of the kidney (Soller), by a blow from the handle of a wheelbarrow (Allingham), by being run over by a wagon (Page, Barker, Godlee, Bardenheuer), by traumatism from overstretching (Fenger), or by violent displacement of the kidney and pelvis whereby the ureter was ruptured in the upper portion (Le Dentu).

It is uncertain whether by these injuries the ureter is crushed against the transverse process of the first lumbar vertebra, as Tuffier thinks, or is so stretched from the kidney as to rupture in its upper portion, as in Fenger's case. Both methods are possible. The fact remains, however, that most of the ruptures are found above the small pelvis.

Early diagnosis is often difficult, if not impossible, because of the uncertainty of the symptoms. Slight transient hematuria, which might easily be overlooked, was noted in only 3 cases (Barker, Allingham, and Page). Copious hematuria, as reported in Hicks' case, indicates rupture of the kidney rather than of the ureter. Hematuria may be entirely absent, as in Godlee's case.

If no injuries to the other organs complicate the ureteral rupture, there are no grave symptoms in the beginning.

The next important symptom, swelling from the accumulation of urine around the place of rupture, is not seen until some time after the receipt of the injury—seven days (Allingham), two weeks (Chaput), two or three weeks (Godlee, Page, Barker, Hicks), thirty-nine days (Croft), seven weeks (Stanley), or several weeks (Cabot). The swelling is usually accompanied by pain, is localized, round, oblong, or sausage-shaped, following the course of the canal, and is palpable from the abdomen.

The surgical treatment has never yet been directed in an early stage to the ureter itself, but has consisted in puncture—single (Joel), once repeated (Hicks), or five times repeated (Stanley), all of which were successful—or incision and drainage, either through the abdominal cavity (Chaput, Page) or through the lumbar region (Allingham).

In most of the cases septic infection of the kidney took place through the resultant fistula, and secondary nephrectomy was necessary in order to save the patient's life (Godlee, Page, Barker, Chaput, and Bardenheuer). In other cases wherein the collection was not even opened and the patients survived, the kidney remaining, obliteration of the ureter (Havilland) or strictures ensued (Pye-Smith, Soller, Fenger).

As before mentioned, suture of the ruptured ureter has not yet been attempted, but, as Page points out, it might possibly be done, although it will probably be difficult to find the rupture; and this so much the more as an early diagnosis is rarely made. It is ordinarily not until some weeks later, when the swelling from urinary infiltration sets in, that operation is resorted to. Whether or not the ureter can be found in this cavity, which usually contains infected urine, and the rupture successfully dealt with, is as yet an open question.

Open wounds of the ureter, of which Tuffier found only 5 cases in the literature—3 incised or punctured wounds and 2 gunshot wounds—have not as yet been treated by direct ureteral surgery, as these cases date back to a time when such a procedure had not been thought of. If positive diagnosis can be made (and intermittent discharge of small quantities of urine at the time might make the diagnosis positive), and if the external wound is extra-peritoneal, there is no reason why the ureter should not be cut down upon and the wound treated by one of the methods now at our disposal.

Pozzi states that three injuries are possible:

1. Incomplete division;
2. Complete division without displacement or divided ends;
3. Loss of substance.

He suggests suture of the ends of the divided ureter.

Longitudinal wounds of the ureter will be considered in the discussion of the operation for stone. An extra-peritoneal longitudinal wound should be carefully united with extra-mucous sutures. In addition to the suture Van Hook makes a suggestion which appears valuable in cases where the incised ureter is covered with peritoneum—namely, to slide a fold of peritoneum from both sides over the sutured wound and unite the peritoneum over it. If no peritoneum can be used, an omental graft may be employed.

Transverse wounds of the ureter are much more difficult to treat satisfactorily, as there is a tendency to retraction and gaping of the wound, and as, if direct suturing is resorted to, there is always a tendency to stenosis even if the sutures do not tear out.

Reunion of a transversely divided ureter, first studied experimentally on

dogs by Tuffier and others, was not successful until the method of invaginating the upper into the lower portion was devised by Poggi and Van Hook. It was first practised successfully in man by Kelly, who used Van Hook's method. Poggi divided both ureters in dogs, dilated the lower end with a forceps, invaginated the upper end into the lower, and united with sutures. When the animals were killed, fifteen days and three and a half months later, he found union without stenosis at the point of operation.

Van Hook has also succeeded in reuniting the completely divided ureter by a different method, which might be termed implantation of the upper into the lower end after closure of the end of the latter. In a very elaborate paper upon the surgery of the ureter he gives the reason why his method of lateral implantation is preferable to the simple invagination of Poggi. He believes that the ureter can sustain resection involving a considerable amount of tissue, since ureters measuring 25 cm. while *in situ* will easily measure 30–35 cm. when removed, and he further remarks that elongation by traction on the divided ends is probably practicable to a very considerable extent.

Van Hook proposes in incomplete transverse wounds to transform the transverse into a rhomboid-shaped longitudinal wound by opening longitudinally upward and downward from the transverse wound and cutting off the four corners, thus creating a condition similar to that produced when a stricture of the ureter is opened longitudinally. The rhomboid wound may then be united transversely by folding the ureter upon itself in the manner proposed by Fenger in the operation for stricture.

This operation will probably be safe in extra-peritoneal wounds. If, however, the wound opens into the peritoneal cavity, it is not certain that covering with a fold of peritoneum will be sufficient: it might be safer to divide the ureter completely, and then resort to Van Hook's method of lateral implantation.

Early attempts to unite complete transverse wounds of the ureter, as a rule, failed in experiments upon animals and in operations on the human subject. In Tuffier's experiments on dogs death from peritonitis usually followed, and when union took place there was so much cicatricial constriction as to cause stenosis.

In the first case in which direct union was attempted in the human subject the result was also unsatisfactory. This case was reported by Schopf.

Schopf's Case.—During laparotomy for the extirpation of an intra-ligamentous ovarian cyst he divided the ureter near the brim of the pelvis. Having secured the divided ends by artery forceps, he united the ureter by silk sutures, which did not pass through the mucosa and probably invaginated the borders of the transverse wound. The patient made an uneventful recovery, but died seven weeks later from tuberculosis. The autopsy showed that the right ureter at the place where it crosses the psoas muscle was imbedded in cicatricial tissue, and that a cicatrix existed in the entire circumference of union.

Uretero-ureterostomy.—Van Hook's method of invagination (Figs. 170, 171)—or uretero-ureterostomy, as Kelly calls it—is an important step forward in this direction, as it has proved on animals and men sufficient to prevent leakage and also stenosis. He describes his method as follows:

“1. Ligate the lower portion of the tube from 3–6 mm. from the free end. Silk and catgut may be used. Make, with fine sharp-pointed scissors, a longitudinal incision twice as long as the diameter of the ureter in the wall of the lower end, $\frac{1}{2}$ cm. below the ligature.

“2. Make an incision with the scissors in the upper portion of the ureter,

beginning at the open end of the duct and carrying it upward $\frac{1}{2}$ cm. This incision ensures the patency of the tube.

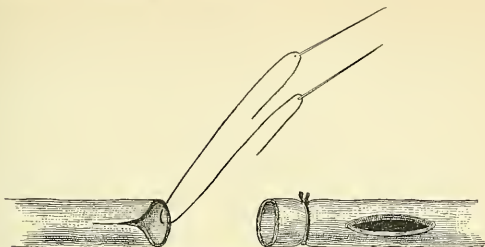


FIG. 170.—Uretero-ureterostomy (Van Hook's method). The needles have been introduced into the wall of the renal portion of the ureter. The end of the vesical portion of the tube has been ligated and a slit made in its wall.

“3. Pass two very small cambric sewing needles, armed with one thread of sterilized catgut, through the wall of the upper end of the ureter 3 mm.

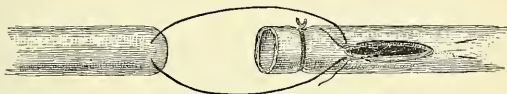


FIG. 171.—The needles carrying the traction suture attached to the renal portion of the ureter have been passed into the slit in the wall of the vesical portion, carried down a short distance, and pushed out through the wall.

from the extremity, from within outward, the needles being from 2–4 mm. apart and equidistant from the end of the duct. It will be seen that the loop of catgut between the needles firmly grasps the upper end of the ureter.

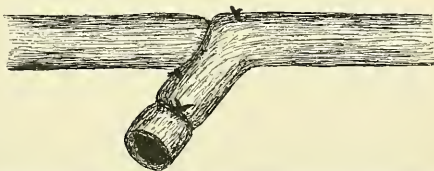


FIG. 172.—By means of the traction suture the renal portion of the ureter has been implanted into the vesical portion. The ends of the traction suture have been tied together.

“4. These needles are now carried through the slit in the side of the lower end of the ureter into and down the tube for 1 cm., where they are pushed through the wall of the duct side by side.

“5. It will now be seen that the traction upon this catgut loop passing through the wall of the ureter will draw the upper fragment of the duct into the lower portion. This being done, the ends of the loop are tied together securely, and, as the catgut will be absorbed in a few days, calculi do not form to obstruct the passage of the urine.

“6. The ureter is now enveloped carefully with peritoneum, as already described in other operations, provided an intra-peritoneal operation has been done.”

Bloodgood has repeated Van Hook's experiments with equally satisfactory results. In addition to Van Hook's procedure, Bloodgood applied two sutures through the external coats only as an additional security against leakage. His drawing of the united ureter shows not only no narrowing of the caliber at the point of union, but even a little diverticulum of the canal.

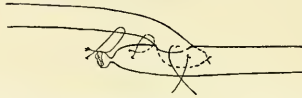


FIG. 173.—Ureter anastomosed; traction sutures tied; and two fixation sutures in place ready to be tied (Bloodgood).



FIG. 174.—Longitudinal section of ureter, showing new lumen and diverticulum (Bloodgood).

A most important and interesting proof of the value of this method has been furnished by Kelly in the first operation of this kind on the human subject. This important case was the following:

Kelly's Case.—Mulatto, twenty-five years of age, who had a large uterine myoma, filling both true and false pelvis and extending above the umbilicus. Hysterectomy was performed May 1, 1892. The ureter was ligated and cut, supposing it to be an engorged vein. Ureter was four times its normal size by reason of pressure from the tumor (hydro-ureter). On removal of upper ligature 20 c.cm. of clear urine escaped. Van Hook's plan tried of tying lower end of divided ureter, making slit in ureter below ligature and implanting upper into lower end by means of silk traction sutures. Edges also sutured to intussuscepted portion by ten fine silk rectangular sutures passed through outer coat only. Gauze laid over anastomosed end and brought out at lower angle of abdominal wound to ensure drainage. No urinary odor about the dressings. Passed water second day. Discharged cured in six weeks.

B. McE. Emmet in removing a tumor from the pelvis divided the left dilated ureter at the level of the fifth lumbar vertebra. Although the upper end of the dilated ureter was wider than the lower, he succeeded in making a union by Van Hook's method, and the patient recovered. He used fine silk for the sutures.

Oblique End-to-end Uretero-ureteral Anastomosis.—J. Wesley Bovee reports the case of a woman of thirty-six who had received a blow on the right flank from a stone thrown by a boy, followed by an exudate in the pelvis to the right of the uterus. Abdominal section, performed April 30, 1896, showed a right tubo-ovarian abscess, during the extirpation of which the right ureter was included in the ligature of the ovarian vessels and cut off. The diagnosis was made by passing a sound through the lower end of the ureter down into the bladder, and after enucleation of the sac of the abscess an end-to-end anastomosis of the ureter was made in the following manner:

The ends of the ureter were cut obliquely, the lumen dilated for an inch, and the ends sutured together with fine silk. With a small round, straight needle a rectangular suture was inserted and tied, but not very tightly. Two interrupted sutures followed, and this alternation of rectangular and interrupted sutures was continued until the entire circumference of the ureter had been sutured. Over these sutures were inserted four or five interrupted sutures. None of them penetrated the mucous membrane of the ureter. The sutured ureter was covered by sewing the peritoneum over it. The abdominal wound was closed without drainage. For the first two days the urine was withdrawn by the catheter every six hours. The wound healed in two weeks, and the patient left the hospital four weeks after the operation. Four months later the urine was normal. A month later a sound was passed freely into the right ureter, and no constriction could be found.

The author concludes that uretero-ureteral anastomosis should be done preferably by lateral implantation (Van Hook's method) or by oblique end-to-end anastomosis (the author's method), although the transverse end-to-end method may be safely employed.

STONES IN THE URETER.

It is a common occurrence that small renal stones pass down through the ureter, under the symptoms of renal colic, into the bladder to be evacuated with the urine. But it is comparatively rare that a stone is retained in the ureter permanently. This takes place when the stone is too small to be retained in the renal pelvis and too large to pass entirely through the normal ureter, or when a small stone which would pass through a normal ureter is retained in a ureter with strictures, valves or bends.

Stones in the ureter are usually small, round or oval, single or multiple. As an exception may be mentioned a stone in the St. George's Hospital Museum, 14 cm. long, which almost filled one of the ureters (Harrison).

Stones in the ureter are most commonly arrested in the upper portion, and with about equal frequency in the middle and vesical portions.

Uric-acid and oxalate-of-lime stones may be found in a non-infected urinary tract, while phosphatic calculi are found after infection has taken place. The ureter at the seat of the stone shows symptoms of chronic inflammation, the wall is thickened or the ureter is dilated, and the stone may cause pressure atrophy and perforation. In the vesical portion of the ureter the dilated canal may protrude into the bladder, forming the so-called encysted stone of the bladder. Above the seat of the stone the ureter is often dilated, so that the stone can be pushed up into the pelvis of the kidney. In other cases, where there is only a local dilatation at the seat of the stone, this is not possible. The ureter below the stone is often smaller than normal, either from contraction due to chronic ureteritis or from disuse, when little or no urine passes down.

When once permanently located in the ureter the stone may increase in size. So long as no infection has occurred the disturbance is merely mechanical, causing dilatation above, and at the most only a local aseptic inflammation at the seat of the stone.

Infection usually takes place, however, sooner or later, and on the whole it is more common to find pyonephrosis than simple aseptic dilatation.

The **symptoms** are pain, renal colic, intermittent cystonephrosis, or calculus anuria. In many cases the symptoms are not typical, and the beginning is often insidious, as the symptoms of renal colic may disappear when

some urine passes down by the side of the arrested stone. The location of the arrested stone can usually not be diagnosed from the symptoms, which are substantially the same whether a stone is arrested in the pelvis of the kidney or at any place in the ureter down to its vesical end. Dilatation of the ureter above the stone can very rarely be felt, and the stone itself has been felt in only one case near the middle portion of the ureter, while when located in the vesical portion it may be palpated through the vagina or rectum. When the end of the stone protrudes into the bladder it may be felt by a steel sound.

Location of pain in the ureter is of value only when fixed pain or tenderness remains in the same place after the intermittent attacks of renal colic have passed away. Guyon has called attention to the fact that excessive sensitiveness at the vesical orifice of the ureter upon rectal exploration may indicate stone in the ureter. Pain increased by walking or flexing the body is found both in stones in the pelvis and in the ureter. Abdominal palpation in the line of the ureter, as indicated in the anatomy, should be done by gentle, steady pressure until the fingers feel the resistance of the posterior abdominal wall; but this is of value only in thin subjects with lax abdominal walls. Rectal and vaginal palpation should be aided by pressure with the other hand above the symphysis pubis.

As to the course of stones in the ureter, it is well to remember that some cases present no symptoms whatever. Sometimes spontaneous expulsion takes place after several months; in other cases infection and calculous pyelonephritis come on after an interval free from symptoms following the original renal colic. Calculous anuria was found in about 50 per cent. of the cases operated upon (Tuffier), and oftentimes the bilateral obstruction comes on insidiously without any symptoms in the previous history to indicate the lesion of the opposite kidney.

The **diagnosis** may be easy if the stone is located in the vesical end of the ureter, but it is usually difficult or impossible for stones in the middle or upper portion. The pain is not characteristic, as the same fixed pain is found in nephrolithiasis, pyelonephritis, and neurosis. Pain may be absent entirely, and in some cases no symptoms of stone in the ureter have been present until dilatation of the pelvis—cystonephrosis—develops. Stones in the middle or upper portion of the ureter cannot be diagnosed from stones in the pelvis or calyces of the kidney.

As an aid in the diagnosis of renal calculi catheterization of the ureter has been done by Kelly in the two following cases:

1. Pyelitis; colon bacillus infection. Several black specks in the pelvis of the kidney were withdrawn by suction with the renal catheter. The specks were found to be uric-acid gravel. By nephrolithotomy a renal calculus was removed.

2. Small black pieces of stone were caught in the eye of a renal catheter in a case of pyonephrosis; the end of the catheter showed scratch-marks from the stone, and a diagnosis of renal calculus with pyonephrosis was made.

This procedure may also prove of value in the diagnosis of stones in the ureter.

The **treatment** consists in removal of the stones. This may be accomplished by different methods according to their location.

(a) *Removal through the Bladder.*—Stones have been removed by dilatation of the female urethra by Emmet, Berg, Richmond, Czerny, and Sanger; by suprapubic cystotomy in 2 cases (Tuffier). Ureteral stones often protrude into the bladder and can be recognized by the sound. The mucous mem-

brane covering them may have to be divided, but the stones are usually extracted without difficulty. The wound in the vesical end of the ureter is generally left open, but is sometimes sutured, as in the case reported by Berg. Stones in this location, so far as operative procedure is concerned, should be classed among stones in the bladder.

When stones are located a little higher up, but are not accessible from the bladder, they may be reached by—

(b) *Ureterotomy through the Rectum.*—Ceci removed successfully a stone from the ureter by incision through the rectum.

(c) *Ureterotomy through the Vagina.*—Removal of stone by means of vaginal ureterotomy has been performed by Emmet and Cabot.

Emmet's Case.—A click having been elicited by the sound, ureteral stone was suspected. On backward pressure with a larger sound a stone could be felt through the vagina and rectum. Stone cut down upon through vaginal wall by scissors. Opening enlarged forward toward the neck of the bladder, this being the only safe direction to avoid entering the peritoneal cavity. Opening closed with interrupted sutures. Good recovery.

Cabot's Case.—Woman aged thirty-nine. Attacks of renal colic for sixteen years, often followed by passage of stones. Left pyonephrosis felt as a distinct tumor. Vaginal examination revealed small hard mass in left broad ligament close to cervix uteri. Sound in bladder could not be brought within half an inch of mass. Ureterotomy and removal of stone through vagina. Evacuation of ten to twelve ounces of pus. Tumor in region of kidney disappeared. Uretero-vaginal fistula remained for four months with small amount of pus. The author concludes that the kidney was destroyed so far as secreting tissue was concerned.

(d) *Extra-peritoneal ureterotomy* has been performed by Twynam, Cabot, Ralfe and Godlee, Kirkham, Morison, and Fenger.

Twynam's Case.—Boy, eight years. Left renal pain, hematuria. Laparotomy for diagnosis revealed stone in right ureter just below brim of pelvis. Laparotomy wound closed. Three weeks later extra-peritoneal incision in right iliac region; ureterotomy, removal of stone, ureterorrhaphy, drainage; recovery. Long ends of sutures brought out of wound.

Cabot's Case.—Man, forty years. Seven or eight sharp attacks of pain, referable to left side of abdomen, above middle of Poupart's ligament, during three months before operation. Sensitive spot on back midway between crest of ilium and twelfth rib. Diagnosis: stone in ureter. Lumbar incision; ureterotomy; removal of calculus two inches below kidney; wound in ureter not sutured; recovery.

Ralfe and Godlee's Case.—Woman, twenty-six years. Renal colic persistent on left side. Lumbar nephrotomy. No stone in kidney. Exploration revealed stone in left ureter two inches below kidney. Longitudinal ureterotomy; removal of stone. Subsequent passage of gravel and small stone *per urethram*; recovery.

Kirkham's Case.—Man, fifty-eight years. Right renal colic, followed by pain on left side and anuria. Diagnosis: destruction of right kidney by previous attack; left kidney now affected. Exploratory left lumbar incision. Palpation of kidney negative. Stone in ureter half an inch above the point of crossing of external iliac artery. Ureterotomy; removal of stone; no sutures; drainage; recovery.

R. Morison's Cases.—1. In a case of anuria due to calculus in the right ureter Morison removed two stones from the right ureter close to the bladder by extra-peritoneal ureterotomy, and closed the wound in the ureter with

fine catgut. The patient died on the table. Autopsy showed dilated right ureter, sacculated right kidney with interstitial nephritis; left ureter occluded by stones. Left sacculated kidney contained no kidney tissue.

2. Man, thirty-one years. Occasional left renal colic, no hematuria. Lumbar incision; stone in ureter three inches below the kidney removed by ureterotomy. Wound in ureter left open; recovery.

Fenger's Case.—Man, thirty-five years. Increasing attacks of renal colic for two years. No hematuria; no tumor. Diagnosis: nephrolithiasis. Lumbar nephrolithotomy. No stone in kidney. Palpation showed two stones in the ureter one and a half inches below kidney. Longitudinal ureterotomy; no sutures; recovery.

(e) *Intra-peritoneal ureterotomy* has been performed by Cullingworth and Arbuthnot Lane.

Cullingworth's Case.—Woman, thirty years. Right renal colic; large pyonephrosis. Vaginal examination showed hard masses to the right and left of uterus. Diagnosis: right pyonephrosis and independent ovarian disease. Laparotomy. Right ureter dilated. Stone immediately above bladder. Ureterotomy; removal of stone; escape of pus. Ureterorrhaphy, with interrupted silk sutures. Glass drain in abdomen. Death from peritonitis in eighty hours. Autopsy revealed right and left pyonephrosis. Sutures in ureter held.

Arbuthnot Lane's Case.—Woman, twenty-three years. Left renal colic for twenty years; hematuria; pyuria. Laparotomy. Pelvis of left kidney dilated. No stone. Ureteral opening could not be found. Eight months later laparotomy. Stone in pelvic portion of ureter forced up to crest of ilium. Abdominal ureterotomy; removal of stone. Ureterorrhaphy, with continuous silk suture; no leakage; recovery.

Diagnosis as to the location of the stone was made before operation only in the cases in which the stone was afterward removed through the rectum or vagina (Ceci, Emmet, Cabot). When the stones are located higher up it is, as a rule, impossible to make a positive diagnosis. In the small pelvis diagnosis may possibly be made by vaginal examination, but in Cullingworth's case he mistook the stones for diseased ovaries, and positive diagnosis was not made until the abdomen had been opened.

If the stone is located still higher up, diagnosis of location is wellnigh impossible. Cabot made the diagnosis of stone in the ureter, but could not locate it until a lumbar incision had been made.

The location of the stone has not been determined until exploratory incision, either extra- or intra-peritoneal, has been performed. When the stone has been found in this way its removal has been accomplished either by pushing it up into the pelvis and extracting it through an opening in the pelvis or kidney, or by longitudinal ureterotomy.

It is often impossible to push the stone up into the pelvis because of the local dilatation of the ureter, the nest, as Le Dentu calls it, but some operators, such as Israel, Von Bergmann in two cases, Hall and Tuffier, have succeeded in accomplishing this. Fenger tried, unsuccessfully, to push a stone into the pelvis by a needle passed through the wall of the ureter. He does not consider this procedure important if the ureter can be reached by an extra-peritoneal incision.

The difficulty in dislodging the stone is well illustrated in the case reported by Hall, who succeeded only after manipulations with one hand in the abdomen.

Hall's Case.—Woman, thirty-six years: had had recurrent attacks of

renal colic for four years. No hematuria. Pain in region of left kidney, which could be palpated between the hands. Examination caused no hematuria. No stone could be felt. Dr. Hall was unwilling to make a lumbar incision on uncertain diagnosis, and advised exploratory laparotomy. Examination in narcosis revealed a small tumor in region of left kidney—the dilated ureter above the stone. Abdominal section: stone could now be felt about three inches below the kidney. Lumbar incision for removal of stone. Stone difficult to dislodge, finally accomplished by hand in abdomen. Incision on convex surface of kidney; invagination of sac consisting of dilated ureter and pelvis. Extraction of stone; recovery.

The dislodgement and removal of the stone were easy in the case reported by Tuffier.

Tuffier's Case.—Renal colic for nine years, finally attended with constant pain. Right kidney enlarged. Nephrolithotomy. Examination revealed no stone. Examination of ureter showed hard ovoid body, 3 em. long, at place where ureter crossed the promontory. Stone movable, and was pushed up into pelvis of kidney. Incision of convex surface of kidney. Extraction of stone. Suture of kidney and lumbar wound. No drainage. Healing by first intention.

Longitudinal ureterotomy has thus been done in 7 cases through an extra-peritoneal incision, 6 of which were successful, and 1 patient died; and in 2 cases through the abdomen, 1 case was successful, and 1 patient died from peritonitis.

The treatment of the ureteral wound is different in the extra- and intra-peritoneal operations. In the intra-peritoneal operation immediate absolute closure of the ureter is of vital necessity: as the urine above a stone is almost always infectious, the question of accurate suturing is one of great importance. In the extra-peritoneal operation, where the infected urine can be drained out effectually until the wound closes, the question of suturing is of little importance.

In his trans-peritoneal operation Arbuthnot Lane used a continuous silk suture with perfect success. In Cullingworth's intra-peritoneal operation he employed interrupted silk sutures, and post-mortem examination revealed no leakage from the wound in the ureter.

In an extra-peritoneal operation Twynam applied interrupted silk sutures, the long ends of which were brought out through the wound. As might be expected, the sutures did not hold.

In some of the extra-peritoneal operations no sutures were used, but drainage was employed, and the wound closed in Kirkham's case in forty days; in Fenger's case in a month; in Fenger's case of exploratory longitudinal ureterotomy in fifty days; and in Cabot's case the wound also closed without disturbance.

Whenever practicable the stone should be removed through a lumbar incision rather than through the abdomen. Stones located low down in the small pelvis, which cannot be pushed up within reach of an extra-peritoneal incision, like that for ligation of the iliac artery, might be reached by a sacral operation, although no case of this kind is as yet on record.

Laparotomy for the purpose of diagnosing the location of the stone has been of value in several instances. In Arbuthnot Lane's case the stone was thus located after exploratory lumbar incision had failed. In this case, however, it might have been possible by opening the kidney or ureter and exploring above to locate the stone through a lumbar incision.

In Hall's case the stone was located through a median abdominal incision

and removed through a lumbar nephrotomy. As in this case it had already been determined which ureter was the seat of the stone, the laparotomy might have been omitted.

In Twynam's case, however, exploratory laparotomy was absolutely necessary, since the symptoms pointed to stone in the left ureter, which was healthy, while the stone was found in the right ureter, and was removed three weeks later by an extra-peritoneal ureterotomy.

The operative results for stone in the ureter are, on the whole, favorable. In 17 cases collected by Tuffier only 3 patients died, and in these cases the other kidney was diseased. In ordinary cases, in which a certain amount of healthy secreting kidney tissue remains, removal of stones from the ureter presents no more dangers than removal of stones from the kidney or its pelvis.

The question of gaining access to different portions of the ureter in order to overcome obstruction has been solved, so far as the removal of stones is concerned, by a number of operations already on record, as follows: The vesical end of the ureter has been reached from the bladder by Emmet, Richmond, and others; from the vagina, by Emmet and Cabot. The pelvic portion of the ureter has been reached by extra-peritoneal lumbar incision, and the stones removed either by pushing them up into the pelvis and pyelotomy in 4 cases (Tuffier), or by longitudinal incision of the ureter in 4 cases (Tuffier), and by Fenger in 1 case.

From the middle portion of the ureter stones have been removed in 4 cases (Tuffier) by longitudinal ureterotomy by the prolonged lumbar incision. There is no difficulty in gaining access to the upper two-thirds or three-fourths of the ureter by the oblique lumbar incision. It is different with the lower third or fourth of the ureter, which is located deep down in the pelvis, and is even held by Le Dentu to be inaccessible. But Cabot has justly pointed out that this portion of the ureter is also accessible without opening into the peritoneum by means of the sacral operation of Kraske, with removal of part of the sacrum or temporary resection of the latter.

VALVE-FORMATION, BENDS, AND STRICTURES.

Valve-formation and oblique insertion of the ureter was first noticed in the case reported by Glass and cited by Rayer. A girl was born with right hydronephrosis, and died at the age of twenty-three. At the autopsy three gallons of liquid were found in the sac. On the interior surface of the sac the orifice of the ureter was seen as large as a goosequill. The ureter passed obliquely for 30 cm. between the membranes of the sac, and was patent the entire distance to the bladder. On account of the non-obstruction of the ureter Rayer considers this the most remarkable case on record.

Rayer observed a case of double hydronephrosis in which the ureters were also patent, which he attributed to congenital malformation. The patient was a boy of seventeen, who had been sickly all his life, and had had pain for seven years in the region of the left kidney. A tumor was found and the diagnosis made of left hydronephrosis. He died from septic infection of the sacs. At the autopsy the left ureter was found patent, the upper portion situated in the wall of the sac, with an opening almost similar to a valve in a vein. Water passed easily from below upward, but not down from the sac into the ureter. There was a small hydronephrosis in the right kidney. The right ureter was dilated to the size of a lead-pencil from the bladder up to the sac. At the upper end it was retracted, and when water was injected

from below it entered the sac through an opening the size of the lachrymal punctum.

Virchow in discussing hydronephrosis remarks: "The cases are extraordinary in which hydronephrosis exists with the ureter patent. I have examined such cases several times, and have found in each case a valvular obstruction caused by folding of the wall, due to oblique origin of the ureter from the renal pelvis."

Simon gives a full and comprehensive description of this condition. The ureter does not enter the pelvis of the kidney at its lowest point with a funnel-shaped opening, but enters it at the side at an acute angle, and often runs for a variable distance in the wall of the pelvis. In 2 similar cases observed the ureter ran, not in the wall proper, but between the wall and the peritoneal covering for 7-10 cm. In contradistinction to the previous authors, who thought that valve-formation was the cause of the hydronephrosis, and therefore congenital, Simon believes that the hydronephrosis in its beginning causes the valve-formation, and consequently that valve-formation is not a congenital affection. He has examined a specimen in which a stone was found in the ureter 5 cm. from the pelvic orifice in a case of hydronephrosis the size of a child's head, and with valve-formation in the upper end of the ureter. He believes that temporary obstruction from any cause may produce sufficient asymmetrical dilatation of the pelvis to give rise to oblique insertion and valve-formation, which when it once exists, even if the primary cause of obstruction disappear, may remain as a permanent obstruction of greater or less degree to the passage of urine. He considers valve-formation in hydronephrosis very common, as he found it in 11 out of 18 reported cases.

The mechanical aspect of valve-formation in the causation of intermittent hydronephrosis was studied by Krakauer, who made experiments designed to explain the fact that spontaneous evacuation of urine is sometimes seen in hydronephrosis due to this cause. Acting upon the proposal of Simon, Krakauer produced an imitation of the hydronephrosis due to valve-formation in the following manner: He caused to be made a rubber balloon having a capacity of 150 c.cm., with a tube which ran for several centimeters in the wall before opening at an acute angle into the side of the balloon. When the balloon was filled to distention, he observed that the first 50 c.cm. were evacuated rapidly, the second 50 c.cm. less rapidly, and the remainder still less readily. From this experiment Krakauer concluded that a higher pressure in the balloon, equivalent to an overfilling of the distended pelvis, is capable of overcoming a greater hindrance or impediment in the tube of exit—the ureter—than is a lower pressure. Applying this fact to the obliquely inserted ureter in the dilated renal pelvis, he concludes that partial filling of the dilated pelvis will close the valve entrance and permit no evacuation through the ureter; further accumulation of urine and over-distention of the dilated pelvis will overcome the obstacle and the urine will be evacuated through the ureter. This fact explains intermittent cystonephrosis.

Tuffier has studied the mechanism and treatment of intermittent hydronephrosis as caused by movable kidney by a series of experiments, the first of which takes into consideration the mode of formation of the hydronephrosis. In the first experiment he made an artificial exstrophy of the bladder on a dog. A few days later he examined the function of the ureters, and found the same number of contractions, jets, and the same quality and quantity of urine on both sides. He then mobilized one kidney, and found, first, that the intervals between the jets grew larger and the quantity of urine one-third to one-fourth less, but the proportion of urea was unchanged. From the sixth

to the eighth day the pelvis and ureter became distended above the bend, especially the pelvis.

As neither the pelvis nor the kidney has a muscular layer capable of compensatory contraction, the hydronephrosis once established would continue. The first symptoms, then, are increased pressure of the urine in the pelvis and renal congestion. The distention later on leads to bending of the ureter at the border between the fixed and movable portion—namely, at the pelvis. It is usually in a line with the renal vessels that the bend is found after four weeks.

Secretion and absorption may take place above the bend. The organ may continue to secrete for a long time. Patients have been found to live for several years with one kidney only, and this kidney hydronephrotic (Wright, Küster). The kidney tissue may remain relatively healthy.

The same was observed in some of the experiments. A dog with intermittent hydronephrosis of forty-five days' standing lived after ligation of the other ureter, and microscopic examination of the hydronephrotic kidney tissue showed only interstitial edema and dilated collecting tubes, but a normal condition of the kidney tissue.

Convincing proof is also found by uranalysis. In the experiments the urine from the bladder—that is, from the other kidney—and the urine from the dilated kidney contained the same amount of urea. This was also found in some observations on man in the cases of Rogers, Rochet, and Weir, and in one case by Tuffier in the service of Tillaux.

The kidney showed various changes in shape: In 3 operations the kidney was increased in volume and horseshoe-shaped; in another it formed almost a complete circle. In another variety the kidney was elongated, flattened, and had the shape of the tongue of a dog (one of Tuffier's observations). Tuffier believes this change in shape is characteristic of the initial stage of hydronephrosis, and that if he had taken this into consideration he would have observed more than 9 hydronephroses in his 45 nephropexies.

The physical phenomena in the beginning of hydronephrosis are as follows: The kidney is a secretory organ, but has the power to absorb liquids and salts. In a state of retention the kidney absorbs part of the liquid contained in the calyces, pelvis, and collecting tubes. It is easy to prove this endosmotic action. There is only little absorption in the ureter, but rapid absorption in the calyces and parenchyma in the normal condition; when there is retention and pressure, however, absorption becomes rapid. Tuffier injected 2 ctg. of strychnine into the pelvis of the kidney of a dog. It produced no symptoms until the ureter was ligated. In spite of this absorption of liquid under pressure, in spite of this distention, the kidney tissue goes on secreting for a long time in the intermittent—that is, open—hydronephrosis.

On the other hand, when the hydronephrosis becomes closed and of long standing, the secretion of urea first diminishes, then stops, and the secreting kidney tissue gradually disappears.

Intermittent hydronephrosis has a double mechanism:

(a) The bend is movable. In the beginning it is easily straightened out when the kidney is brought into position. Even when the pelvis is much distended it can be straightened out by replacing the movable kidney. This was proven in a case where the bend straightened out when the patient lay down. At the operation Tuffier found a large, fluctuating, horseshoe-shaped kidney, the pelvis much dilated, and the ureter normal. This condition was entirely cured by nephropexy.

(b) The kidney is immovable, and the bend is forced when the tension reaches a certain point. Tuffier found in an operation the following condition: the kidney was voluminous, but not very tense; the bend was visible, and the ureter empty below. Pressure on the kidney forced the liquid down through the bend.

Consequently, intermittence may be due to two mechanisms: 1, straightening of the bend, and 2, a certain degree of pressure.

Tuffier considers that a causal relation between intermittent or permanent cystonephrosis and mobility of the kidney is shown by the following facts:

1. Cystonephrosis is more frequent in women: 21 women to 5 men; Tuffier's 12 operations were all on women.

2. The seat of the hydronephrosis is on the right side in 21 out of 23 cases. This is in accord with the opinion of Landau, defended by Terrier and Bandoïn, but Tuffier considers himself the first who has given anatomical proof of this by experiments and clinical observations. In his experiments on dogs he produced a bend in the ureter as follows: Through a lumbar opening he rendered the kidney movable and fixed the ureter in some cases, fixed the kidney in an abnormal position in others, and left the movable kidney and ureter without fixation in others. He had 4 negative results and 5 hydronephroses. The latter presented the following conditions: 2 or 3 cm. below the hilus there was a sharp bend of the ureter. The pelvis and kidney above were thin-walled and distended, the more so the longer the condition had existed—from seven to fifty-five days. These hydronephroses were open—that is, a slight compression on the kidney caused the liquid to force its way through the bend. In these cases the kidney continued its function, as was proven by an experiment in which the opposite ureter was ligated, and the animal remained alive in spite of the intermittent cystonephrosis.

The simple mobilization of a healthy kidney is sufficient to cause a hydronephrosis, and this condition is due to bending of the ureter. When the kidney is lifted up the bend is straightened out, and there remains only the difference in diameter above and below to show the place of the former obstruction. The bend can consequently be straightened out with the utmost facility. The bend is formed by displacement of the upper movable portion of the ureter upon the lower immovable portion. Tuffier gives some very instructive plates showing the changes in kidneys and ureters of the animals experimented upon. Besides these experimental results, he has seen this bend of the ureter in two operations for hydronephrosis. In 1892 in a case of nephrectomy for cystonephrosis he dissected out the ureter and found an S-shaped bend 4 cm. below the pelvis. He could not straighten it out completely. Pressure on the kidney forced the liquid down to the bend, and it required increased pressure to force it through the bend. Here the bend was fixed, but in another case the bend could be straightened. In this case of intermittent hydronephrosis which was cured by nephropexy, lumbar incision was made, the kidney isolated, and likewise the ureter for 10 cm. Two cm. below the pelvis was a bend with dilatation above. In freeing the bend the renal vessels were in the way. By lifting the kidney up in place the bend straightened out and the pelvis evacuated its contents into the bladder. The pelvis was as large as a mandarin orange.

A third clinical observation was in a woman with movable right kidney who had presented the following symptoms for several years: When she was up and around she had pain, a tumor could be felt, and she passed a small amount of urine. The symptoms disappeared when she lay down, which she was compelled to do for an hour twice a day. On examination Tuffier found

the kidney so displaced that the hilus pointed upward. He performed nephropexy, and found the pelvis and kidney dilated, but the ureter not dilated. It was thus evident that in the upright position the ureter was bent on the pelvis, and that the bend disappeared in the horizontal position.

These observations correspond with the experiments, and further with the observations, of Clement Lucas, Israel, Monod, and Rochet. It is evident that the mobility of the kidney causes the bend, and this is important because it gives a clue to the treatment.

Nephropexy is advised by Tuffier in all hydronephroses not too voluminous, and is the method of choice in the great majority of intermittent hydronephroses. Tuffier reports 9 operations with 9 recoveries.

In our opinion the operation is effective only in beginning valve-formation, and useless when stenosis is present, and it is often impossible to make a diagnosis without examination of the seat of obstruction from within. There must consequently be some uncertainty when nephropexy alone is made.

There is a marked difference in shape between the empty and the full dilated floating kidney. The full kidney is round and tense; the empty kidney is flat and flabby. The color is whitish. Little hemorrhage follows denudation or incision. The suture for fixation is passed through the parenchyma, but not into the pelvis.

Nephropexy, however, is not effective in very voluminous sacs and when the drainage cannot take place through the ureter—that is, where the ureter is inserted too high up.

Landau states that intermittent hydronephrosis, where there is no gross pathological impediment to the passage of urine, it is not so rare as might be judged from the infrequency of reports of this condition in the literature.

The etiology of this condition was given by Landau as (a) bending; (b) torsion; (c) oblique insertion of the ureter. These conditions cause stagnation of the urine in the pelvis, dilatation of the pelvis, and then compression of the upper part of the ureter by the distended pelvis. These pathological conditions of the ureter are in many cases caused by floating kidney. Direct traction upon the ureter has also been reported as the cause of hydronephrosis in certain cases of prolapse of the uterus.

The amount of secreting substance left is very variable: more is found in the smaller tumors, but even in large tumors secreting kidney substance may be spread out over a large surface. In one of Simon's cases he could feel the calyces from the tenth rib to the crest of the ilium.

The ureter is small on account of atrophy from disuse. Its upper portion, which passes up through or in the wall of the pelvis, may be stenosed from pressure of the sac or from inflammation. Its opening into the pelvis is a narrow crescentic slit sometimes only 2 mm. in length, and often difficult to find.

Weigert describes an autopsy in a case of hydronephrosis: A vigorous man who had been treated in the hospital for chronic hemorrhagic nephritis finally died of uremia. Autopsy revealed right hydronephrosis the size of a child's head. A bend in the ureter 9 cm. below the kidney and 21 cm. above the bladder (the left ureter was normal and was 30 cm. long) had caused the hydronephrosis. The ureter below the bend was normal; above the bend it was dilated, first to 1 cm., and finally to 4 cm., in diameter. When the hydronephrotic sac was lifted up and the bend straightened out the clear fluid contained in the hydronephrosis could be squeezed down through the bend into the bladder (see Fig. 175). Weigert described this as a congenital anomaly. It is more likely that it was not congenital, but that the bend in the ureter was caused by the descent of a floating kidney, and that bending

of the ureter at the end of its upper third caused the stenosis, which consequently was an acquired condition.

Operations for the Relief of Valve-formation.—As valve-formation always causes an intermittent or permanent impediment to the flow of urine, the pelvis of the kidney is in a state of hydro- or pyonephrosis. The so-called sac is accessible through the peritoneal cavity or by an extra-peritoneal operation through the lumbar region.

The first attempt to operate on the valve, after Simon's, which was unsuccessful, was made in 1890 by Trendelenburg, who opened the anterior wall of a large hydronephrotic sac by lateral laparotomy, saw the ureteral opening on the side of the sac, and divided the ureter down to the lower part of the sac, to the inner wall of which he sutured the divided borders of the ureter. The ureteral opening was thus displaced from the side to the bottom of the sac in order to keep the ureter patent. The result of this operation is uncertain, as the patient died from intestinal obstruction.

In 1891, Küster, in his celebrated case of resection of the ureter and implantation of the distal end into the pelvis, opened the hydronephrotic sac from the lumbar region, found the ureteral opening, and divided it through its course in the sac-wall, with the intention of stitching the divided border to the inner wall of the sac, as Trendelenburg had done. Before finishing this operation, however, he explored the ureter and found a stricture, which caused him to abandon the operation for valve-formation and to resect the stricture.

The valve-formation can be remedied by a plastic operation after previous opening of the dilated pelvis following lumbar nephrotomy. It is natural to select the lumbar region for entering the pelvis, because the operation is extra-peritoneal, and consequently there is no danger of infecting the peritoneal cavity, and because the lumbar incision gives the readiest access to the upper portion of the ureter. If it is possible in this manner to re-establish the flow of urine, we can save for future function what active kidney-tissue may be left, the danger of primary nephrectomy is avoided, and the patient may regain perfect health without urinary fistula. That this can be accomplished satisfactorily and promptly is illustrated by the following cases,

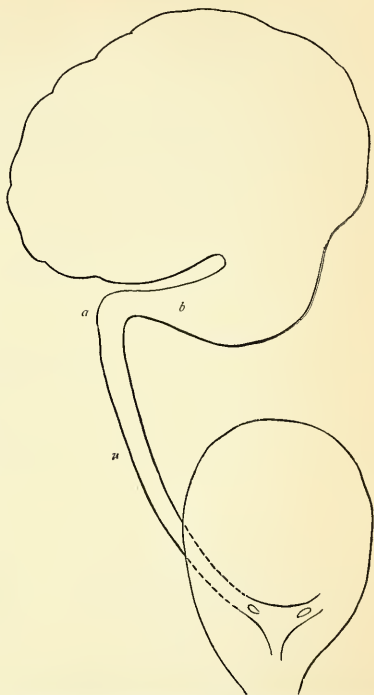


FIG. 175.—*a*, right ureter; *a*, bend; *b*, dilated portion of ureter above bend (Weigert-Virchow).

the first of which, by Fenger in 1892, was the third attempt and the first successful operation for valve-formation :

CASE 1.—Lady twenty-eight years, with valvular stricture or stenosis of the pelvic orifice of the left ureter in a somewhat floating kidney, with intermittent infected cystonephrosis of eight years' standing. An incision 10 cm. long was made from the angle of the twelfth rib and the extensor dorsi muscle obliquely downward and forward to the iliac crest above the anterior superior spine. Palpation of the kidney revealed neither fluid nor stone.

Nephrotomy by means of the Paquelin cautery and dilatation of the opening with forceps, so as to permit digital palpation of the pelvis and calyces. The calyces were dilated, and the pelvis was a large cavity extending from the lower border of the kidney with a round, smooth, soft surface. No stone could be felt nor could the ureteral entrance be made out. Examination with a steel sound gave similar negative results. A small bent metal probe was now passed into the pelvis, but the ureteral entrance could not be discovered. The posterior surface of the pelvis was now opened, and the borders of the wound grasped and held open with forceps for ocular inspection. The inner surface of the pelvis was seen to be normal in color and appearance. At the lower posterior portion of its inner wall was seen a small semicircular opening 4 mm. in length from above downward and 6 mm. in transverse diameter. The posterior border was convex, the anterior border straight. A metal probe introduced through this opening passed easily down into the bladder.

An olive-pointed bougie, No. 5 French, which was passed down, was tightly grasped by the ureter. By lifting up the pelvis the ureter could now be palpated. The wall was thin, and seemed liable to rupture unless great care was exercised. The bougie was removed, and on again lifting the pelvis and inspecting the entrance into the ureter it was seen that the ureter came off, not from the most dependent portion of the dilated pelvis, but from its posterior half or wall. Thus the anterior straight border of the ureteral entrance formed a valve or fold resembling the valve in a vein, which would close against the posterior wall of the opening when the pelvis was filled with urine or fluid to a slight or medium degree. A greater degree of dilatation, by pushing away the posterior wall of the pelvis, would reopen the entrance to the ureter. This accounted for the evacuation of urine containing pus after a period of occlusion of two days' duration.

To do away with this valve-formation the following operation was performed on the plan of the Heineke-Mikulicz operation for stricture of the pylorus (Fig. 176): An incision 5 mm. in length was made through the mucous membrane into the muscular wall or fold of the pelvis. The terminal points of the incision through the valve were now approximated by a fine silk suture, thereby changing the former vertical incision into a horizontal line. The entrance into the ureter was by this means made wider and more nearly circular.

A bougie, No. 11 French, was now passed through the opening in the pelvis 13 cm. down into the ureter, and the upper end brought up through the pelvis and out of the wound in the kidney, to keep the opening into the ureter dilated during healing of the wound. The incision in the pelvis was united by ten fine silk interrupted sutures passed through the pelvic wall, but not including the mucosa. The kidney was now replaced and fixed in normal position by nephropexy. The patient recovered without fistula and had no return of the cystonephrosis.

CASE 2 (Fenger).—A married woman twenty-eight years of age, with aseptic remittent cystonephrosis in a movable kidney, of at least seven months' duration. On making a lumbar incision a thin-walled tumor presented in the wound, from which, upon opening of the sac-wall, a quart of clear straw-colored fluid was evacuated. Upon palpation the finger could not reach either the upper or the lower end of the sac, which was shaped like an hour-glass. The lower portion of the sac was round and larger than the fist, and its lower end extended down into the large pelvis. The ureteral opening could not be found on palpation or inspection with sunlight; search for the ureteral opening with a probe was also negative. The incision opening in the lower portion of the sac was sutured to the skin and the remainder of the wound united. The hydronephrotic cavity was packed with borated gauze, and two large drains introduced, one up and one down. The secretion from the sac gradually decreased until only four or five ounces passed through the fistula in the twenty-four hours, and she was sent to her home for further treatment.

Two months later the patient was sent back on account of infection of the sac. Six months later operation to reopen the ureter. Palpation prior to operation showed the sac to be considerably diminished in size, but the entrance to the ureter could not be found from within the sac. Thus the ureter was searched for and taken up below and

outside of the sac. Incision over the lower portion of the sac, where the ureter was found and isolated. On making traction on the ureter and inspection of the sac a nipple-shaped projection with a depression in its center was seen on the side of the sac. Through this depression a long flexible silver probe passed into the ureter and down into the bladder without difficulty.

The ureter was now operated upon from within the sac in the following manner: A grooved director was inserted into the ureter, and the sac-wall, which was separated from the ureter by loose, movable connective tissue, was resected all around, and the borders of the unfolded ureter sutured to the borders of the wall of the sac. Thus free entrance of liquids from the sac into the ureter was positively secured. The large opening in the sac, 5 cm. in diameter, was now closed by sutures in the outer half of the wall which did not take in the mucous membrane or the kidney-tissue layer in the inner wall of the hydronephrotic sac. Only a small opening, the size of a lead-pencil, was left for

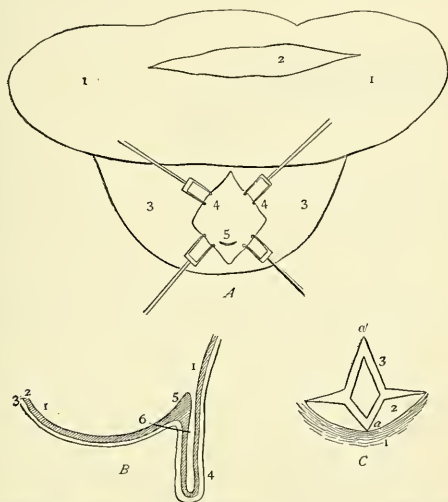


FIG. 176.—Illustrating operation for valve-formation. *A*, kidney and dilated pelvis: 1, kidney; 2, opening on its convex surface after nephrotomy; 3, dilated pelvis; 4, with opening on its posterior surface from pelviotomy; 5, opening of the ureter into the pelvis, a small transverse crescent-shaped slit.

B, dilated pelvis and ureter, showing valve-formation: 1, pelvis; 2, mucous membrane; 3, muscular and external coat; 4, ureter; 5, valve; 6, line of incision dividing valve.

C, valve seen from the pelvis and divided to illustrate the plastic operation: 1, inner wall of pelvis above the nreteral opening; 2, nreteral opening; 3, the divided valve; *a* and *a'*, the corners of incision to be united by a suture.

drainage. The adhesions of the opening into the sac were first dissected off from the skin or from the border of the lumbar opening. Gauze was packed along the drainage-tube down to the opening in the sac, the abdominal wall united by buried and skin sutures, and the usual dressings applied. The renal fistula closed on the fortieth day after operation.

In this case a slightly atrophic ureter ran obliquely on the antero-lateral wall of the sac for 3 cm. There was no stenosis. The ureteral opening could not be seen or found from the inside of the sac until the ureter below the sac had been laid bare, so that the place of entrance could be seen when traction was made on the ureter.

This case conforms to the law that a lumbar renal fistula does not persist when the ureter is patent. Whether it is worth while to save a kidney with a daily secretion of only three ounces is a question not to be decided until future observations have taught us more about the subject than we know at

present—namely, where to draw the line between a valuable and a valueless organ.

A somewhat different method of operating on this valve has been suggested by Küster, but has not yet been tried (see Fig. 177). He reports a case in which he divided the valve longitudinally. He proposed to freshen each flap and unite it by sutures to the freshened inner wall of the sac. Küster was not able to carry out this plan, because he found, in addition to the valve, a stricture in the ureter 2 cm. below the pelvis. This condition caused him to resect the upper 3 cm. of the ureter and unite the upper end of the distal portion of the pelvis by a plastic operation.

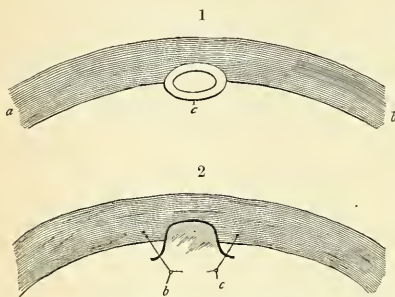


FIG. 177.—1. Küster's intended operation on the valve (same as Trendelenburg's): a, b, wall of sac; c, transverse section of ureter. 2. b, c, the ureter divided on its anterior surface; near b and c are sutures uniting the borders of the divided ureter and the wall of the sac.

The second successful operation was performed on August 14, 1893, by Herman Mynter.

Mynter's Case.—Man, twenty-five years of age. Valvular stricture of pelvic orifice of ureter. Intermittent hydronephrosis for twelve years; periodical attacks of pain every two or three months in right lumbar region. Diagnosis: right renal calculus producing occlusion of ureter. Exploratory nephrotomy. No stone found. Ureter permeable, but presented valve-formation at pelvic orifice. Plastic operation on valve. Gauze drain; recovery without fistula.

The operation for valve-formation can best be done by the extra-peritoneal lumbar incision. The dilated pelvis or hydronephrotic sac is easily found and opened by a longitudinal incision. The opening of the ureter into the sac should be looked for, but cannot always be found, as in some cases it is very narrow. In such cases it may be located by incising the ureter below the sac and passing a probe upward toward the pelvis. The valve or inner wall of the ureter, running in the sac, is now divided longitudinally from the opening in the sac, and the resultant wound treated in one of the three following ways:

(a) By turning the flaps out and uniting them to the inner wall of the sac by sutures (Trendelenburg, Küster);

(b) By drawing the corners of the longitudinal incision together with one suture, transforming the longitudinal into a transverse wound (Fenger);

(c) By uniting the wound longitudinally with numerous fine silk sutures, "taking in the outer two coats of the ureter and sac and avoiding the mucous membrane" (Mynter).

In one case Kelly emptied a large hydronephrosis by catheterizing the ureter. The patient had an obscure tumor the size of a quart measure on the right side of the abdomen. It was movable, elastic, and painless. He introduced the long renal catheter until a little fluid escaped, and then by pressure on the tumor emptied it completely, confirming the diagnosis of large hydronephrosis.

Strictures of the Upper Portion of the Ureter.—It has been seen

in the description of valve-formation that a stricture often forms in the portion of the ureter located in the wall of the dilated pelvis; but this stricture is treated by the operation for valve-formation as described above. Independent strictures below the pelvis require different treatment. If such strictures are single and accessible, they can be operated upon with a view to re-establishing the continuity of the canal.

Outside of observations at the post-mortem table little attention has been called to the question of strictures of the ureter, because in the cases of cystonephrosis formerly operated upon, the kidney was opened or extirpated and no attention was paid to the ureter.

From the post-mortem table we know that multiple strictures can be found as a result of chronic inflammation of the canal, as in the instance depicted by Hallé, mentioned by Tuffier, in which not less than three strictures were found, the ureter between the strictures being dilated.

As a result of traumatism limited strictures have been seen to be formed, as in the cases of Pye-Smith and Sollier. Pye-Smith reports the following case of stricture of the ureter and dilatation of the kidney, apparently of traumatic origin:

Pye-Smith's Case.—Male, twenty-four years of age; farrier. Never had stricture. Two years before kicked on left side "under short ribs," and passed blood with urine several days. In bed three days. No difficulty in passing water. On examination a large tumor was found occupying left half of abdomen. The urine contained a trace of albumin. August 22, 1871, the tumor was tapped, and six and a half pints of a reddish fluid containing pus and red blood-corpuscles evacuated. He died six weeks later. On autopsy the ureter was found to be dilated to a circumference of 4 cm., then contracted so as not to admit the smallest probe. No impacted calculus; no sign of recent inflammation. The disease was probably traumatic and the ureter probably injured. During the two years following the canal was gradually contracting and forming stricture; consequently, the pelvis of the kidney gradually expanded.

Sollier's Case was one of traumatic stricture of the ureter in a man of forty-five who in 1870 sustained a traumatism by a kick from a horse in the left hypochondrium. The injury was followed by pain in the left side, gradually increasing for nine years, when symptoms of nephritis appeared and the patient died from uremia. At the autopsy it was found that the left kidney had been transformed into a number of "cavities the size of nuts." The calyces, pelvis, and upper portion of the ureter were dilated. In the middle portion of the ureter was found a "cicatrical stenosis."

Little is also known as to the frequency of strictures, but it may possibly be concluded from the frequency of permanent urinary fistulæ following nephrotomy that they are not of infrequent occurrence. Tuffier states that fistula followed nephrotomy in 45 per cent. of the cases collected, and we are forced to believe that the permanency of the fistula is caused by imperiousness of the ureter either from valve-formation or from stricture. How often this is caused by a stone lodged in the canal, and how often by a stricture without stone, we will not know until the ureter has been investigated by probing from above in a large number of nephrotomies. From the statistics collected by Tuffier, which show that nephrotomy for calculous pyelitis was followed by 34 per cent. of fistulæ in 114 cases, and that nephrotomy for non-calculous pyelitis was followed by 57 per cent. of fistulæ, we cannot draw any certain conclusions as to the frequency of stricture in non-calculous pyelitis as compared with the frequency of stones in the ureter; but it is likely that strictures are common.

As to the frequency with which strictures occur in different parts of the ureter, we have a statement from Tuffier to the effect that in 29 instances of congenital hydronephrosis a stricture was found in the upper end in 15 cases and at the lower end in 14. In Sollier's case of traumatic stricture it was located in the middle portion of the ureter.

It is probable that only strictures situated in the upper abdominal portion of the ureter are accessible for operative interference. Such strictures have been dealt with by dilatation or operation.

Dilatation by bougies from above has been reported by Alsberg.

Alsberg's Case.—Lumbar nephrotomy in a case of left hydronephrosis. For ten days all urine passed through fistula, from which it was concluded that the other kidney was defective in function. Ureter successfully dilated from the wound by thin bougies. After several days urine passed through bladder. Some months later the fistula closed. The hydronephrosis did not reappear.

Dilatation from below has been practised by Kelly, who found in a case of pyuria from gonococcus infection the region about the left ureteral orifice puffy, red, and edematous, and also a stenosis in the vesical portion of the ureter, through which he finally succeeded in passing the catheter, whereupon 160 c.cm. of purulent urine escaped.

Only 4 operations have as yet been performed for stricture—namely, 1 by Küster and 3 by Fenger—and the successful results were reached in each case by a different method. All were strictures in the upper part of the ureter near the pelvis of the kidney. The methods employed were longitudinal ureterotomy through the stricture and transverse union (Fenger 2 cases), resection of ureter and implantation of the distal end into the pelvis (Küster), and longitudinal ureterotomy, excision of stricture from within, and transverse union (Fenger).

Longitudinal Incision (Fenger).—When the stricture is not too extensive it is divided longitudinally after opening the ureter above or below. The upper and lower ends of the longitudinal wound are then brought together by folding the ureter upon itself. The remainder of the wound is united by sutures through the outer and middle coats, thus transforming the longitudinal into a transverse wound.

CASE 1 (Fenger).—A farmer forty-seven years of age. At the age of thirteen, in jumping from a horse to the ground, he sustained a violent jerk on account of miscalculation of distance, his feet not having touched the ground, while his hands still retained hold of the hames. This injury was followed by sharp, constant pain in the left side, which obliged him to remain in bed for a month. He had no special inconvenience until ten years later, when, after over-exertion, he had an attack of sharp pain in the left side; at this time he was in bed about a week. One year later he had a third attack, which was attended by pain and soreness and obstinate constipation. For the next ten or fifteen years he had four or five attacks a year, lasting from two to three days. The last attack occurred October 22, 1892.

The patient was well nourished. In the left hypochondrium could be found a tumor, immovable, hard, and not nodular, which extended 5 cm. below the ribs and to within 8 cm. of the umbilicus. The urine contains a little pus. Diagnosis: nephrolithiasis in the infundibulum or pyonephrosis from stone or obstruction in the ureter.

November 26: For the past week there has been more pus in the urine, indicating that the contents of the pyonephrosis have been evacuated through the ureter. Examination in narcosis showed that the tumor had disappeared. The patient was anesthetized with ether, and placed on the right side with a pillow under the loin. An incision was made from the angle of the twelfth rib 15 cm. downward and forward to within 2 cm. above and anterior to the crest of the ilium. The adipose capsule of the kidney was so adherent that when it was removed the fibrous capsule was stripped off also. The exposed surface of the kidney was not shining, but was red, velvety, and nodulated, each nodule forming a flat prominence about 2 cm. in diameter. Each prominence was compressible and resembled a dilated calyx. The kidney was of normal size. After excision of a piece of the kidney substance for microscopic examination the dilated cavity of pelvis and calyces was opened, and a jet of urine tinged with pus came out over the wound.

Digital exploration revealed that the globular protuberances were dilated calyces which communicated with the pelvis, forming a common cavity. A reasonable amount of kidney substance appeared to be present, especially in the lower part. The wall of the pelvis was smooth and there was no stone or gravel. The entrance to the ureter

could not be found. The kidney was therefore lifted up over the border of the twelfth rib. A longitudinal incision 2 cm. long was made in the exposed pelvis and the edges held apart with retractors. No ureteral entrance could be seen or felt.

The external wound was now prolonged downward for 4 cm. to within 2 cm. of the anterior superior spine of the ilium. The ureter could now be seen as a string or band, not dilated. Its upper end was imbedded for 1 cm. in cicatricial tissue. A longitudinal incision 1 cm. long was made in the ureter about 2 cm. below the pelvic opening. A metal probe introduced into the ureter through this incision passed easily into the bladder. In passing it upward, however, a stricture was found just below the point of entrance of the ureter into the pelvis. The ureter was adherent to the surrounding adipose tissue at this point. The adhesions were separated by the handle of the scalpel and the stricture opened by a longitudinal incision on the probe as a guide. The opened stricture was seen to be 1 cm. long. In the remainder of the ureter a diffuse atrophic narrowing had occurred.

The patency of the ureter was re-established by uniting the wall of the ureter below the stricture to the pelvic wall, leaving the stricture as a loop (Fig. 178).

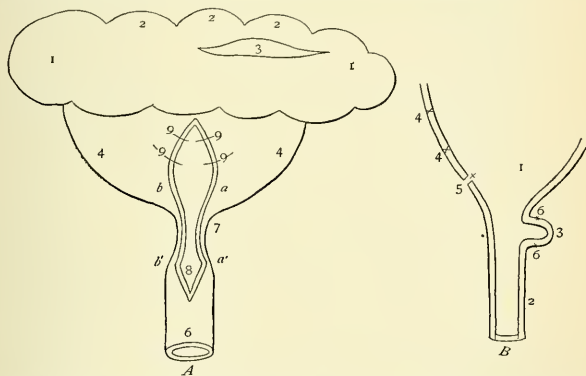


FIG. 178.—Illustrating operation for stricture of ureter. *A*, sacculated kidney, dilated pelvis, ureter with stricture at its upper end; 1, kidney; 2, sacs corresponding to dilated calyces; 3, nephrotomy; 4, dilated pelvis; 5, opening in posterior surface of pelvic-pelviotomy wound; 6, ureter below stricture; 7, stricture in upper end of ureter; 8, opening in ureter below stricture, extending up through the stricture into the pelvis; 9, sutures closing the upper half of the wound in the pelvis; *a*, *a'*, and *b*, *b'*, points of incision in ureter and pelvis to be united by sutures after folding the ureter upon itself at the place of stricture.

B, pelvis and ureter after union by sutures: 1, pelvis; 2, ureter; 3, fold of ureter at place of stricture; 4, sutures of wound in pelvis; 5, place of sutures between points *a*, *a'*, and *b*, *b'*; 6, 6, additional sutures, as many as needed to close borders of the fold formed by approximations of *a* to *a'* and *b* to *b'*.

The upper part of the wound in the pelvis was closed by sutures. No bougie was left in the ureter. The wound was drained by a large tube passed into the wound in the kidney 7 cm. upward to the upper corner of the kidney. A smaller drain was passed down to the pelvis and ureter. Gauze strips were packed around the anterior and posterior surfaces of the kidney and 7 cm. down along the ureter. The divided muscles of the abdominal wall were then united, with the exception of the lower 7 cm., which were packed with gauze. The external wound was united by sutures and dressed in the usual way. The operation occupied two hours. The patient was weak at its close. The next day he passed naturally urine containing no blood. The pain decreased and the amount of urine in the dressings became progressively less. November 29 to 31 blood was found in the urine, which showed that the ureter was patent from the third day after the operation.

January 5, 1893, the wound was closed. The patient was well and strong, suffered no pain, and could walk around all day. No tumor could be made out. Pressure in renal region was painless. The urine at this time was normal in quantity, forty-six ounces, and upon microscopical examination of the sediment only a few pus-cells could be seen. No trace of albumin could be found in the urine. The patient has gained flesh, and is much better than before the operation. Four years later he was accepted as a good risk by a life insurance company.

CASE 2 (Fenger).—A man twenty-one years of age. A year previous, in 1893, he had contracted gonorrhœa, which was followed by inflammation of the neck of the bladder. Three months later he had a sudden severe attack of right renal colic, which lasted seven hours. Examination of the urine at this time revealed marked hematuria and pyuria. For four weeks he had recurrent attacks of renal colic, lasting from three to ten hours, every other day.

Under enforced rest and rigid diet the pus in the urine slightly decreased. On March 8, 1894, he had a severe attack of renal colic, which persisted for three days, and a large hard tumor could be felt on the right side.

Lumbar nephrotomy three days later. The lower two-thirds of the kidney were found to be dilated and the large sac contained about two pints of urine and pus. The upper third of the kidney contained good secreting tissue. No calculi were found, no tuberculosis. The patient's condition did not warrant search for the ureter.

After the first eight days the right ureter was patent for ten days, as was proven by the presence in the bladder-urine of pyoktanin, which had been injected into the fistula. The ureter then closed, and its patency could not be re-established. Three weeks after the operation about two hundred and fifty small, well-formed calculi about the size of No. 6 shot were passed through the fistula. The patient wore a silver urinal, and passed through the bladder about thirty ounces of urine in the twenty-four hours, and about the same through the fistula.

On September 17 operation for relieving occlusion of the ureter. The granulation-tissue around the fistulous opening was removed with the sharp spoon. A lumbar incision was made through the fistula downward and forward and the kidney laid bare. The incision was prolonged downward 5 cm. The surface of the kidney was normal in color, the kidney enlarged and lobulated. The adhesions were slight and were easily broken up. The pelvis was found to be dilated. Search for the ureter was now made, and it was recognized below its pelvic origin, and exposed for about 4 cm. from the pelvis. An aspirator needle was introduced into the dilated pelvis of the kidney and thin bloody fluid withdrawn. The pelvis was now opened on its posterior surface. A futile attempt was made to locate the pelvic orifice of the ureter from the pelvis. A small depression, however, was noticed, which indicated the point of entrance.

A longitudinal incision was now made in the ureter about 2 cm. from the pelvis below the stricture; a flexible sound introduced through this incision passed easily down into the bladder. The lower portion of the ureter was somewhat contracted from disuse. A fine silver probe was next introduced through the incision and passed upward; the location of the stricture was thus found to be at the point where the ureter emerges to form the pelvis. With considerable difficulty the probe could be pushed through the stricture into the pelvis. With the probe as a director a longitudinal incision was now made through the stenosed portion of the ureter between the two openings. The upper and lower borders of the wound were brought together by silk sutures, thus folding the ureter upon the pelvis. The small longitudinal opening in the ureter was left unsutured.

Before closing the wound in the pelvis an incision was made through the convex outer border of the kidney into the dilated calyces, and the upper end of a flexible bougie, which had been previously passed down into the ureter through the opening in the pelvis, was passed up from the pelvis through the convex surface of the kidney and out of the lumbar wound, to remain twenty-four hours and then be removed. A piece of kidney tissue was also removed for examination.

The patient made a good recovery, but the fistula persisted.

At an operation seven months later the cause of the persistent fistula was found to be valve-formation at the upper end of the lower branch of the ureter, which prevented the urine from the lower half of the kidney from passing down into the pelvis. The pelvic end of the ureter was open, and permitted free passage of the urine from the upper half of the kidney into the bladder, thus demonstrating that the previous operation for stenosis of the ureter at its pelvic orifice had been effective.

Resection of the ureter and implantation of the distal end into the pelvis was done by Küster in the following case :

The patient was a boy eleven years of age who had had a lumbar nephrotomy six months previous for open left hydronephrosis. The operation was followed by vesical anuria and permanent fistula. On May 25, 1891, the boy was seen by Küster. Two months later Küster re-established the patency of the ureter by the following operation: A lumbar extra-peritoneal incision was first made into the sac, but the ureter could not be found. The lower end of the sac—the dilated pelvis—was then incised, on the upper border of which was seen a layer of kidney-substance the thickness of a thumb.

The ureter could now be seen running several centimeters in or upon the posterior wall of the sac and terminating in a slit in the pelvis. On attempting to introduce a fine probe into the ureter a stricture was encountered 2 cm. below the pelvis.

As a cure seemed impossible without removing the stricture, the ureter was transversely divided below the stricture and at the entrance to the sac. The ureter was now united to the pelvis by dividing the upper end of the ureter longitudinally, unfolding the divided end, suturing it to the opening into the sac, and closing the remainder of the wound in the pelvis by catgut sutures (Figs. 179, 180).



FIG. 179.—Küster's operation for implantation of the ureter into the sac (pelvis): *a*, upper end of *a*; *b*, ureter running in the wall of the sac; *a*, *c*, slit in upper end of ureter.

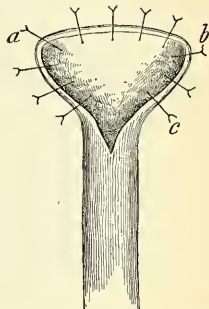


FIG. 180.—The divided end of the ureter unfolded, and in the extent of *a*, *b*, *c* sutured to the wall of the sac (Küster).

The next day some bloody urine escaped into the bladder, but ordinarily the urine passed out through the lumbar fistula. From this time more and more urine passed into the bladder, until four months after the operation as much as 100 c.cm. passed in the twenty-four hours.

Four months later the fistula was closed by curetting, dilating, and closing the canal by tier sutures. In the first twenty-four hours after this operation the patient passed 1300 c.cm. of bloody urine from the bladder. He recovered, but with a lumbar hernia which had to be held in place with a bandage; the fistula remained closed. The boy was able to work and had excellent health. The urine contained a few pus-corporuscles and a small quantity of albumin.

Longitudinal Ureterotomy, Excision of Stricture from Within, and Transverse Union (Fenger).—A woman, thirty-two years of age. At the age of seventeen, after jumping from a wagon to the ground, she at once experienced pain in the right side immediately under the ribs, so severe that she fainted. This was followed by intermittent attacks of pain in the right hypochondrium lasting from a few hours to several weeks.

After a miscarriage in 1893 the attacks increased. The patient was somewhat emaciated; abdominal examination revealed an obscurely defined tumor in the right side of the abdomen, close to the umbilicus, 10 cm. long and 7 cm. wide, which was dull upon percussion. The tumor was readily movable to the median line and backward to the normal position of the kidney, but attempts to move the tumor caused considerable pain. The urine contained neither albumin nor sugar. During the attacks of pain she urinated frequently, but passed only small quantities of urine.

Cystonephrosis of right movable kidney, probably due to stone in kidney or pelvis, and probably infected, was diagnosed, and exploratory incision for drainage and possible removal of stones advised.

On August 6, 1895, a lumbar incision was made (Fig. 181). The kidney was large, with but little perirenal fat, and was freely movable. After isolation of the dilated pelvis, in which no stones could be felt, the ureter was laid bare, whereupon a nodular mass was felt 5 cm. below the pelvis. The pelvis was then incised longitudinally and about an ounce of urine escaped. Upon manipulation of the ureter four stones were squeezed up into the pelvis and removed through the wound. A sound passed down from the pelvis into the ureter was arrested 6 cm. below the pelvis, at a point where a somewhat soft thickening was felt on palpation. A longitudinal incision 1 cm. long was now made

into the ureter, through and below a transverse valvular stricture (Fig. 182). A probe inserted through the opening in the ureter below the stricture passed easily down into

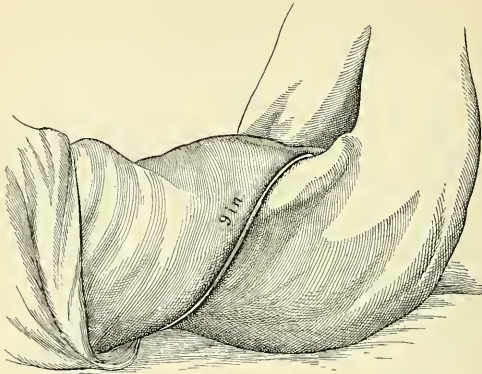


FIG. 181.—Line of incision when wound was nearly healed.

the bladder. By holding the longitudinal wound open and stretching this part of the ureter over the index finger the valvular stricture was excised from within the ureter with scissors, leaving the muscular and external coats of the ureter intact. A plastic operation on the ureter was now performed—namely, longitudinal division of the stricture and transverse union of the longitudinal wound (see Fig. 183).

This method of operating for ureteral stricture is preferable to resection of the strictured part of the ureter (Küster's operation), for the following reason: It is a more economical operation, and preferable when elongation of the ureter is not sufficient to permit the two cut ends of the ureter, after excision of the stricture, not only to come into contact, but even to permit of closure and invagination without stretching.

A flexible bougie was passed from the wound in the pelvis into the ureter and left there. The wound in the pelvis was left open. The cal-

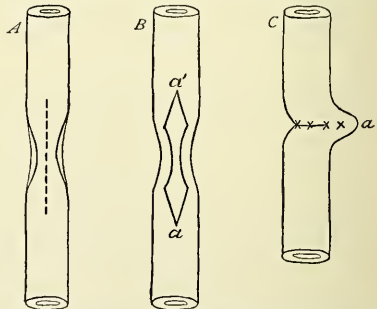


FIG. 183.—Fenger's plan of operating for ureteral stricture on extra-peritoneal surface of ureter: (A) ureter stricture and line of incision; (B) opening through the stricture extending into the proximal and distal portion of the ureter, the extreme ends of the incision *a* and *a'* to be united; (C) ureter after suturing; *a*, the bend at the site of the stricture.



FIG. 182.—Circular valve in the ureter; natural size.

ices were moderately dilated, and in one of them a small stone was found and removed. Rubber drainage-tubes were inserted, one down to the wound in the ureter, and another to the pelvis of the kidney. These tubes were surrounded with gauze. The external wound was closed with heavy silk sutures.

Microscopical examination of the valve showed that it consisted of firm fibrillary connective tissue, with normal distribution of vessels, no muscular fibers of the wall extending into it (Fig. 184).

The free border of the valve looking into the lumen of the ureter was clad with stratified cylindrical and cuboid epithelium. The border of the valve was folded, and

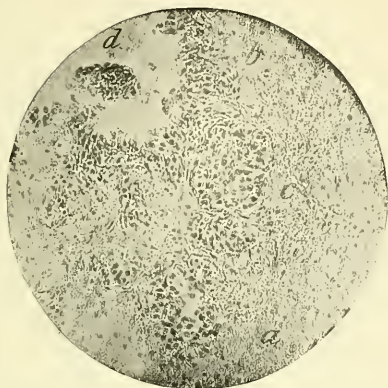


FIG. 184.—Microscopic section of valve: *a*, firm fibrillary connective tissue, with normal distribution of vessels; *b*, stratified cylindrical and cuboid epithelium, lining free border of valve; *c*, island of cuboid epithelial cells; *d*, lumen of ureter.

thus a cross-section through the bottom of a fold showed an island of cuboid epithelial cells.

On the fourth day the gauze was almost dry, indicating that the urine had passed along the bougie through the ureter. On the sixth day the amount of urine passed was thirty ounces in twenty-four hours, and on the following day the bougie was removed from the ureter. Six weeks after the operation the fistula was closed and the patient left the hospital, and has since remained well.

Exploration of the ureter with the sound led to the detection of the stricture, a valve, which was excised through a longitudinal opening in the ureter at its seat. The author considers this operation preferable to excision of the entire wall of the ureter and invagination after Van Hook's method, as it is followed by the least possible shortening of the canal. This point may be of importance if more valvular strictures should have to be operated upon.

INFLAMMATION OF THE URETER.

Ureteritis very rarely exists isolated, but almost always together with inflammations in the bladder or the pelvis of the kidney. It has the same causes as the inflammations of the bladder and the pelvis of the kidney—namely, as predisposing causes, arterio-sclerosis, incomplete retention of urine in prostatic patients, and retention of urine in the ureter from obstructive causes in the small pelvis so common in women. The retention causes stagnation and gives the microbes time to develop, and the arterio-sclerosis lowers the vitality of the epithelium, favoring infection. Congestion in the whole urinary tract by exposure to cold on the skin or paraplegia from diseases or injuries of the medulla may also cause retention and lower the vitality of the mucosa. Infection only rarely takes place as a metastasis from microbes in the circulation.

Infectious diseases and pyemia only exceptionally come into question as determining causes. Most often the microbes are brought in directly from without. In traumatism to the ureter and the kidney they may be brought in by an unclean catheter. In exceptional cases only, an abscess in the small pelvis may communicate with the ureter or bladder and cause infection with pus-microbes or the colon bacillus. The stagnating urine behind a hypertrophied prostate or a stricture of the urethra is an excellent culture-soil for

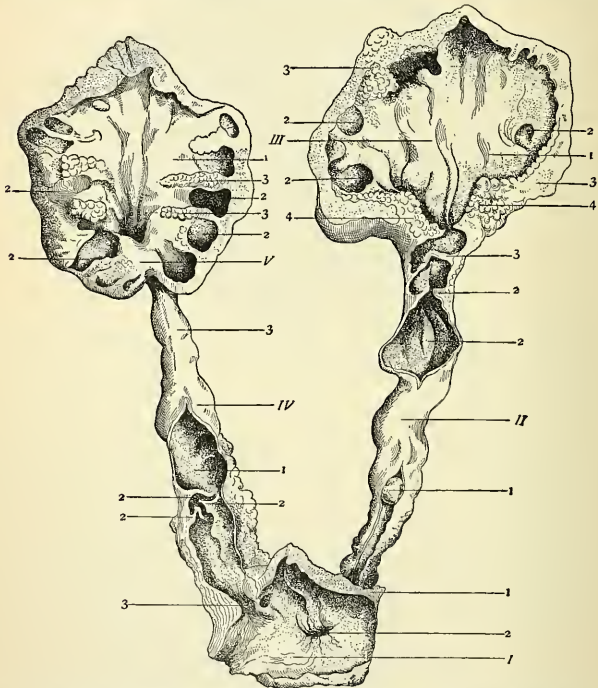


FIG. 185.—Double uretero-pyelonephritis, with stricture and dilatation of the ureter (Musée Guyon, Specimens Nos. 158 and 159).

I. Part of the opened bladder: 1. Hypertrophic vesical wall; 2, vesical opening of left dilated ureter; 3, vesical opening of right ureter.

II. Left ureter opened and unfolded in its upper portion; split in its lower portion: 1. Stone arrested in lower third of canal; 2, lumen of dilated ureter, constricted by two valvular folds, 3, 3.

III. Left kidney opened on its convex border: 1. Cavity of dilated pelvis; 2, openings to dilated calyces; 3, renal tissue; 4, fibro-lipomatous deposits.

IV. Right ureter opened in its lower half: 1. Cavity of the canal; 2, imbricated valvular folds; 3, narrowed upper portion.

V. Right kidney opened on its convex border: 1. Cavity of pelvis; 2, calyces; 3, fibro-lipomatous septa.

the microbes that invade from without. Gonorrhœa is followed by ascending infection in 2–3 per cent. of the cases only. Ascending infection following childbirth finds a ureter prepared by compression to receive infection from suppurating genitals and unclean catheters. Pelvic inflammations, pyo-

salpinx, or abscess of the broad ligament may also prepare the way, either by pressure on the ureter or by lymphangitis extending to the ureteral wall (Hallé). The balsamic irritants cause transient aseptic inflammation only. The microbes that most commonly enter are the pus-microbes, the colon bacillus, and the gonococcus, the latter rarely alone, but usually preparing the way for one or several of the others. Albarran (cited by Tuffier) found in 25 cases of pyelonephritis the colon bacillus alone in 16, streptococcus alone in 2, and mixed infection in 7 cases—namely, streptococcus, colon bacillus, micrococci, and other bacilli. The microbes from the bladder may ascend into the ureter from reflux of the urine during vesical contractions, from active locomotion of microbes or migration by diffusion, or antiperistaltic movements of the ureter.

Tuffier calls attention to the fact that in retention in the bladder with distention of the ureter the uretero-vesical sphincter becomes insufficient, facilitating regurgitation of infected urine from the bladder or diffusion of microbes up into the urine stagnating in a dilated ureter. Such urine, if it contains albumin, is an excellent culture medium, especially where the vitality is lowered by arterio-sclerosis or where painful cystitis causes frequent contractions of the bladder.

Infection through the circulation rarely attacks a ureter directly, but, having located in the kidney, from there secondarily may cause a descending infection of the ureter, which generally occupies the upper third of the canal only.

The inflamed ureter in acute cases, besides the usual signs of acute inflammation, may, according to Hallé, show multiple superficial ulcers in the mucosa. The deeper of these may result in consecutive stenosis.

The condition of the ureter presents two different aspects in the chronic forms. We distinguish between ureteritis with dilatation and ureteritis without dilatation, but with considerable thickening of the wall. The vesical opening of the ureter seldom undergoes change, with the exception that it may be insufficient. In patients with hypertrophy of the prostate Tuffier has found sclerosis of the orifice.

Ureteritis with Dilatation.—The ureter is enlarged and elongated from the size of a finger to that of an intestine; a circumference of 10 cm. has been seen. It is not uniform in caliber, but is often irregularly nodulated, showing dilated portions between multiple, sometimes very narrow, strictures. Secondary phosphatic stones often form, and are arrested at the seat of the narrow strictures. The wall is thickened and hard at the place of the strictures, thinned and transparent in the dilated portions. The mucosa is red and thickened, rarely ulcerated, and liquid injected passes down with difficulty. The strictures are usually located in the upper, middle, and lower portions of the ureter, at the neck of the pelvis, and 7 or 8 cm. above the bladder. The strictures are formed by thickening of the muscularis and are clad with mucosa often devoid of epithelium.

Ureteritis without Dilatation.—The ureter is not elongated; its caliber is diminished, so that it forms a thick, straight, hard cord with a thick wall of sclerosed fibrous or fibro-lipomatous tissue, due to the chronic peri-ureteritis. The hardened cord can sometimes be felt upon abdominal palpation. The lumen is either uniform or presents here and there local retractions. These strictures consist of sclerotic connective tissue with no hypertrophy of the muscularis. The mucous membrane is usually deprived of its epithelium; hence the tendency to obliteration when the kidney is removed and no pus or urine passes down.

Symptoms.—The symptoms are the same as those of pyelonephritis, and it is very difficult to differentiate the symptoms of disease of the ureter from the concomitant disease of the pelvis and kidney above. Pain may be felt along the course of the ureter, dull persistent pain below the kidney, tenderness on pressure by rectal, vaginal, or abdominal palpation. The urine is uniformly whitish, often acid, and may contain more pus than would occur from a cystitis alone. Upon standing in a glass or test-tube there is a sediment of pus at the bottom, above which the urine is thin and milky. But this is characteristic of pyelitis rather than of isolated ureteritis.

Crises of renal retention of urine form a most valuable symptom in the cases of multiple valves or strictures in the ureter, and signify, as Hallé has pointed out, the characteristic symptoms for temporary occlusion of a valve. If the disease is unilateral, the pus disappears suddenly from the urine, which remains clear for three or four micturitions, or even for a day or two. Following the pain of the crisis, the distention may be felt by abdominal palpation either as a swelling of the corresponding kidney or of the ureter at the brim of the pelvis. He advises that the bladder be left undisturbed, if possible, during these attacks of fever and pain. The swollen ureter may be felt as a tender cord through the rectum or the vagina, extending upward, backward, and outward in the direction of the ureter, but may be difficult to distinguish from a pyosalpinx or a tuberculous vas deferens. Upon abdominal palpation a nodulated tender cord may rarely be felt.

An acute ureteritis may disappear with the cystitis or pyelitis that caused it. Even chronic cases may improve temporarily after successful treatment of prostatic hypertrophy or strictures. Recovery may take place by obliteration of the ureter if either the kidney is removed or is also obliterated. This is especially apt to take place in ureteritis without dilatation, while a dilated suppurating ureter after nephrectomy is apt to continue to discharge pus and eventually to require ureterectomy.

Cystoscopy and catheterization of the ureter are of immense value in the **diagnosis**, and may be the only ways in which a positive diagnosis can be made, especially in cases where other symptoms, except the flow of pus from the ureteral opening, are absent.

Treatment may be either preventive or curative. We must treat the urethral strictures, the cystitis, the prostatic hypertrophy, to prevent or reduce the inflammation of the ureter. Antiseptic internal remedies, salol, borax, etc., may have some if only temporary effect. Double pyelitis in old prostatic patients cannot be helped by direct surgical procedures, which, on the other hand, may be most effective when the disease is unilateral (Hallé).

Local treatment by means of catheterizing the ureter and intra-ureteral injections is a most effective and rational procedure, and we owe to Kelly the introduction of this treatment, which in his hands has proven eminently successful.

In case of a woman with pain in the right kidney Kelly passed a renal catheter into the pelvis of the right kidney, but nothing flowed. The catheter was left in position, and was afterward, as nothing escaped, connected with an aspirator bottle, and 280 c.cm. of thick yellow pus withdrawn. In several other cases he had a similar experience.

Ureteral and renal pyuria are treated, according to Kelly, by the new method in three ways: 1. Evacuating the pus; 2. Washing out the inflamed ureter and pelvis; 3. Dilating the stricture or removing the calculus.

The treatment begins with the evacuation of the pus, which establishes

the diagnosis, and now the catheter can be left *in situ* for drainage or reintroduced at intervals of from one to three or four days. Kelly prefers not to leave it in permanently. For washing out the ureter and the pelvis of the kidney he prefers bichloride of mercury 1:10,000, or boracic acid one-half saturated solution. The latter can be used all the time; the bichloride at shorter or longer intervals as shown by the effect.

The washing out can be done in one of two ways: first, on the siphon plan, in a manner similar to that employed for siphoning out the stomach, by elevating and lowering the funnel connected with the catheter by a long rubber tube. This method is preferable when the dilatation, and consequently the quantity of pus, are considerable. Second, the fluid can be injected with a small one- or two-ounce syringe. When the pus is too thick to flow, the injection of a watery fluid thins it and permits it to escape. If the kidney can be handled, manipulation will help to mix the pus with the fluid. If this is not done, the injected fluid may return without bringing the pus with it. Suction by means of the syringe may start the flow by clearing the catheter of clots which obstruct its lumen. After evacuating large accumulations from the kidney Kelly never injects more than two-thirds to three-fourths the amount taken out, to avoid renal colic. He has cured three cases by this treatment, and states that the improvement takes place in the following order: 1. The amount of pus diminishes; 2. The pus becomes thinner and more mixed with urine as the kidney begins to secrete; 3. The pus becomes scanty, the dilatation of the kidney diminishes and finally disappears, and cure takes place.

Thorkild Rovsing describes under the name of "psuedo-membranous pyelitis" an inflammation of the ureter accompanying nephrolithiasis, characterized by the passage of pseudo-membranous bodies of various sizes up to that of an olive-stone, grayish like boiled meat, round or olive-shaped masses arranged in concentric layers and containing a nucleus of gravel of urates. The author believes them to be coagula deposited around gravel and changed by the action of microbes in this peculiar manner. The microbes found in the author's two cases and in one reported by Lennander were the colon bacillus. These round and oval masses are found in great numbers, and occasionally occlude the ureter and give rise to attacks of renal colic. One of the patients refused operation, but in the other case he did a nephrectomy on the dilated suppurating kidney. The ureter was irrigated from the lumbar wound, bringing down into the bladder a great deal of pus and the masses described above. The upper end of the ureter was then closed by a ligature. In the course of the following two months similar bodies and pus appeared in the urine, and finally a stone $2\frac{1}{2}$ cm. long, $1\frac{1}{2}$ cm. broad, and 1 cm. thick was found in the vesical end of the ureter, and removed by suprapubic cystotomy. Perfect recovery followed.

TUBERCULOSIS OF THE URETER.

Tuberculosis of the ureter may be descending or ascending. The ureter may either be dilated or stenosed. In the dilated ureter local retractions alternating with dilatations may be found, and tuberculous ulcers on the mucosa in the dilated territories. The ureter is more commonly not dilated, but is the seat of diffuse tubercular infiltration of the entire wall, so that the ureter is felt as a hard solid or nodular cord. The tuberculous infiltration of the mucous membrane may produce caseous masses which may encroach upon or fill the lumen.

The ureter may be primarily obliterated, and no pus will be found in the urine. If the ureter is permeable, the kidney is not enlarged; while if the ureter is stenosed or obliterated, tuberculous cystonephrosis is found.

Tuffier saw a case of tuberculosis of the spine, the tuberculous abscess from which was in contact with the ureter. In this place the tuberculosis invaded the ureter, causing an ascending tuberculous ureteritis which obliterated the canal and extended to the kidney. In another case of tuberculosis he observed on one side a ureteritis obliterans extending the whole length of the canal with dilatation of the kidney of this side; on the other side there was a ureteritis with dilatation, alternating with stenosis and tuberculous ulcers.

Edward von Meyer reports a case from Czerny's clinic. The patient was a girl of eighteen with right pyonephrosis. Tubercle bacilli were not found, although she had a tuberculous history. She was kept a long while in the hospital in order to ascertain, if possible, the condition of the other kidney; this was obtained accidentally by the injection of Koch's tuberculin. The general reaction was not violent, but locally the sensation of pressure in the region of the right kidney increased. "In a few hours after the injection the patient passed perfectly clear urine free from pus, in considerable quantity, of normal specific gravity, and containing no albumin." This experiment was repeated several times, and always with the same result. The diagnosis was made of tuberculosis of the pelvis of the kidney and part of the ureter; the tuberculin injection caused swelling and occlusion of the ureter. Tubercle bacilli were now found in the urine, probably from "disintegration of the tubercles." Czerny performed nephrectomy and found a kidney with multiple cheesy abscesses, the ureter thickened and imbedded in cicatricial masses, so that its removal down to the pelvis minor was necessary.

N. Tirard reports a case of tubercular growth of the ureter in a boy of five who died from general tuberculosis. In the left ureter a hard nodule was found at the junction of the upper and middle thirds. The ureter was dilated above and constricted below. Force was required to pass a probe through this nodule. On slitting the ureter open, it was found to be studded with small tubercles, and at the place of the nodular swelling the wall was surrounded by a ragged mass which consisted of a caseous surface on which urates were deposited. There was no tuberculosis outside of the ureter either in the bladder or the kidney.

Howard Kelly reports the case of a woman of twenty-five who had chronic pyuria. The ureteral catheter showed clear urine from the right kidney. In the left ureter resistance was met some distance up, and no fluid passed after waiting ten minutes. He succeeded in manipulating the catheter through an obstruction, when a continuous stream of purulent alkaline urine containing tubercle bacilli was evacuated. Thus the diagnosis of tuberculosis of the left kidney and ureter was made, and the patient cured by nephro-ureterectomy.

TUMORS OF THE URETER.

Tumors of the ureter are rare, and consequently little is known about them. No primary tumor of the ureter is on record. A tumor from the kidney or its pelvis may extend down into the ureter, which has been seen in villous tumor of the pelvis. It has also been observed that a primary tumor of the pelvis may be implanted at a distance in the ureter in the shape of multiple polypi.

Ribbert reports the case of a four-year-old girl operated upon by Oscar

Witzel. The child had a tumor which filled the right half of the abdomen. No history. The tumor and the upper 2 cm. of the ureter were extirpated, but large retro-peritoneal tumors had to be left, and the patient died six days later. The autopsy showed a large right cystonephrotic sac, on which the flattened kidney lay. The cyst was consequently the dilated pelvis, the wall of which was transformed into a layer of tumor-tissue 3 cm. thick. On the inside of the sac, in addition to flat prominences in the thick portions, there were seen polypoid tumors, especially from the site of the kidney—one as large as the fist with a pedicle the size of a finger, a second tumor a little smaller with a broader base, and a considerable number of small, thin-pedicated polypi.

The right ureter, as shown at the autopsy and described by Ribbert, was enormously dilated, tortuous, and tense. The dilatation was caused by numerous polypi of different sizes originating from the mucous membrane. They occurred in groups in the somewhat thickened wall. They were from several millimeters to several centimeters long, and some were as "large as a catheter." The larger ones were thickened in the middle; the smaller ones had a thin pedicle terminating in a club-shaped end. Some of the polypi had no free end, but were reattached at a place where a second group of polypi originated. Three long and slim polypi originated 2 cm. above the vesical orifice of the ureter. The total number of polypi, not counting the very small ones, was twenty-two. The polypi were soft and mostly gelatinous and transparent, grayish-white in the thicker portions, with here and there hemorrhagic spots. The vesical opening of the ureter was normal. Upon microscopic examination the tumors were found to be strio-cellular myosarcomata.

In Rayer's *Atlas*, Plate XI. fig. iv., are shown a kidney and ureter. In the ureter two inches below the pelvis is a polypus 1 cm. long and $\frac{1}{2}$ cm. in diameter; in the pelvis are seen seven polypi about the same size and five smaller ones. The polypi were soft, spongy, and yellowish red.

A primary tumor of the bladder may extend to the vesical portion of the ureter, causing stenosis, as is so often found in malignant tumors in this region. A tumor may invade the ureter from without when located somewhere in its course, as was seen in J. H. Taggart's case of sarcoma of the ureter. Retroperitoneal sarcoma had invaded the right ureter after totally surrounding the ureter from the kidney to the brim of the pelvis. In this territory the sarcoma also entirely surrounded the aorta and vena cava, and invaded the latter with a sarcomatous thrombus. The whole lower part of the ureter was transformed into a large solid cord, the sarcoma having invaded the wall down to the bladder, into which the sarcomatous wall of the ureter projected as a polypoid tumor.

An especial position, not strictly speaking among the tumors, is occupied by the psorospermial cysts which may be found in the ureter alone or in the renal pelvis and bladder also. Harrison states that obstruction from psorospermial cysts or mucous cysts of the ureter is very common in rabbits, but exceptional in man.

Rayer in his *Atlas*, Plate LII., has depicted two cases of what he terms "vesicular eruption" of the ureter, pelvis, and bladder, which undoubtedly are psorospermial cysts. They form multiple small globular, transparent protuberances, with the mucosa stretched over them, from the size of a pin to that of a buckshot. They may cause dilatation and obstruction, as in J. Jackson Clarke's case of psorospermial cysts of the left kidney and ureter and of the bladder, with hydronephrosis of the left kidney: A woman about

sixty was admitted to St. Mary's Hospital, where she died soon afterward from cerebral apoplexy. In the dilated pelvis of the left kidney and the upper half of the ureter numerous cysts were seen of a greenish-brown color and of the size of a hempseed. There was moderate hydronephrosis. There were also numerous small cysts at the neck of the bladder and at the vesical orifice of the ureters. He found psorosperms in the cysts.

In F. S. Eve's case of psorospermial cysts of both ureters they were found together with hematuria, but there was probably no connection between them. The patient, a woman of fifty-one, complained of frequent micturition with hematuria. The urine later became alkaline and the patient anemic. Fever set in, and the patient died two weeks later. The ureters were the seat of the psorospermial cysts, some of which had ruptured and left round openings in the mucous membrane. The author did not know whether or not the psorospermial cysts were the cause of the hematuria.

FISTULÆ OF THE URETER.

Fistulæ of the ureter are either traumatic or spontaneous. A traumatic fistula is caused either by a complete rupture or a transverse wound, when retraction of the ends of the ureter renders re-establishment of the canal impossible. A spontaneous fistula may result from a perforation caused by a stone, by tuberculosis, or by cancer, but spontaneous fistulæ are comparatively rare.

Each fistula has two openings and a canal. The external opening is either cutaneous, when it is located on the skin either of the inguinal region or the anterior abdominal wall; or visceral, when it opens into the uterus, vagina, or intestinal tract.

The canal is usually shorter in the visceral and longer in the cutaneous fistulæ, and is often tortuous, with thick, indurated walls.

The internal or ureteral opening is frequently surrounded by a small cavity close to the divided ureter or the opening in the ureter above the stone or stricture.

The characteristic symptom is the flow of urine. The urine is either normal or contains pus if pyelitis exists or if a periureteral abscess-cavity is present. The flow of urine is continuous if the fistula is located in the upper portion of the ureter, but may be intermittent if located in the lower third and if the opening is small (Tuffier). The urine may remain clear, and infection may not take place for a long time in the cutaneous fistulæ, but if the ureter opens into an abscess or into the uterus, intestine, or vagina, infection will cause ascending ureteritis and nephritis, often accompanied by dilatation from stenosis in some part of the fistula. The stenosis and retention will cause intermittent attacks of fever and pain.

As to the **course** and **termination**: The fistula, unless caused by operation, is persistent throughout the patient's life. Often he may be in relatively good health for a long time, but ascending infection is always liable to supervene, and the flow of urine is a constant source of misery.

In making a **diagnosis** it must be determined whether the urine comes from the renal pelvis or ureter. In pelvic and renal fistulæ the urine is usually purulent, as it comes from a suppurating pelvis or kidney, while in ureteral fistulæ the kidney is often healthy, and the urine therefore normal.

To distinguish a ureteral from a vesico-vaginal or vesico-uterine fistula colored fluid may be injected into the bladder, or a sound may be passed

through the fistula into the bladder, to be felt by a sound passed through the urethra.

Treatment.—It is difficult, and probably impossible, to cure ureteral fistula without operation. Possibly permanent catheterization of the ureter may be of advantage in a few cases, but as yet no cures have been recorded. Fistulæ above the vesical portion of the ureter have, as a rule, been cured only by nephrectomy; and, although this operation has given fairly satisfactory results, we should always seriously consider the possibility of saving the kidney by an attempt to re-establish the continuity of the ureter, either by uretero-ureterostomy or by operation for the stenosis of the ureter below the fistula. Persistence of a ureteral fistula is always due to occlusion or stricture of the distal or vesical portion of the canal. Thus we should attempt to determine the cause of the impermeability and overcome it by dilatation or operation. Nephrectomy of a useful kidney should be the operation of last resort.

Fistulæ in women in or near the vesical portion of the ureter—the uretero-uterine or uretero-vaginal fistulæ—have been treated by kolpokleisis or by implantation into the rectum, but should preferably be treated by implantation into the bladder.

The cure of the incontinence of urine caused by uretero-uterine and uretero-vaginal fistulæ is accomplished in four ways:

- (a) Plastic operations with a view to displace the fistula from the vagina or cervix into the bladder;
- (b) Kolpokleisis;
- (c) Implantation of the ureter into the bladder;
- (d) Nephrectomy, the operation of last resort.

(a) **Plastic Operations.**—Simon, through an artificial if not pre-existent vesico-vaginal fistula, opened the proximal end of the ureter from the bladder, cauterized the divided borders until cicatrization had taken place, thus securing against reclosure, and finally closed the vesico-vaginal fistula.

Landau passed a catheter into the ureter through a vesico-vaginal fistula, bringing the distal end of the catheter out through the urethra, and by immediately closing the vesico-vaginal fistula invaginated the ureteral opening into the bladder.

Bandl employed a combination of the methods of Simon and Landau.

Schede inverted the ureteral opening into the bladder, together with a zone of the surrounding vaginal mucous membrane, with the intention of preventing subsequent cicatricial stenosis.

Pozzi employed with advantage a method of splitting similar to that devised by Gerdy for vesico-vaginal fistula.

These plastic operations are often difficult in technique. Repeated attempts at closure have frequently to be made, and in some cases inflammation of the ureter and kidney has resulted. The operations on uretero-uterine and uretero-cervical fistulæ are especially difficult. The operations are taxing to the patience of the operator and patient, rather than dangerous to life. They have always been attempted before direct methods of obliteration were resorted to.

(b) **Kolpokleisis**, proposed by Vidal du Cassis and Simon, and first practised by Hahn, consists in closure of the vagina on the distal side of a vesico-vaginal fistula, and possesses the disadvantage that the latter may contract, and that marital relations are made impossible excepting in cases wherein partial kolpokleisis, as devised by Kaltenbach, can be done.

(c) **Implantation of the ureter into the bladder** for uretero-vaginal fistula was performed in 1893 by Novaro. In February, 1893, he operated successfully by the Paoli-Busachi method in the following case: The patient had had vaginal hysterectomy performed for carcinoma extending into the broad ligament; the operation was followed by uretero-vaginal fistula. Two months later laparotomy in Trendelenburg's position was performed, the ureter dissected out from the vagina, divided for 1 cm., unfolded, and united by sutures to an incision in the bladder $1\frac{1}{2}$ cm. long, situated two finger-breadths above the normal point of insertion. Gauze drainage out through the abdominal wound. For several days the gauze was impregnated with urine, showing leakage at the point of union. This was only temporary, however, and ten days after the operation the function of the urinary organs became normal and remained so.

(d) **Nephrectomy**, the operation of last resort, really means the abandonment of the struggle with the fistula. It has been necessitated in some instances by infection of the kidney, and, although not very fatal, as in 14 cases on record only 1 patient died, it is applicable only to cases where the other kidney is healthy.

The operative results, as collected by Nebe in 1890 and Iversen in 1892, were as follows: Of 14 uretero-uterine and uretero-cervical fistulae, all following childbirth, 8 were operated upon—1 with hysterokleisis (Duclout); 1 kolpokleisis (Hahn), both relatively successful. The remaining 6 cases (Zweifel, Credé, Fritsch, Netzel, Traub, and Iversen) were unsuccessful and nephrectomy had to be done. It will thus be seen that direct displacement of the ureter into the bladder was not found applicable to this class of cases.

Of uretero-vaginal fistulae 32 cases were collected by Nebe, 5 by Iversen, 1 reported by Arie Geyl, 1 by Pozzi, and 1 by Hergott (cited by Pozzi)—a total of 40 cases, of which 10 were secondary to operations or pelvic abscesses, 28 followed childbirth, and in 2 cases the cause was unknown. Of these 40, 24 were operated upon as follows: Plastic invagination into the bladder through the vagina was successful in 10 cases (Bandl 2; Lannelongue, Geyl, Parvin, Schede, Solowjeff, Schauta, Pozzi, and Hergott); kolpokleisis was performed in 5 cases (Gusserow 2, Kehrler, Schede, and Kaltenbach, partial); and nephrectomy in 5 cases (Schede, Gusserow, Czerny, Heilbrunn, and Fritsch). In the remaining 4 cases attempts at operating were abandoned.

In the 10 cases which did not follow childbirth 5 followed vaginal hysterectomy, 3 pelvic abscess, and 2 operation on vesico-vaginal fistula. Two were cured by direct closure (Nicoladoni, Emmet); 3 by kolpokleisis (Kaltenbach 2, Hempel); in 3 nephrectomy was performed (Stark, Böckel, Bardenheuer, whose patient died). The remaining 2 cases, both following pelvic abscess (Emmet), were not operated upon.

It will thus be seen that in 34 cases of ureteral fistula this condition was remedied by plastic operation in 11 cases, by kolpokleisis in 7, hysterokleisis in 1, and nephrectomy in 15.

The perfect success of implantation of the ureter into the bladder in Novaro's case, as well as in cases of wounds of the lower end of the ureter, would seem to indicate that Paoli and Busachi may be right in proposing the application of this operation to uretero-uterine and uretero-vaginal fistulae. If the operation is as safe and certain as the cases now on record indicate, and if the future function of the implanted ureter remains undisturbed, this method would seem to be superior to the older plastic operations through the vagina, which are difficult in technique, uncertain in results, and sometimes fail entirely.

Taking into consideration the fact that in almost all, if not in all, of the cases the kidney in question was healthy from the beginning, it seems to be a reproach against our present methods of treatment that in 44 per cent. of the cases the kidney should have been sacrificed.

URETERECTOMY.

Ureterectomy has been done for tuberculosis or suppuration of the ureter where there was retention or evacuation of infectious contents either into the bladder or through a persistent lumbar fistula.

Ureterectomy is termed primary when the ureter is removed simultaneously with the kidney; secondary when, after nephrectomy, the removal of the ureter of the same side becomes necessary.

Both primary and secondary nephrectomy may be either total or partial, and the operation may be performed by either the trans-peritoneal or extra-peritoneal method.

Primary total ureterectomy was twice performed by Kelly in 1895. Primary partial ureterectomy was performed in February, 1891, by Tuffier, who removed 4 cm. of the ureter with the kidney; by Kelly in March, 1893, for tuberculosis; by Postnikow in February, 1894, who termed the operation nephro-ureterectomy, and removed the kidney and the ureter down to 2 cm. above the bladder; and in 1896 by Elliot, who removed the kidney and the abdominal portion of the ureter.

Secondary ureterectomy is done when, after removal of the kidney, the fistula from the diseased ureter does not close or persistent discharge into the bladder takes place. Secondary total ureterectomy was first performed by Reynier, who did a nephrectomy in April, 1892, and an extirpation of the ureter seven months later. Secondary partial ureterectomy was made by Poncet, who extirpated a tubercular kidney in February, 1891, and about three years afterward extirpated 7-8 cm. of the ureter.

Primary Total Extra-peritoneal Nephro-ureterectomy.—**CASE 1.**—Kelly reports a left nephro-ureterectomy for tuberculosis of kidney and ureter in a woman of twenty-three who had suffered from childhood from incontinence of urine. She had had intermittent pain in the bladder for six years, and pain in the left kidney and pyuria for a year. Cystoscopic examination and catheterization showed the right kidney to be normal; the bladder normal, except the left ureter, which was found to furnish the pus and to be stenosed, probably from tuberculosis. Kelly determined, therefore, to extirpate the kidney, together with the entire ureter, and eventually to resect the diseased portion of the bladder-wall around the ureteral opening. The kidney and ureter down to the bladder were removed by an extra-peritoneal operation in December, 1895, in the following manner: An oblique lumbar incision was made from the vertical muscles of the back down to an inch above the symphysis pubis. The tuberculous kidney was enucleated after clamping and tying the renal vessels, but was left connected with the ureter during the dissection of the latter. This dissection was continued down to the pelvic brim, the ureter being freed with the fingers and pulled downward with the attached kidney. The lumbar portion of the wound was closed over a gauze drain before the dissection of the pelvic portion of the ureter was made. Through the lower part of the incision the round ligament was exposed and the deep epigastric vessels divided between ligatures. The peritoneum was loosened from the external iliac vessels, and the ureter dissected out down to the base of the broad ligament. The uterine vessels were here ligated by

passing sutures around them, and divided where they cross the ureter, so as to expose the latter, which could then be loosened up to its intravesical portion at a point 5 cm. below the vaginal vault. The contents of the ureter were squeezed up toward the kidney and the ureter clamped 2 cm. above the bladder, and a ligature put around it close to the latter. The ureter was divided close to the clamp, and the kidney, with its ureter 23 cm. long, lifted out. The vesical end of the ureter was sterilized with crude carbolic acid and dropped to the pelvic floor, whence a gauze drain was brought out through the lower end of the wound. The patient made an uninterrupted recovery.

CASE 2.—Kelly performed a similar operation on a woman of thirty with tuberculosis of the right kidney and ureter, with remittent attacks of colic and retention. Vaginal examination showed the ureter as a hard, tender cord 1 cm. in diameter. Cystoscopic examination showed that the left kidney and ureter were normal, the bladder normal with the exception of a red mammillated area around the right ureteral orifice, from which purulent urine was taken with the ureteral catheter. No tubercle bacilli were found in the urine.

In 1895 an oblique incision 16 cm. long was made from the posterior vertical muscles to the outer border of the right rectus muscle. The kidney was loosened, found to be the seat of extensive tuberculosis in its middle portion, and removed after first clamping the renal vessels and ligating them separately. At this moment the renal vein slipped out of the forceps, but was speedily caught and a ligature put around it by means of a needle. The kidney, still connected with the ureter, was pulled out of the wound, thus making the ureter tense while the peritoneum was stripped off with the fingers down to the common iliac artery. From here the ureter in the small pelvis was isolated by introducing the whole hand in the wound to strip off the peritoneum from the small pelvis and ureter down to the broad ligament. At this point the ureter broke off, and was caught by a forceps and isolated for 2 cm. more. The ureter was then ligated just behind the broad ligament and cut off above the ligature. The lower portion of the ureter was caught through an incision in the vaginal vault and drawn down into the vagina, and held there while the abdominal wound was closed with a gauze drain inserted in its middle. The patient was then placed in the lithotomy position and the lower end of the ureter extirpated through the vagina. During this dissection the friable ureter broke off twice, but was caught again, and finally cut off close to its entrance into the bladder-wall. The vaginal wound was left open and packed with iodoform gauze. Recovery was uneventful.

Primary Partial Extra-peritoneal Ureterectomy.—Tuffier reports the case of a married woman, thirty years of age, who had suffered for six years from symptoms of right pyelitis with intermittent cystonephrosis. The left kidney was healthy. On February 22, 1891, he operated immediately after one of the periodical evacuations. Through a lumbar incision he came down upon the dilated kidney half full of liquid. In attempting to make a sub-capsular nephrectomy the thin-walled sac was ruptured and discharged its purulent contents; it consequently became necessary to remove the capsule with the kidney. During the isolation of the sac he exposed the abdominal portion of the ureter. This was the size of a pen-holder, and presented a sigmoid bend 4 cm. below the hilus of the kidney. When pressure was made upon the sac before rupture, the fluid would pass down and distend the ureter as far as the lower curve of the bend. Upon increased pressure the bend would straighten and the fluid would pass through. This manipulation demonstrated the cause of the intermittence of the cystonephrosis. The

isolation was difficult because the partially filled, thin-walled sac was adherent to its surroundings. After isolation down to the ureter the pedicle was clamped with a curved forceps and the sac cut off. He thus gained space to ligate the vessels. The ureter was then ligated immediately below the sigmoid bend and the upper portion removed.

The operation, which had lasted for an hour, was followed by considerable shock and complete anuria for more than twenty-four hours. The patient recovered without fistula, and regained her health with the exception of a slight cystitis.

Trans-peritoneal Primary Partial Nephro-ureterectomy.—On March 30, 1893, Kelly performed this operation for tuberculosis of the left kidney and ureter. The patient, who had been a stout and healthy girl, had become worn out and emaciated from tuberculosis of the left kidney and ureter, which caused frequent and extremely painful spasms of the bladder. Vaginal examination showed a thickening of the left ureter, which was felt as a tender nodular cord 1 cm. in diameter, and could be palpated up to the brim of the pelvis, and above this point could be traced by abdominal palpation as a well-marked line of tenderness. Catheterization of the ureters showed that the right ureter and kidney were normal. The catheter in the left ureter passed through a stricture, whereupon 90 c.cm. of purulent alkaline urine containing tubercle bacilli were evacuated.

An incision was made through the left side of the abdomen parallel to the outer border of the rectus muscle. The viscera were displaced to the right, and the posterior peritoneum cut through on the outer side of the colon, which was drawn to the right to expose the ureter on the psoas muscle. The ureter was traced up to the cystic kidney, which was enucleated with difficulty on account of fibrous tissue which surrounded the hilus. After ligation of the vessels and removal of the kidney the large hard ureter was dissected from above downward to the pelvic brim. At about the middle of its course the ovarian vessels were tied. After freeing the ureter from the common iliac vessels its further detachment became so difficult that it had to be tied and cut off 4 cm. below the pelvic brim on the floor of the pelvis. The abdominal portion and upper half of the pelvic portion of the ureter were thus removed. The mucosa of the ureter above the ligation was sterilized with the thermo-cautery and the wall sutured. From the bed of the ureter an opening was made outward through the lumbar region for drainage with a strip of gauze. The opening in the posterior peritoneum was not united, as the borders lay in apposition. The abdominal wound was closed without drainage. The lumbar drain was removed on the fifth day, and both wounds healed by primary union. The urine became clear and the patient made an excellent recovery. About six weeks later Kelly attempted to remove the lower end of the ureter by a vaginal incision, but found it impossible, as it was surrounded by dense cicatricial tissue which bled profusely when incised. Three years later the patient was in excellent health, with but one of her old discomforts remaining—namely, frequency of micturition.

Primary Partial Trans-peritoneal Nephro-ureterectomy.—P. J. Postnikow, in a case of left hydronephrosis in a woman of fifty-five, on February 18, 1892, found by median laparotomy a dilated ureter connected with the hydronephrotic sac. The hydronephrotic kidney was opened and stones found in the lower portion of the ureter. Thirteen stones were pushed up and removed through the wound, leaving a large one which could not be caught. The ureter was isolated down below the stone, and the kidney and ureter down to 2 cm. above the bladder removed. A lumbar opening was made

and a strip of iodoform gauze inserted down to the ligated lower end of the ureter, the peritoneum closed by sutures over the ureter, and the abdomen closed. The patient had severe shock and vomiting for four days. After this she improved rapidly, was out of bed in fourteen days, and two months afterward was in perfect health.

Primary Partial Extra-peritoneal Nephro-ureterectomy.—J. W. Elliot reports the case of a woman of twenty-four who had a right nephrotomy in 1895 for suppuration. Wound closed in twenty-six days. On account of recurrent pain the wound was reopened and a urinary fistula remained. The amount of urea in the urine from the fistula was on an average 48 grains in twenty-four hours. On April 17 he removed the right kidney by extra-peritoneal operation. The ureter was found to be dilated to the size "of a man's thumb;" the walls were thick and rigid. This ureteritis, with dilatation, extended to the brim of the pelvis. The ureter was extirpated down to this point, and the upper end of the pelvic portion closed by inversion and sutures. The specimen showed "uretero-pyelonephritis; this was probably caused by a stone which had disappeared." The wound healed without fistula, and seven months later the patient was in perfect health.

Secondary Total Extra-peritoneal Ureterectomy.—Paul Reynier had a patient, a man with pyonephrosis following typhoid fever. Lumbar incision April 27, 1892, revealed the "kidney transformed into a purulent cyst" and the ureter dilated to size of intestine. The kidney was extirpated and the ureter sutured to lower angle of wound. Suppuration in the dilated ureter continued, so as to cause a flow of pus partly through the lumbar fistula and partly through the ureter into the bladder as seen by the cystoscope. The suppuration continued in spite of irrigation of ureter from the lumbar wound. Two or three months later a second operation was performed, consisting of dilatation of the lumbar wound and isolation of the ureter up to the "superior strait of the pelvis." The ureter was pulled out as far as possible and a ligature applied, and the ureter divided low down. During this maneuver the ureter ruptured and retracted into the small pelvis, and the operator was unable to find it. Thinking the ureter had been ruptured close to the bladder, he did a third operation eight days later, and tried to find it through a pararectal incision, as devised by Roux for extirpation of the seminal vesicles, but was unsuccessful, as two months later pus was still seen to enter the bladder through the ureteral orifice. A fourth operation was done for the total extirpation of the lower end of the ureter on November 14, as follows:

The bladder was distended with boric-acid solution; Peterson's balloon inserted in the rectum; an extra-peritoneal incision was made above and parallel to Poupart's ligament; the peritoneum was loosened from the iliac fossa, and blunt dissection made along the vas deferens till the iliac vessels were exposed, on top of which the ureter was found adherent to the peritoneum, its upper end obliterated, enlarged to the size of an intestine until just above the bladder, where the caliber became normal. The length of the dilated portion of the ureter was 12 cm. After having isolated it and scraped the mucous membrane with the sharp curette in its intravesical portion, he applied a ligature close to the bladder and extirpated the ureter above. The patient made a speedy and lasting recovery.

The author believes this to be the first total extirpation of the ureter, and concludes that in a certain number of cases it is not sufficient merely to remove the kidney and leave a dilated suppurating ureter, as persistent fistulae have been seen to follow nephrectomy, most commonly in tuberculosis, but also in non-tuberculous cases. He attributes the complaints of pain in

the side so often stated to follow nephrectomy to the leaving of the ureter. In the author's case these pains persisted until the whole of the ureter was removed, and in cases of this kind a subsequent total ureterectomy is the only means of effecting a cure.

As to the method of operating, the author lays stress upon the inguinal incision and the route along the vas deferens as a guide to find the lower portion of the ureter in the small pelvis, either at the superior strait or lower down, where the vas deferens crosses the vessels. Peterson's balloon in the rectum will push up the bladder and make the vesical portion easier of access. This incision gives better access than the iliac incision of Twynam, and, being extra-peritoneal, is preferable to the pararectal route, which does not give free access to the ureter.

Secondary Partial Extra-peritoneal Ureterectomy.—Poncet reports the case of a woman of twenty-eight with tuberculosis of right kidney and ureter. On November 5, 1890, right nephrotomy was performed. On February 28, 1891, the right kidney was extirpated. The patient was well, with the exception of a small fistula, for two years. Then she had pain in the course of the ureter and frequent micturition. In April, 1893, deep curettement of the fistula was done. On October 18, 1893, on account of the persistence of the fistula and pyuria, ureterectomy was performed. An incision was made from the fistula toward the anterior superior spine of the ilium, $1\frac{1}{2}$ cm. from it, and prolonged 5 or 6 cm. below. After division of the wall the peritoneum was pushed aside. Small openings were twice made in the peritoneum and sutured. When the iliac vessels were reached two small lymph-glands, which were at first taken to be the ureter, were removed. It was difficult to find the ureter, and the peritoneum was opened repeatedly. Finally, the ureter was found as a hard cord in the peritoneum which had been pushed aside. The ureter was now isolated upward and downward with great difficulty on account of adhesions. When the neighborhood of the bladder was reached the ureter was caught by a hemostatic forceps, cut off above, isolated upward, removing a cord 7 or 8 cm. in length. It was obliterated in the upper portion for 1 cm. The large opening into the peritoneum was drained with iodoform gauze. The wound healed and the patient recovered after a catheterization cystitis. (This operation was probably not a total extirpation of the ureter, as the portion removed was only 7–8 cm. in length, and was probably not removed below the posterior surface of the broad ligament.)

Tuffier has studied the remote results of nephrectomy. A permanent fistula following nephrectomy is a rare complication. In 12 cases of Tuffier's there was no fistula, and in 73 operations collected from the literature there were 25 per cent. of definite fistulæ, but it was not stated whether the operation was performed for tuberculosis or renal calculus. In reality, however, there is often prolonged although not abundant suppuration. Thus, suppuration continued in one of Tuffier's patients for ten months after lumbar nephrectomy. In 7 per cent. of the cases he has found temporary fistulæ. The cause of the fistula is either perirenal sclerosis or ureteritis. The perirenal sclerosis forms a septic cavity with unyielding walls like an empyema. Such a patient is operated on too late. The ureteritis should be treated by scraping the wall (?). It is only the ureteritis with dilatation—that is, with retention of pus—that is capable of causing a fistula; but even in this case if there is sufficient drainage into the bladder a cure may take place (but the suppuration goes on and pus enters the bladder all the time).

If it is desired to extirpate the entire ureter with the kidney, Tuffier proposes the following procedure: Make a lumbar linear incision, commencing at the angle of the twelfth rib and the sacro-lumbar muscle, down to the crest of the ilium, and then parallel to it, along it, and then down along Poupart's ligament to the upper orifice of the inguinal canal. Cut off the kidney, ligate the ureter, pull it out, and enucleate progressively from above down to the bladder. This is an exceptional operation to be employed in cases of obliterations of the ureter only, and, as permanent fistulæ are infrequent, it will be rarely indicated.

H. A. Kelly details the operation of nephro-ureterectomy as follows (see Figs. 186, 187, 188): Oblique lumbar incision from the sacro-lumbar portion of the erector spinæ downward and forward 2 cm. anterior to the anterior superior spine of the ilium, and then obliquely downward to the terminal of the semilunar line 2 cm. above the symphysis pubis. The perirenal fat is loosened from the kidney, and the latter brought out of the incision, drawing it down over the lower lip of the incision to expose the renal vessels, pelvis, and

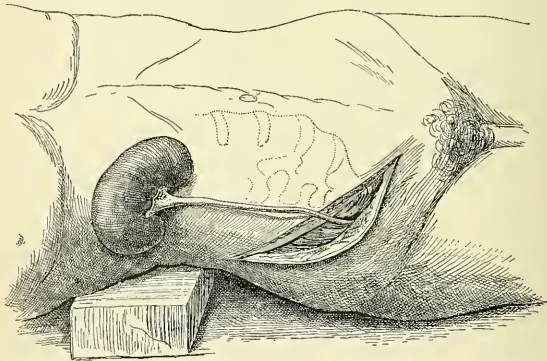


FIG. 186.—Extra-peritoneal nephro-ureterectomy. Cadaver with kidney detached and entire ureter separated down to its vesical extremity through the incision shown in the cut, without opening the peritoneum at any point (Kelly).

ureter. The kidney and pelvis are now examined to determine whether nephrectomy or a conservative operation is to be done. When tuberculosis is found nephrectomy is done. The vessels are clamped by artery-forceps 1 cm. from the kidney, after freeing them from the surrounding fat. The vessels are then ligated separately if possible.

If the ureter is found to be diseased, the kidney and entire ureter are now removed in the following manner: By pulling on the kidney and ureter the latter is made tense and dissected out from the surrounding loose connective tissue, with the index and middle fingers pushing the colon and cecum to one side and stripping off the loose connective tissue surrounding the ureter. This dissection is carried down to the brim of the pelvis, where the common iliac artery is felt. To free the ureter from this point down to the vaginal portion the entire hand is passed into the wound, at first between the peritoneum and the abdominal wall, then under the peritoneum of the pelvis major, and finally between the peritoneum and the walls of the pelvis minor.

This blunt dissection is facilitated by pulling on the kidney and making the ureter tense. In this way the ureter is freed and followed to the broad ligament, where considerable resistance may be felt, and the ureter appears to pass through an opening in the ligament, above which the pulsations of the uterine artery can be felt. At this point, about 6 cm. from the kidney, the abdominal end of the ureter is caught in forceps and held, and a stout silk ligature put around it and tied securely just behind the broad ligament. By pushing and working with the finger about 2 cm. more of the ureter is freed. The ureter is now cut off $\frac{1}{2}$ cm. above the ligature with a long pair of scissors introduced through the lumbar incision, guided by the hand introduced into the pelvis in the same way. Before cutting through the ureter the operator should take care to squeeze back its contents and keep the upper end tightly compressed until it is removed.

The next step is the removal of the lower end of the ureter. This is done either through a continuation of the original incision or through the

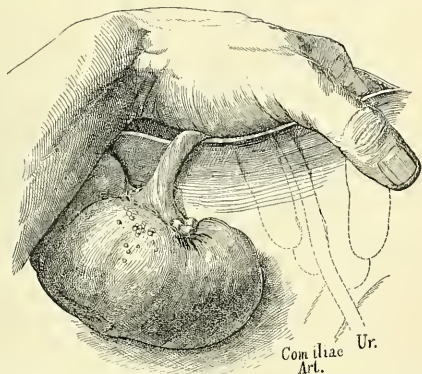


FIG. 187.—Renal vessels divided and ureter freed down to the brim of the pelvis. The object of this picture is to show the ease with which the entire abdominal portion of the ureter can be palpated through a horizontal incision, with only a part of the hand introduced (Kelly).

vagina. The vagina is thoroughly disinfected, and with the patient lying on the opposite side, two fingers of the hand corresponding to the ureter to be removed are passed up to the vaginal vault, and the other hand introduced into the pelvis through the abdominal incision. The fingers of both hands can now be brought together with only vaginal tissue between them. An opening is made in the vaginal vault, the end of the ureter brought down into the vagina, clamped in a pair of forceps until the lumbar wound is closed, after which the vaginal end of the ureter is removed.

The steps in this operation are as follows: The opening in the vaginal vault is made by passing the entire hand through the lumbar wound, down into the pelvis and pressing the index and middle fingers against the vaginal fornix, at the same time lifting up the uterine artery on the index finger, so as to avoid the danger of cutting it. The end of the ureter lies between these fingers. The index and middle fingers of the other hand are now introduced into the vagina and pressed up against the fingers of the hand in the abdomen, the palmar surfaces of both hands being turned upward.

The opening in the vault necessary to draw the end of the ureter into the vagina is now made by an assistant, who introduces a pair of sharp-pointed scissors up to the vaginal vault along the fingers of the operator, and, guided by him, pushes the scissors through the thin septum. By spreading the blades of the scissors in withdrawing them the opening in the vault is enlarged to about 2 cm. This opening is located about 2 cm. to the side of the cervix. A pair of forceps is pushed through the opening to grasp the ligature attached to the ureter, and the ureter is drawn through into the vagina and held there during the closure of the lumbar incision. This is done in the usual manner, after thorough cleansing of the wound, by separate suturing of the muscles and fascia, and a gauze drain placed through the wound.

If the patient's condition permit, the last step in the operation—namely, the extirpation of the vesical end of the ureter—is now proceeded with.

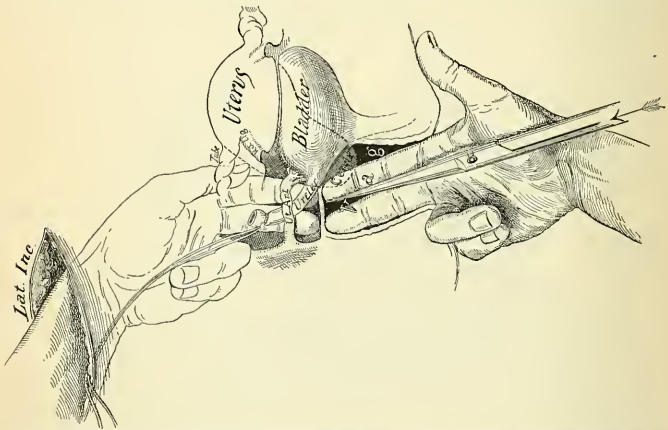


FIG. 188.—Opening the vaginal vault to bring the extremity of the right ureter through. The patient lies in the left semi-prone posture, and the left hand is carried through the lumbar incision behind the peritoneum down to the right vaginal fornix; the uterine artery is held up on the index finger. The right hand is introduced through the vagina to the vault. The assistant then pushes the scissors through the vault, guided by the operator (Kelly).

The patient is put in the lithotomy position, the end of the ureter and the opening in the vault exposed by retractors, and the corresponding side of the cervix caught by a bullet-forceps and drawn to the opposite side. By pulling on the forceps holding the ureter this is made tense while the operator cuts down through the vaginal vault, at first at the side between the anterior and lateral walls, and then, curving the incision forward under the base of the bladder, to a point $1\frac{1}{2}$ cm. from the vesical end of the ureter. The ureter should now be freed down to its vesical extremity, and here ligated and cut off. The wound in the vaginal vault is then closed by sutures, leaving space for a gauze drain, which is pushed up through the vault into the extensive connective-tissue space above, and left hanging down in the vagina.

That this operation is difficult it is needless to state. The wound is extensive, the freeing of the ureter in the pelvis minor has to be done guided by touch and not aided by vision, and the ureter, especially when extensively

diseased, is liable to break and cause trouble in finding the broken ends. In fact, the ureter broke off three times in one of Kelly's operations, and also in the operation of Reynier.

The three cases whose histories Kelly gives exhibit three different ways of removing the kidney with its ureter:

"First, trans-peritoneal—that is, through an incision through the abdominal wall opening the peritoneal cavity; this incision involves the necessity of a second incision through the peritoneum, covering the posterior abdominal and pelvic walls in order to get at the ureter.

"Second, retro-peritoneal—the extirpation of the kidney and ureter through a long abdominal incision beginning in the loin and extending downward and forward, and ending somewhere in the neighborhood of the symphysis pubis. By this method the peritoneum is detached from its cellular connection with the abdominal and pelvic walls, lifted up, and the ureter exposed without opening the peritoneal cavity.

"Third, retro-peritoneal—by a short abdominal and a vaginal incision; by this procedure the kidney is detached and the ureter freed from all its connections through a short incision in the loin as far forward as the base of the broad ligament. The rest of the ureter is then pulled through an opening made in the vault of the vagina, and removed down to its vesical end by continuing the vaginal incision forward toward the neck of the bladder."

IMPLANTATION OF THE URETER.

1. **Implantation of the Ureter into the Bladder.**—When the upper end of the divided ureter is long enough to reach the bladder, implantation into this organ is preferable to all other procedures, as the danger of subsequent infection of the ureter and kidney is thereby avoided.

The experiments of Paoli and Busachi in 1888 upon dogs were successful. Their method consisted in splitting the distal end of the ureter and uniting it by sutures to an incision in the bladder.

The successful implantation of the ureter into the bladder by Novaro, Krug, Penrose, Baum, and others leads us to believe it possible in these cases to save the kidney, which would otherwise be sacrificed.

The congenital abnormal opening of the end of the ureter outside of the bladder, in the urethra or the vagina, causing partial incontinence of urine, is naturally treated in the same way as uretero-vaginal fistulæ, either by vaginal, suprapubic, or trans-peritoneal implantation into the bladder.

(a) **Extra-peritoneal implantation of the ureter into the bladder** has been made by Baum and Westermark.

Baum's patient had a double ureter on the right side, one ending at the mouth of the urethra and causing partial incontinence of urine. Baum performed a suprapubic operation, cut an opening through the bottom of the bladder, and connected it with the proximal end of the accessory ureter, the distal end of which was ligated. The author himself does not recommend this operation, which he chose because the patient was a virgin, as he considers it under ordinary circumstances unnecessarily severe. He considers the operation through the vagina preferable.

Westermark reports the case of a woman forty-two years old with carcinoma of the uterus, which he extirpated by the sacral method. The carcinoma had invaded the lower portion of the left ureter and the neighboring portion of the bladder. He then extirpated the lower end of the ureter and a portion of the bladder-wall 4 cm. in diameter. The wound in the bladder

was united and the ureter implanted in the corner of the bladder-wound. Fine catgut sutures were applied through the muscularis of the bladder, not including the mucosa and the muscular layer of the wall of the ureter. By means of four such sutures the outer surface of the bladder-wall was folded over the ureter, making it pass obliquely into the bladder. Over this a new row of sutures was placed, folding in, over an additional piece of the ureter a little higher up, an additional layer of bladder-wall, on the principle of Witzel's operation for gastrostomy. The ureter healed without any leakage of urine. Six months later the patient was in perfect health.

(b) *Intra-peritoneal Implantation of the Ureter into the Bladder.*—In February, 1893, Novaro operated successfully by the Paoli-Busachi method in a case of vaginal hysterectomy, followed by uretero-vaginal fistula, which has been reported above in the section on Fistulae.

In the two following cases of implantation into the bladder the operators acted upon Van Hook's suggestion of uretero-ureterostomy, and the effect of the operation in each case was complete, as undoubtedly no leakage of urine took place:

Krug reports the case of a colored woman, about thirty years of age, who had suffered from a fibroid for over six years. During most of this time she had been subjected to electrical treatment. When he saw her on the morning of the operation he found her very much emaciated, with a poor pulse. The tumor filled the entire pelvis and extended above the umbilicus. On opening the abdomen universal adhesions were found. After having removed the greater part of the omentum he commenced by tying off the tube and ovary on the left side. The next ligature was placed around the round ligament and the excess of broad ligament on that side. Although he expected to meet with some difficulty in shelling out the tumor, which was entirely intra-ligamentous, and therefore paid particular attention to the ureter, he found that in cutting off the round ligament he had cut the left ureter in front of the tumor. The tumor had evidently grown intra-ligamentous, unfolding the two sheets of the broad ligament, lifting up the ureter, and the injury was done at a place where he felt absolutely secure. Putting clamp-forceps on the proximal and distal ends respectively, he finished the operation, which was an extremely difficult one. Finding then that he could reach the bladder without putting too much tension on the proximal end of the ureter, he decided to graft the ureter into the bladder. An incision being made into the bladder, the ureter was treated in a manner similar to that employed by Van Hook in invaginating the cut ends of the ureter. In sewing up the incision in the bladder care was taken to prevent leakage without constricting the lumen of the ureter. Several tiers of running sutures were made, and all available peritoneum used to build up a solid wall around the ureter. A permanent catheter was introduced into the bladder, which remained for four days. For two more days the patient was catheterized every four hours. A normal amount of urine was passed immediately after the operation. There was no rise of temperature nor any other untoward symptom. The patient left the hospital about four weeks after the operation; at last report she was doing hard work and feeling splendidly.

Penrose reports a case of a woman forty years of age with scirrhus carcinoma of the cervix uteri involving the left broad ligament and about 2 cm. of the ureter. He performed abdominal hysterectomy in July, 1893. The left ureter passed through a hard mass in the left broad ligament: 2 cm. of the ureter were excised and the distal end ligated with silk. The peritoneum was sutured over the seat of operation, and the proximal end of the ureter

implanted into the bladder after Van Hook's method. The vagina was closed. The abdomen was closed without drainage. No disturbance of bladder or kidney followed. The patient left the hospital twenty days after the operation and made a good recovery.

In a case of vaginal hysterectomy for fibroma, followed by uretero-vaginal fistula, Bazy performed laparotomy, and found the lower portion of the dilated ureter, which was buried and compressed in cicatricial tissue. The ureter was aspirated, loosened, and implanted into the bladder. The operator placed a permanent catheter in the bladder and one in the ureter for five days. Cystoscopic examination one month later showed the ureteral opening in the bladder to be patent, and that a pre-existent dilatation of the kidney had disappeared. Bazy termed this operation "uretero-cysto-neostomy."

The perfect success of the operation in these cases would seem to indicate that Paoli and Busachi may be right in proposing the application of this operation to uretero-uterine and uretero-vaginal fistulæ. If this operation is as safe and certain as the above cases indicate, and if the future function of the implanted ureter remains undisturbed, this method would seem to be superior to the older plastic operations through the vagina, which are difficult in technique, uncertain in results, and sometimes fail entirely.

(c) **Vaginal implantation**, as probably the safest method, was chosen by Davenport in the following case: Woman, twenty-nine years. Incontinence of urine from early childhood, due to malposition of the ureter. Incontinence increased by menstruation and pregnancy. One ureter was found in the vesico-vaginal septum, running forward, its orifice being close to the external orifice of the urethra. Operation for displacement of its orifice into the bladder; recovery.

2. Implantation of the Ureter into the Bowel.—Implantation into the small intestine, colon, and rectum has been studied experimentally by Rosenberg, Novaro, Morestin, Tuffier, Gluck and Zellar, Harvey Reed, Van Hook, and others.

Morestin made experimental bilateral implantation of the ureter in the rectum on 10 dogs, all of whom died—6 from peritonitis and ascending renal infection, 2 from infection, and 2 from compression of the ureter. He also made unilateral implantation of the ureter in the rectum on 14 dogs, most of whom died. He concludes that implantation of the ureter into the rectum is a grave operation, and that bilateral implantation is to be rejected.

Tuffier in the discussion of Morestin's paper stated that the absence of the ureteral sphincter facilitates ascending infection. If the vesical orifice of the ureter be implanted, it is better, but there is still liability to ascending infection.

Boari, after successful experiments on this point in dogs with a bobbin, refers to two cases in the human subject in which the method was successfully applied. The ureter is fastened round one end of the bobbin, which is then introduced into the bowel through a small longitudinal incision, which is afterward sewn up. In process of time union occurs and the bobbin is passed *per anum*. The drawings which illustrate the paper make the method easy to be understood.

In the first case (tuberculosis of the bladder) the button was passed *per anum* on the eighth day, and round its neck was seen the silk which had been fastened round its end to affix the ureter. The first urine was noticed sixteen to twenty-four hours after the operation, and henceforth, at intervals of two to three hours, about 200–300 c.cm. In the second case (large vesico-vaginal fistula with total destruction of the urethra) the button came away

per anum on the twelfth day. In both cases Boari reports that the results were satisfactory.

The technical difficulties of implantation of the ureter into the bowel have been fairly well overcome, but there seems to be a serious objection to this plan of implantation on account of the liability to infection of the ureter and kidney by intestinal microbes, and also because of some tendency to constriction at the place of implantation. Van Hook found both these conditions present in dogs as early as ten days after the operation. Reed found acute nephritis in one dog killed twenty-four days after the operation, but in another similar case the kidney was apparently healthy.

In man the implantation suggested by Roux was tried unsuccessfully by Simon, but successfully, according to Rosenberg, by Chaput in two cases.

In a case of uretero-vaginal fistula following vaginal extirpation of the uterus Chaput implanted the ureter into the colon. He performed laparotomy, divided the peritoneum on the posterior wall, isolated the ureter, divided it transversely, and fixed its renal end into the colon by a double row of step sutures. The vesical end of the ureter was ligated. The patient recovered and was well satisfied with her condition. She was obliged to void mixed urine and feces three or four times a day. Five months after the operation there were no signs of infection of the kidney.

Van Hook condemns the operation very strongly on account of the liability to infection; and he is undoubtedly right. The bowel, therefore, should never be chosen when it is possible to implant the ureter into the bladder. If this be impossible on account of defect in the ureter, it is still an open question whether or not implantation into the colon should be tried before resorting to implantation on the skin in the lumbar region or abdominal wall, or nephrectomy.

Maydl has proposed and executed an original and ingenious way of implanting both ureters with an island of the surrounding bladder-wall into the sigmoid flexure as a cure for exstrophy of the bladder. He thinks it possible that when the ureteral sphincter in the vesical wall is preserved ascending infection may be avoided; and the results thus far obtained seem to justify his expectations.

He performed the operation in the case of a girl of twenty-two, who had exstrophy of the bladder, with a double left and a single right ureter. He made an incision around the bladder so as to loosen it from the abdominal wall, beginning at the umbilical end, and at this point opening into the peritoneal cavity. He next excised from the lower portion of the bladder an oval island containing all three ureteral openings, the margin of the island being $1\frac{1}{2}$ cm. outside of the ureteral openings, care being taken not to open into the ureters. The ureters were now carefully dissected out after sounds had been introduced through the ureteral openings. The dissection was made guided partly by the sounds and partly by the fingers introduced into the peritoneal cavity from above. The island with the ureters was now freed from its surroundings, care being taken not to divide the vessels in connection with the ureters. The remainder of the bladder-wall was extirpated. The sigmoid flexure was then drawn out of the wound, emptied, compressed above and below, and a longitudinal incision made in its convex surface for implantation of the island with the ureters. This was accomplished first by a row of mucosa sutures, and this again covered by muscularis and serosa sutures. The bowel was then replaced in the abdomen and an iodoform-gauze drain passed down to the place of implantation. The abdominal wall was united by step sutures down to the drain, and a permanent

drainage-tube inserted in the rectum. The patient left the hospital in eighty-four days. One year later she was in excellent health; rectal micturition took place every six or eight hours. The patient was able to do her work as a servant and showed no symptoms of infection of the kidneys.

In another case, a girl of seven, there was rectal micturition only five or six times in the twenty-four hours.

Maydl has operated on 5 cases: 1 died in twelve hours, probably from protracted narcosis. He believes that the danger of infection is less in the sigmoid flexure than if implantation is made in the ileum, where the processes of decomposition are more active.

The contraindications for this operation are pre-existing nephritis or pyelitis.

3. Implantation of One Ureter into its Fellow.—Monari divided the ureter close to the bladder in dogs, closed the vesical end with a silk suture, isolated the renal end sufficiently to permit it to pass through an incision in the mesentery of the sigmoid flexure, and united it with the ureter of the opposite side (Fig. 189). Union followed, and when the dog was killed four months later a constriction was found at the place where the ureter passed through the opening in the mesentery, with consequent dilatation of the ureter above and of the pelvis, but at the place of anastomosis with the other ureter there was no narrowing of the lumen. He proposes to use this method on man in cases of abnormal exit of the ureter, in preference to implanting it in the bladder.

Implantation in the bladder is probably preferable to the method proposed by Monari, because it is easier of performance.

4. Implantation of the Ureter on the Skin.—Le Dentu

was the first to implant the ureter on the skin for anuria in a case of absolute impermeability from cancer in the small pelvis. The symptoms were relieved, but the patient died thirteen days later from cancerous cachexia. This case, however, established the operation as an effective procedure to be employed in combating anuria due to incurable mechanical causes, as it at least prolonged life.

Pozzi, in the removal of a retro-peritoneal parovarian cyst by laparotomy, divided the ureter at about its middle. The upper end was dissected out for 4 or 6 cm. and implanted into the skin in the lumbar region through a button-hole opening. The distal portion of the ureter was sutured to the lower end of the abdominal wound. The patient recovered from the operation, and three months later nephrectomy was resorted to, which was followed by

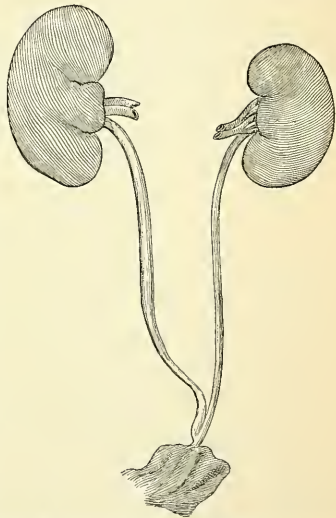


FIG. 189.—Monari's operation of implantation of one ureter into its fellow.

recovery. Microscopical examination of the kidney showed that it was healthy, with the exception of a few small islands of interstitial nephritis. No septic invasion had taken place, as no micro-organisms were found. The integrity of the kidney in this case, after so long a period of exposure through the open ureter, is remarkable, and, according to Albarran, was due to the antiseptic precautions in the after-treatment. This case was one in which uretero-ureterostomy might have been performed with advantage.

Losses of substance of the ureter too extensive to permit of uretero-ureterostomy, or located too high up to permit of implantation of the upper end into the bladder, will require either implantation on the skin or into the bowel. As both of these methods are objectionable on account of the liability to infection sooner or later, and the consequent necessity of nephrectomy, operative procedures to effect a connection with the bladder have been proposed by Rydygier and Van Hook based upon dissections on the cadaver.

Rydygier proposes to implant the two ends of the ureter on the abdominal wall, and by plastic operation to make a channel of skin between them to make good the loss of substance of the ureter.

Van Hook proposes by plastic operation on the bladder to create a diverticulum long enough to meet the upper end of the ureter.

In both of these methods it is proposed to place these newly-formed channels in the abdominal wall. Theoretically, these methods appear feasible, but they have not as yet been practised on animals or on the human subject.

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THE SURGICAL DISEASES OF THE KIDNEY.

By P. R. BOLTON, M. D.

THE kidneys are deeply placed in the abdomen, lying in contact with its posterior wall, behind the peritoneum, and extend from the eleventh rib downward and slightly outward to the level of the third lumbar vertebra or almost to the iliac crests. The upper end of the right kidney is a trifle lower

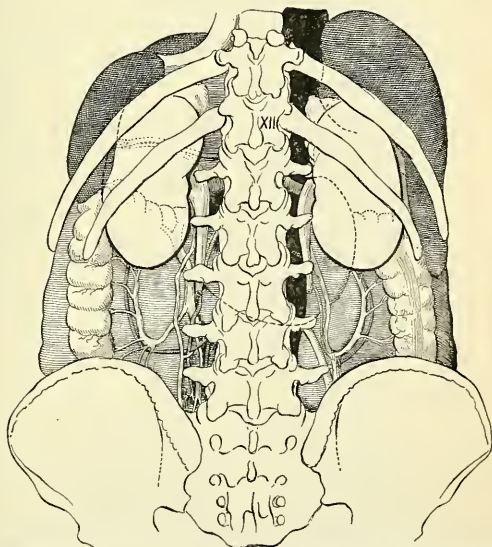


FIG. 190.—Relation of the kidneys as viewed through the lumbar wall. The two dark-shaded parts indicate the liver to the right, the spleen on the left; in front of the vertebral column the black tint represents the vena cava; the twelfth rib is long (after Farabent).

than the left, but, as its long axis is shorter than the left, the lower ends of the two organs lie in about the same horizontal plane.

The posterior surfaces of the kidneys do not look directly backward, but rather backward and inward, and are in relation in each side with the diaphragm above, separating the kidney from the eleventh and twelfth ribs, and below with the anterior layer of the transversalis fascia, which is interposed between the kidney and the quadratus lumborum muscle, and supports the ilio-inguinal and ilio-hypogastric nerves and lumbar vessels.

In front the right kidney lies in relation with the right lobe of the liver,

with the second part of the duodenum, and with the ascending colon, while in front of the left kidney are the stomach, tail of the pancreas, and descending colon, with the spleen applied to its outer border. The internal border of each kidney corresponds to the outer margin of the psoas muscle, and in the case of the right is close to the ascending vena cava.

Each kidney is enveloped by a quantity of fat, the fatty capsule, which, together with the structures entering the hilus, the renal artery and vein, and the ureter, serves to maintain the organ in its place. Traced upon the anterior abdominal wall, the upper end of the kidney with its suprarenal capsule is found in the epigastric region; the lower end lies behind the line erected from the middle of Poupart's ligament to the cartilage of the eighth rib at the level of the umbilicus, while the middle portion is behind the junction of the hypochondriac, epigastric, umbilical, and lumbar regions.

In the back the upper end of the kidney corresponds to the eleventh rib, and its lower end to the third lumbar vertebra, while its internal border is about $7\frac{1}{2}$ cm. from the median line in the adult.

Thus the kidney may with propriety be regarded as situated within the thorax to the extent of almost its upper half, and its relations to the dia-

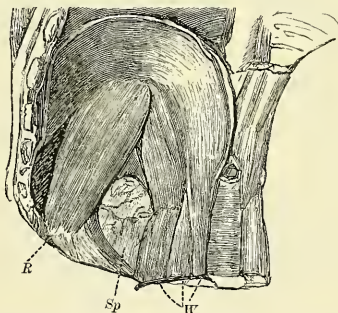


FIG. 191.—Muscle-fissure (*Sp*) between the origin of the diaphragm at the spinal column (*W*) and on the ribs (*R*) (Tillmantus).

phragm and pleura are of no inconsiderable importance. Lange's¹ investigation of the anatomy of this region proves that in not a few instances the development of the twelfth rib is imperfect, and that when such is the case—and indeed occasionally when this rib is of normal length—the posterior border of the diaphragm, the ligamentum arcuatum externum, may be found below the level of the rib; and, as this structure marks the line of reduplication of the pleura, this membrane may readily be wounded through incisions made in the loin.

In other instances the posterior fibers of the diaphragm may be rudimentary or even absent, when the fatty capsule of the kidney will be found lying in direct contact with the pleura.

The normal mobility of the kidney is of interest in connection with the subject of so-called movable and floating kidneys, and has been found to be considerable by experiments upon the dead body and observations upon the living organ exposed during operation.

¹ *Annals of Surg.*, 1885, i. p. 286.

The movement imparted to the kidney by the descent of the diaphragm is not alone one in the vertical direction, but is also slightly outward; but for

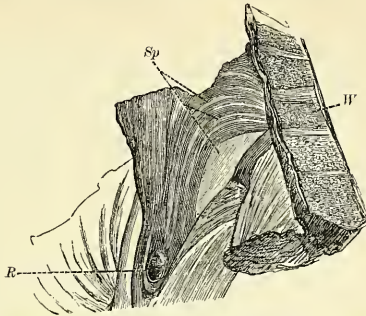


FIG. 192.—Muscle-fissure (*Sp*) between the origin of the diaphragm at the spinal column (*W*) and on the ribs (*R*) (Tillmanns).

practical purposes the movement downward is alone to be considered, and this amounts normally to less than one inch.

ABNORMALITIES.

Malposition of the kidney, while rare and usually of only anatomical interest—for the functions of the displaced organ are generally performed in

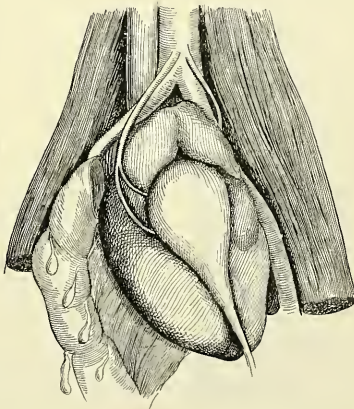


FIG. 193.—Representing the lobulated appearance of the kidney and its relations to the aorta and sigmoid flexure of the colon. Misplaced and malformed left kidney; misplaced sigmoid flexure of colon (Canton).

a perfectly normal manner—becomes important in the consideration of the diagnosis of abdominal tumors.

The misplaced kidney too may be the site of any of the diseases peculiar to this gland, and may therefore demand surgical treatment; or the kidney in its abnormal position may by its encroachment upon other viscera interfere with their functions.

Among the records of 8842 autopsies Morris¹ found 10 instances of misplaced kidney, the kidney lying either in the iliac fossa, in front of the sacro-iliac joint, in front of the promontory of the sacrum, or in the hollow of the sacrum. The kidney under these circumstances may be bodily displaced or may be rotated on any of its axes, and is not infrequently separated from its suprarenal capsule.

In a few cases malposition of the left kidney has been associated with malformation of the sigmoid flexure, which then is represented by a continuation of the descending colon to the right sacro-iliac joint, where the rectum begins.

Misplacements of the kidney either exist at birth or are effected by disease of neighboring organs; thus the right kidney may be displaced by pathological conditions of the liver, the left by enlargements of the spleen or pancreas, and either kidney may be displaced by tight lacing or by the pressure of tumors.

There are usually no symptoms referable to the misplaced kidney itself, unless it be diseased, but the kidney by its pressure upon other organs may give rise to symptoms of interference with their functions.

Malformations of the kidney vary from the lobulated condition which exists in the fetus and in many other mammals, to the single disk-shaped organ the result of fusion of the kidneys.

The lobes of the lobulated form correspond more or less accurately to the number of divisions of the ureter, the calyces; and there may, therefore, be as many as ten or there may be but two, representing the main branches of this duct.

Of fusion of the kidneys the so-called horseshoe kidney is the commonest type. In this the lower ends of the kidneys are united by a band of kidney-tissue or of fibrous tissue which extends across the spinal column, or, more rarely, the upper ends or the middle portions of the kidneys are so united.

An exaggeration of this form results in coalescence of the internal borders of the kidneys in their whole extent, making a single disk-shaped kidney, which is not infrequently displaced.

While in such cases there may be two separate pelves, there is as often one, but two ureters are present and discharge into the bladder in the usual way.

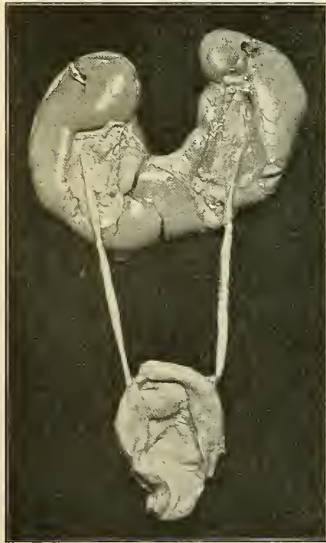


FIG. 194.—Horseshoe kidney (Specimen 3137, Museum N. Y. Hosp.).

¹ *Surg. Dis. of the Kidney*, p. 19.

The failure of development of the kidney is of great surgical importance; and that such cases do occur should constantly be borne in mind in considering any operation upon this organ, but especially in connection with nephrectomy.

The horseshoe- or disk-shaped kidney naturally falls into the group of single kidneys, but has already been described, so that we include only those instances of kidney without a fellow or with an associated organ of rudimentary development and incapable of performing renal functions.

The absence of one or other of the kidneys has been frequently observed, although the proportion of such cases is exceedingly small—1 in 3992 $\frac{2}{3}$ (Morris). In these cases, however, the functions of the kidneys are carried on perfectly well by the kidney present, which is then usually hypertrophied.

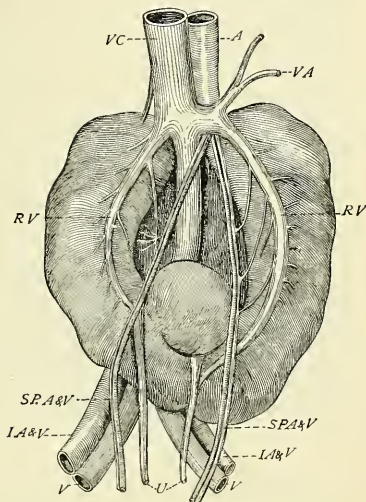


FIG. 195.—Two kidneys blended and occupying a median position: A, aorta; VC, vena cava; VA, vena adiposa; RV, renal vein; SPA&V, spermatic artery and vein; IA&V, iliac artery and vein; U, ureters; V, iliac vein (after Haller).

As to the relative frequency with which the right or left kidney is absent or rudimentary, Benner's¹ statistics show that among 48 cases the right kidney was absent 22 times, the left 21 times, while one or other was rudimentary in 4; 1 not stated.

The causation of this condition has generally been ascribed to interference with the development of the Wolffian body; and the quite frequent association of absence of the kidney with absence or maldevelopment of other parts of the genito-urinary tract of the same side tends to support this view, as of the testis or ovary and of the uterus or seminal vesicle.

The rudimentary development of one of the kidneys depends obviously upon a lesser degree of the same interference with the growth of the Wolffian body that produces non-development of the kidney in other cases.

¹ Quoted by Wagner: *Nieren-chir.*, p. 6.

The degree of non-development varies from some diminution in size to a mass of fibrous tissue in which only a trace of kidney-tissue is found, and



FIG. 196.—Congenital cystic kidney (Specimen 2816, Museum N. Y. Hosp.).

which may properly be judged to be inadequate for the performance of excretory functions should the other kidney be removed.

EXAMINATION OF THE KIDNEY.

Besides the knowledge of the state of the kidney to be derived from chemical and microscopic examination of the urine, and from cystoscopic inspection of the mouths of the ureters or their catheterization, direct investigation of the kidney is practised to ascertain its position, size, mobility, outlines, consistency, and relation to other organs.

Unless the kidney be considerably enlarged or displaced no information can be obtained by inspection. In many if not most persons the kidney, even when of normal size and situation, may be readily felt in its lower half; but where there is an extraordinary amount of fat present in the abdominal wall, or the latter is rigid, or the ribs very oblique and the lower opening of the thorax contracted, or where the colon is distended by fecal material, the kidney can hardly be recognized: it is further obvious that examinations made under anesthesia are far more certain and satisfactory.

Israel¹ gives three methods for palpating the kidney, and emphasizes the necessity of employing none to the exclusion of the others, as each yields information peculiar to itself.

The ordinary bimanual examination is made with the patient supine upon a flat surface, the thighs flexed, and abdominal wall relaxed. If the right kidney is to be examined, the operator stands upon the patient's right and places the fingers of the left hand beneath the loin, and the palmar surface of the fingers of the right hand upon the anterior abdominal wall in a line erected from the middle of Poupart's ligament to the cartilage of the eighth rib and two fingers' breadths below the costal cartilages; then the patient is directed to breathe rather deeply and easily through the mouth, and with each expiration the right hand crowds the abdominal wall backward, holding during inspiration the position previously gained until the kidney is reached, when with the counter-support of the left hand such facts as are sought are learned.

Guyon's method of kidney ballottement is practised with the patient and operator in the same positions, but in addition to the usual maneuvers above described the fingers of the hand upon the loin are repeatedly and sharply flexed, and thus reflex contraction of the quadratus excited, and the kidney is thrust forward against the anterior abdominal wall. This method is of special value in differential diagnosis, for no other abdominal tumor will give this sign.

The third method consists in placing the patient upon his side, or even semi-prone, with the thighs flexed. In this position the abdominal wall is relaxed and the abdominal contents fall away from in front of the kidney to be examined, and the latter may then be reached by the same bimanual compression as before.

In special cases palpation of the kidney may be carried out in the knee-chest or erect position—*i. e.* to ascertain the limits of the excursion of a movable or floating kidney.

The determination of the position or presence of a kidney by percussion is of questionable value.

In those forms of surgical disease of the kidney, then, which are accompanied by enlargement and by probable displacement the organ may be studied by palpation, and many of its features recognized; but the demonstration of an abdominal tumor to be of renal origin requires the consideration of many points, and especially if the tumor is of some size.

The lateral position of the tumor and its emergence from beneath the ribs, and its growth downward and toward the median line, are of great significance; or, if it possess some mobility, its recession to the loin in recumbency and the development of renal ballottement are valuable signs.

The comparative absence of respiratory movements will sometimes distinguish renal tumors from those of the liver, gall-bladder, and spleen.

Finally, the relation of the inflated colon to the suspected tumor will occasionally clear up a diagnosis otherwise uncertain; but it should be borne in mind that on the right side the ascending colon is usually found crossing the lower and inner part of a renal tumor, and is sometimes displaced inward, so as not to be detected on the anterior surface of the mass at all.

The introduction of an exploring needle or aspirator into a tumor previously demonstrated to be of the kidney is often of value in determining the presence or absence of fluid, and, in case fluid be present, in deciding its nature.

¹ *Berlin. klin. Woch.*, 89, Nos. 7 and 8, pp. 125, 156.

It goes almost without saying that this exploration should be done aseptically and through the loin.

Kidney tumors have been confounded with those of the retro-peritoneal glands, of the gall-bladder, of the liver, of the spleen, of the intestine and mesentery, of the uterus, of the ovary, of the pancreas, and with tuberculous peritonitis; and the differentiation from tumors of these organs must depend upon a close study of all the facts of the case.

INJURIES OF THE KIDNEY.

Contusions of the Kidney.—The kidney may be contused by falls or blows in which the loin receives the violence, as by kicks or by falls across beams, but in its severer forms, at least, is usually found associated with the multiple injuries occurring in "run-over" accidents or in crushes between buffers or in elevators, etc.



FIG. 197.—1, Rupture of the isthmus of a horseshoe kidney by fracture of the lumbar spine (Specimen 2930, Museum of N. Y. Hosp.).

Lesions.—The mildest form consists in small hemorrhages beneath the capsule of the kidney, without serious injury of the parenchyma. In the more severe cases laceration of the gland itself occurs, and hematomata of greater or less size are found, particularly at the bases of the pyramids.

In the most severe cases the kidney is ruptured or reduced to pulp, the capsule is split, and hemorrhage occurs into the surrounding tissues, and, if any considerable branch of the artery is torn, may be profuse and the effusion extend behind the peritoneum into the pelvis. In cases of this degree, and indeed in the milder ones, the neighboring structures are often injured.

The overlying peritoneum may be ruptured and the bleeding occur into its cavity; the liver, spleen, the intestine, and lung are sometimes injured, as well as the spine, ribs, and pelvis.

Repair of the kidney-tissue after contusions is usually rapid, but occa-

sionally cysts are formed which persist indefinitely, or the injured kidney may be infected through the bladder and ureter or by the blood.

Symptoms.—After the reception of an injury severe enough to produce a contusion of the kidney the patient is usually in a condition of shock more or less profound. The skin is pale, cold, and moist, the temperature subnormal, and the pulse small, rapid, and feeble.

The symptoms of the accompanying injury may modify the picture, but certain well-defined features should serve to make the diagnosis of contusion of the kidney clear in most cases.

The pain is often agonizing, and, while always felt in the region of the kidney, generally radiates through the iliac fossa in the direction of the ureter, or, when clots are traversing the ureter, the pain is that of renal colic: under these circumstances clots have sometimes been discovered in the urine, and these resemble vermicelli and seem to be casts of the ureter.

The urine very soon after the injury generally contains blood in greater or less quantity, and may in serious cases be present in sufficient quantity to coagulate, or the loss of blood by this means may be great enough to produce death.

The hemorrhage may continue for some time, but, as a rule, diminishes after a few days, and ceases at the end of six or seven days.

More rarely blood does not appear in the urine for some days, or, instead of gradually diminishing in quantity, it may increase.

If the injury to the kidney is associated with rupture of the ureter, no blood, or at least very little, escapes into the bladder; but, as a rule, one may say that the amount of blood in the urine is a very fair guide to the degree of damage of the kidney.

The quantity of urine secreted after contusion of the kidney is diminished, and for a short time there may be suppression, but after a few days the volume of urine rises to the normal again.

Palpation of the kidney, when the pain excited does not forbid it, will occasionally reveal the existence of fulness, or, more rarely, of a well-limited tumor, indicating in the one case perirenal hemorrhage, and in the other distention of the kidney by blood confined within the capsule.

Echymosis, if it appears at all, is late in developing, and may be recognized in the loin or inguinal region.

If suppuration occurs, it is usually due to infection of the bladder by catheterization and to invasion of the kidney by the bacteria through the ureter. The form of inflammation may be either pyelo-nephritis, or one or more abscesses of the parenchyma of some size, or phlegmon of the perirenal cellular tissue.

The advent of a process of this kind is indicated by diminution in the quantity and change in the quality of the urine, by chills and febrile movement, and by pain and tenderness in the region of the kidney, and increase in the tumefaction there; the danger to life of such a condition is of course much enhanced if the other, non-contused, kidney is also affected.

As remote symptoms of contusion of the kidney, hydronephrosis, chronic diffuse nephritis, renal calculi, cysts, and tumors should be mentioned.

The prognosis is grave, and becomes especially so when the lesion is associated with severe injuries of other parts; thus Tuffier¹ gives the mortality of essentially uncomplicated cases as 43 per cent., and of complicated cases as 87 per cent. Grawitz² analyzes 108 cases as follows: Mortality,

¹ *Arch. gén. de Méd.*, t. xxii. pp. 591, 697; xxiii. 355.

² *Arch. für klin. Chir.*, Heft 2, 1889.

46.3 per cent., 50 cases, and of these fatal cases 18 were complicated by injury of more important viscera. In 17 suppuration occurred, with 7 deaths. Of 32 uncomplicated cases in which death followed, 14 died of primary hemorrhage, 8 of secondary hemorrhage, 7 of suppuration, and 3 of urinary retention.

Treatment.—The management of the injuries which may possibly be associated with contusion of the kidney need not be described here, nor is it desirable to do more than to refer to the necessity of combating shock if present in any degree.

The milder cases of contusion of the kidney need no further treatment than rest in bed for a few days and attention to the general condition of the patient.

In the more severe cases, where active measures to restrain dangerous bleeding come into consideration, no time should be consumed, in the writer's judgment, in waiting for the effect of drugs said to possess hemostatic properties in renal hemorrhage, nor in applying cold or pressure to the region of the affected kidney, nor yet in the use of cold enemata.

If the bleeding is severe enough to be dangerous, one ought to proceed without delay to direct treatment of the kidney through an incision in the loin.

The perirenal region must be cleared of clots, and bleeding from the ruptured kidney controlled by gauze packing, by ligature or clamp, or by total or partial nephrectomy.

In the most severe cases, in which contusion of the kidney plays a rôle secondary to the associated injuries, no surgical interference is likely to prove of value, and none should be undertaken.

The treatment of the later complications will be discussed under their proper headings.

Wounds of the kidney are comparatively rare except in military practice, so that the majority of the cases reported have been either gunshot or stab wounds reaching the kidney through the anterior abdominal wall or the loin or the thorax.

Lesions.—All parts of the kidney have been wounded; the wound may be superficial or deep, or the kidney may be perforated or even cut into two pieces. In any case there is free bleeding, but especially in wounds near the hilus dividing the larger branches of the artery.

Neighboring organs may be also wounded; thus in a case occurring at the

New York Hospital some years ago a 38-caliber bullet entered the anterior thoracic wall, traversed the pericardium, pierced the diaphragm, wounded the spleen, perforated the colon in four points, wounded the border of the left kidney, and lodged beneath the skin of the loin. In cases of this kind the wound of the kidney ceases to be the main feature of the injury.



FIG. 198.—1, Stab wound of border of kidney, opening pelvis (Specimen 749, Museum N. Y. Hosp.).

Wounds of the kidney are readily and quickly repaired, and are not complicated by infiltration of urine, as might be expected; but if infection of the wound occurs, suppurative nephritis may develop and destroy the wounded organ.

Symptoms.—The shock which accompanies wounds of the kidney uncomplicated by wounds of other tissues is generally not very profound.

The position of the wound in the loin is of great significance, and more particularly its direction, which may be ascertained by placing the patient in the position occupied when wounded and then introducing the probe. If bleeding from a wound of the loin and leading in the direction of the kidney is profuse, the probability that the kidney has been wounded becomes very great; if urine escapes from the wound, there is no doubt that the kidney has been wounded, and very little doubt that the pelvis is also wounded; but this sign is comparatively rare. Hematuria is often, though not always, present. Without one or other or both of these signs the diagnosis of wound of the kidney remains in doubt.

In wounds of the kidney inflicted through the anterior abdominal wall the diagnosis becomes more difficult, owing to the very frequent wounds of the intestine produced by the same injury, and whose symptoms are likely to overshadow those of the wounded kidney.

Under these circumstances, unless a wound of exit also exists in the loin, or the bullet, in case of a bullet-wound, can be recognized beneath the skin of the loin, or hematuria occurs, the demonstration of a wound of the kidney is wellnigh impossible, and can only be made after the abdomen is opened for exploration or for the treatment of wounds of the other abdominal organs.

In a few instances the kidney has prolapsed through large wounds of the loin.

If the wound of the kidney is infected and suppuration occurs, the symptoms will be those of pyonephrosis, or if the kidney is infected by bacteria finding their way to it through the ureter from the bladder, the symptoms will be those of pyelo-nephritis.

Prognosis.—Wounds of the kidney alone are not of great gravity if they remain aseptic, as is shown by the almost uniform recovery after explorative incisions into the kidney; but the very frequent association of wounds of other abdominal viscera, giving rise to peritonitis, and the great likelihood of infection by foreign bodies, etc., and the possibility of peritonitis developing without wounds of the intraperitoneal viscera, make wounds of the kidney grave injuries.

Thus, of 31 stab wounds of the kidney, 8 were fatal—25.8 per cent.; and of 38 bullet-wounds, 16 were fatal—42.1 per cent. But of the 8 deaths, 6 were at least caused in part by other visceral wounds; and of the 16 deaths, 11 were ascribed to lesions of other viscera.¹

Grawitz² analyzes 50 cases of stab of the kidney as follows: 15 complicated by injuries of other viscera, 35 uncomplicated. Of the 35 uncomplicated cases, 11 died—1 from primary bleeding, 1 from secondary hemorrhage, 6 from suppurative nephritis of the wounded kidney, 2 from suppuration of the uninjured kidney, 1 not stated. Of the 15 complicated cases, 3 were complicated by injury of the spine, and all died; 1 by laceration of the peritoneum, fatal; 2 by injury of the liver, both died; 3 by injury of the intestine, 2 died; 6 by injury of the chest, 4 died; thus 12 died and 3 recovered.

¹ *Traité de Chir.*, Duplay and Reclus, vol. vii. p. 492.

² *Arch. für klin. Chir.*, Heft 2, 1889.

Treatment.—If the external wound is situated in the loin and bleeding is slight, and there are probably no foreign bodies to deal with, after sterilization it may be lightly packed and a large firm dressing applied.

If, however, there is dangerous bleeding or foreign bodies come into question, the kidney should be exposed by an incision which includes the wound if possible; the hemorrhage treated either by gauze pressure, suture, ligature, or clamp, or total or partial nephrectomy performed. If the wound be situated in the anterior abdominal wall and has traversed the peritoneal cavity to reach the kidney, it is likely that some other of the abdominal organs has been wounded; to determine this point, as well as to treat the wound of the peritoneum which overlies the kidney, and the kidney wound itself, the safest course to pursue is to enlarge the wound of entrance sufficiently to examine the intestine in the neighborhood. If wounds of the small intestine are found, the abdomen must be opened in the median line to a sufficient extent to allow proper treatment of the intestinal wounds, as well as to give access to the injured kidney.

On the other hand, if the external wound is situated in one or other lumbar region and the ascending or descending colon is the portion of the bowel wounded, Langenbuch's incision through the linea semilunaris will give the most satisfactory path to the kidney and the intestine.

The wounded kidney is then treated as advised in the case of wound through the loin, but if extirpated the cavity should be drained through a counter-opening in the loin.

If extirpation is not found necessary, the peritoneal wound must be firmly sutured, the contiguous peritoneum wiped clean, and provision for the escape of secretion provided by gauze drainage.

Irrigation of the entire abdominal cavity would hardly be indicated unless considerable quantities of blood or urinous fluid had produced a general soiling of the peritoneum; but if the peritoneum is in a condition that seems to warrant active treatment, the flushing must be thorough, and is better done by salt solution than by antiseptic solutions, which, if concentrated enough to be germicidal, are powerful irritants of the peritoneum; and irrigation must be supplemented by drainage, not only of the region of the affected kidney, but also of Douglas's cul-de-sac and the opposite lumbar region.

If the kidney is prolapsed through a wound of the loin and uninjured or only slightly wounded, it should be replaced and the wound thoroughly drained; if so damaged, either by extensive wound or by strangulation, as to render it useless, the pedicle must be tied off and the organ removed.

If infection of the wound occurs, either from without or by way of the ureter, the condition is one of pyelonephritis or of pyonephrosis, and will be discussed under those titles.

SUPPURATIVE INFLAMMATIONS OF THE KIDNEY, OF ITS PELVIS, AND OF THE PERIRENAL TISSUES.

Suppurative inflammations of the kidney or of its pelvis, or of both together, occur under a variety of circumstances; but since suppuration is common to them all, and the lesion is of the same character, differing only in degree, it is convenient to class all these inflammatory diseases in one group, and thus to avoid a great deal of repetition that would inevitably be involved in separate descriptions of them.

Lesions.—In those forms produced by embolism, and occurring in conditions of general sepsis or associated with infectious endocarditis, both

kidneys are usually involved: they are slightly increased in size, deeply congested, and studded with minute white points surrounded by red zones. These dots are formed by the infiltration of pus-cells between the tubules of the kidney and the disintegration of the kidney tissues; they teem with the bacteria of suppuration.

In those forms caused by extension of the suppurative process from the pelvis of the kidney or the ureter one kidney only may be involved, or both. The kidney is swollen, congested, and studded with foci of pus of various sizes, which are infiltrated between the tubules of the cortex and pyramids; in the latter the foci often appear as streaks running parallel with the collecting tubules. As the disease goes on larger abscesses occur through confluence of the smaller ones, until the entire kidney may be destroyed and the perinephritic tissue infected. The pelvis of the kidney is swollen, congested, coated with pus or fibrin, or ulcerated.

If the disease is slow in its evolution, and particularly if the ureter is more or less obstructed, the pelvis and kidney become distended by a mixture of pus and urine, and the resulting condition is referred to as pyonephrosis.

Such abscesses may rupture spontaneously through the skin or diaphragm or into the intestine or peritoneum.

In suppurative nephritis consequent upon contusions or wounds the resulting process may be circumscribed and confined to one part of the kidney, or the whole gland may be involved and converted into a mass of blood, pus, and broken-down tissue.

Any of these forms of inflammation may extend beyond the kidney, either by rupture of the abscesses into the surrounding tissues or by transmission of the bacteria along the lymph-channels; and when perinephritis does develop, considerable collections of pus may occur about the kidney.

Suppurative inflammations of the perinephritic tissues also occur as primary phlegmons, and run a rapid and severe course; or the inflammation may be propagated from contiguous organs other than the kidney, as the lumbar spine, pelvic cellulitis, appendicitis, etc.

Abscesses of the perirenal tissues usually rupture externally in the loin, but they may burst into the pleura or lung, the intestine or peritoneum, or they may burrow downward through the iliac fossa to the groin and perforate the skin.

Etiology.—All of these forms of suppuration are caused by the presence and growth of one or other of the pyogenic bacteria, oftenest the golden coccus, but not infrequently the common colon bacillus. The channels by which these bacteria reach the kidney, however, are quite varied.

In the cases of miliary abscesses occurring in sepsis or complicating malignant endocarditis the blood conveys the bacteria, and the process is one of embolism, and suppuration goes on wherever the cocci happen to lodge.

In suppurative nephritis due to infection from the pelvis of the kidney



FIG. 199.—Suppurative nephritis: 1, 2, and 3, abscess-cavities (specimen 2386, Museum N. Y. Hosp.).

the pelvis of the kidney is usually invaded by bacteria reaching it through the ureter from the bladder, where, as a rule, they are present as the result of instrumentation or the extension of inflammations of the urethra.

The conditions which call for the introduction of instruments into the bladder are therefore usually the antecedents of this type of nephritis, and in such cases one finds an acute or chronic cystitis due to gonorrhœa or strictures, or hypertrophy of the prostate, or produced by operations upon the urethra or bladder, or, in cases of paraplegia, in consequence of catheterization.

The inflammation originating in the bladder ascends the ureter and pelvis of the kidney and the straight tubules, and then excites the changes above described.

If the pelvis of the kidney happens to contain calculi, they will be found in the abscess-cavities: they appear to act as causative agents in the production of suppuration only to the extent of making the action of the bacteria easier by their mechanical irritation of the tissues involved; or if they partially obstruct the ureter and prevent the free escape of what urine may be secreted and of pus, they may contribute in this way to the development of pyonephrosis.

In suppurative nephritis consequent upon contusions or wounds of the kidney, the bacteria gain entrance to the organ through the external wound, or in the case of contusions through the bladder, ureter, and pelvis, and generally as the result of catheterization, unless some suppurative lesion of their mucous membranes already exists.

Symptoms.—The minute abscesses which occur with general sepsis or with malignant endocarditis give no symptoms that indicate with certainty the condition of the kidneys present; for the occurrence of albumin and casts in the urine is the rule in septic diseases, even without embolism of the kidney.

With the larger abscesses due to injuries of the kidney, or to the presence of calculi, or to uretero-pyelitis, the symptoms are generally well marked and the change in the kidney often capable of easy demonstration; but they differ slightly in their details. When the nephritis occurs with cystitis due to stricture of the urethra, to operations on the urethra or bladder, or to vesical calculus, the patient suffers first from the symptoms of cystitis, and then from the symptoms of nephritis; there are repeated chills and a febrile movement of an irregular type and accompanied by sweating.

Cerebral symptoms become marked; delirium alternates with stupor; the periods of stupor become longer; and the patient finally dies in a state of profound sepsis.

The urine is usually diminished, and may be suppressed, and contains blood, pus, and mucus derived from the bladder and the kidneys.

When the nephritis is due to the extension of a gonorrhœa to the kidneys, the patients first suffer from the gonorrhœa, and then from cystitis, and last from nephritis. The latter adds about the same symptoms above described; these cases are rare.

When suppurative nephritis complicates hypertrophy of the prostate, the patients are men generally more than fifty-four years of age, who have suffered for longer or shorter periods from the symptoms of enlargement of the prostate, retention, and cystitis, and have been obliged to use the catheter; or, more rarely, there have been no bladder-symptoms.

“The first symptom is a diminution in the quantity of urine, with the appearance of blood mixed with it, or the urine may be suppressed alto-

gether. The blood may be present in considerable quantities, so that the patients seem to pass blood instead of urine. The patients rapidly become prostrated, and are very anxious. There are usually no chills, and there may be no rise in temperature. The prostration becomes more marked; the pulse is rapid and feeble; the skin is cold and bathed in perspiration; and the patients die in collapse at the end of a few days. Or, instead of such a history, the patients may behave as if they were the subjects of septic poisoning" (Delafield).

In these forms of suppurative nephritis both kidneys are commonly involved, but, aside from some pain referred to the loins, there may be no local symptoms, and the slight enlargement of the kidney present is rarely demonstrable.

When suppurative nephritis occurs without assignable cause, or when pyelitis excited by the presence of calculi becomes infected from any source and extends to and involves the kidney, the disease is apt to run a slower course.

The patient may have suffered from the symptoms of renal calculi when he develops the symptoms of suppuration; they are at first obscure. There may be repeated chills, and fever of mild and irregular type, with loss of flesh and strength. There may be pain referred to the affected kidney.

If the purulent collections communicate with the ureter, pus may be discharged continuously or at intervals; and in the latter case a tumor may be detected at the site of the kidney, which varies in size, and whose diminutions in size correspond to the presence of considerable amounts of pus in the urine.

If the abscess ruptures, fistulæ are formed which open externally or into one of the neighboring cavities. Protracted suppuration from this abscess may in the end cause amyloid degeneration of the other viscera, including the opposite kidney.

In suppurative nephritis consequent upon injury we get the history of injury, and then of sepsis.

In the case of a wound the diagnosis is quite easy, but in the case of contusion the symptoms usually begin with chills, which may be repeated, and at the same time aseptic fever develops: there may be pain referred to the affected kidney; the urine is diminished and continues to contain blood, and later pus appears. The enlarged kidney may sometimes be palpated.

The disease may go on and the patient die in a typhoid state, or the course may be slower and give the symptoms of pyonephrosis, or the symptoms may gradually subside and the patient recover.

Perinephritis.—There is a form of inflammation of the pararenal cellular tissue which appears to be a primary phlegmon, with which the kidney has nothing to do.

More commonly, however, the perinephritic inflammation is secondary to suppurative nephritis, and then its symptoms are preceded by those of the condition to which it is the sequel.

The disease runs a rapid or less acute course; there are chills, fever, and pain. If the abscess points backward, the loin sooner or later swells and gives fluctuation, and the collection may rupture there; if the pus burrows downward, it may point in the groin; if it bursts into the peritoneum, the symptoms of septic peritonitis are developed; or the abscess may rupture into the intestine or perforate the diaphragm and cause empyema, or be discharged through the bronchi.

Prognosis.—Those forms of bilateral suppurative nephritis occurring

with general sepsis, with enlarged prostate, with gonorrhœa, with stricture of the urethra, or with vesical calculus are fatal in the vast majority of cases, very few recovering. Those forms of suppurative nephritis occurring in but one of the kidneys, and due to renal calculi and to injuries of the kidney, are slower and less severe in their courses, and the patients usually get well if treated with discretion, but many also die.

Perinephritis is not usually fatal, but large collections of pus may form and exhaust the patient, or, rupturing into the peritoneum, pleura, or lung, may produce death.

Treatment.—For the miliary abscesses occurring with general sepsis or due to infectious emboli there is practically no other treatment than that directed to the general disease: if this succeeds, as it rarely does, the lesion of the kidney heals, and the minute scars of these abscesses have been recognized at autopsy in the kidneys of those who had previously gone through such attacks and recovered.¹

For the bilateral suppurative nephritides due to strictures, to enlargements of the prostate, to stone in the bladder occurring in persons of middle or advanced years, there is no treatment. In younger individuals the patient may recover, at least exceptionally, as an observation reported by Weir to the Association of American Surgeons (1894) will show.

For the abscesses of the kidney due to injury or occurring in consequence of calculi the indication is to drain as early as possible, in order to prevent extensive destruction of the kidney-tissue and to anticipate implication of the contiguous tissues.

The kidney is exposed in the loin, the pus located by the aspirating needle, and the cavity opened by the most direct route through the overlying cortex; if calculi are present, they are to be removed; the cavity is washed out and drained by a very large tube or by gauze. If great destruction of the kidney has occurred, it should be removed under the general conditions involved in considering Nephrectomy.

For acute primary perinephritis the treatment is that of cellulitis anywhere—namely, incision and drainage.

The treatment of secondary perinephritis is early incision and drainage, and then the treatment of the disease to which the perinephritis is due.

Pyelitis.—Inflammation of the pelvis of the kidney occurs with some frequency as part of the lesion of pyelonephritis, or as the effect of the presence of renal calculi, or of hydronephrosis, or as the result of obstruction to the escape of urine by strictures of the urethra or enlargements of the prostate; and under these circumstances is cured or benefited by the treatment of the main lesion.

Those forms of pyelitis which occur as primary inflammations are usually treated by medical means, and require no more than mention in this place.

Catarrhal inflammations of the mucous membrane are produced by certain poisons, as turpentine and cantharides, and occur with the exanthemata and with typhoid fever.

Acute purulent pyelitis occurs also as a primary inflammation in children; and for the report of three very interesting cases of this type of disease the reader is referred to a paper published by Holt in the *Archives of Pediatrics*, Nov., 1894.

Under the title of "hemorrhagic pyelitis," Delafield² describes a rare form of pyelitis characterized by intermittent attacks of pain over one kidney and bloody urine, or by bloody urine alone.

¹ R. F. Weir, personal communication.

² *Lectures on the Practice of Medicine.*

Lesions.—The kidney-tissue is normal, and contains no blood in the tubes or stroma. The mucous membrane of the pelvis and calyces is thickened, its stroma is infiltrated, and the epithelium irregular. Only one specimen has been examined.

Symptoms.—The symptoms may be mild or severe.

The milder form of the disease seems to be of most common occurrence in young girls. There are occasional attacks in which, with little or no pain, red and white blood-cells and epithelium from the pelvic mucous membrane appear in the urine, and persist for indefinite periods; in addition, the patient suffers from hysteria and disturbances of digestion. These attacks recur irregularly, and after one or more may never reappear.

The severer form occurs both in males and females. These patients suffer from attacks of pain, and from profuse bleeding from the affected kidney. These exacerbations persist for a time, and then recur, or they may cease entirely; in any case, the symptoms resemble those of renal calculi so closely that in the few cases operated upon this has been the diagnosis.

Prognosis.—Spontaneous cure, or at least cessation of symptoms, seems to be the rule in the milder cases, as also in some of the more severe cases.

Treatment.—In those cases in which, upon the supposed existence of calculi, the kidney has been operated on, cure has followed palpation, needling, splitting, and excision, so that nothing very definite can be said.

In the milder cases the treatment is chiefly symptomatic.

TUBERCULAR NEPHRITIS.

Tubercular inflammations may attack any portion of the genito-urinary tract, as the kidney, ureter, bladder, vas deferens, testicle, seminal vesicle, prostate, urethra, uterus, tubes, or ovaries.

Lesions.—In the kidney, with acute general miliary tuberculosis, miliary tubercles form, but, as a rule, give no symptoms.

In tuberculosis of the kidney, occurring as a primary inflammation or secondary to tuberculosis of some other part of the urinary tract, and reaching the kidney by extension, the destruction of the renal tissue varies in degree.

The kidney is increased in size, and not infrequently appears nodular and mottled; upon section there are found larger or smaller grayish-yellow foci, varying in size from a bird-shot to a marble or, rarely, much larger, and containing cheesy material or fluid pus, sometimes shut in by a delicate zone of connective tissue.

If the pelvis of the kidney is involved, as it usually is, the mucous membrane is thickened and may be ulcerated.

Along with this change in the kidney, in most cases there are tubercular inflammations of one or more of the other parts of the urinary tract above mentioned, and also of some more remote portion of the body.

In the most severe cases the renal tissue is entirely destroyed, and the organ represented by a large sac containing the disintegrated tubercle-tissue; or the ureter may be so much narrowed by thickening of its wall that distention of the kidney occurs as in hydronephrosis.

Tubercular nephritis begins in the stroma of the kidney, and results in the growth of tubercle-tissue and in degeneration and destruction of the epithelium; the tubercle-tissue soon undergoes necrosis and cheesy changes, and then may soften or calcify.

Those parts of the kidney not directly involved generally show the changes of chronic diffuse nephritis.

What is of special importance for surgeons to know is that the perirenal tissue is sometimes involved, and that then very tough adhesions may form between the kidney and contiguous organs, and render removal of the kidney a matter of very great difficulty, or even impossible: thus it has happened, even in skilful hands, that fatal laceration of the vena cava has occurred.

Etiology.—Tubercular nephritis occurs oftener in men than in women, and generally occurs between the ages of twenty and forty years, more rarely before than after this period.¹

The disease may begin in the kidney itself as the result of lodgement in the organ of tubercle bacilli carried there by the blood, to which they have gained entrance by one or other channel; or the tubercular inflammation may



FIG. 200.—Tuberculous nephritis: 1, cheesy focus; 2 and 3, abscess-cavities (Specimen 2931, Museum N. Y. Hosp.).

spread to the kidney from the testis, for instance, by way of the vas deferens, prostate, bladder, ureter, and pelvis.

Of these two ways, the primary, embolic form is probably more rare than the forms in which the kidney is involved secondarily to tuberculosis of the ureter and pelvis, but it is said to be of more frequent occurrence than has heretofore been supposed.²

Symptoms.—Those cases of tuberculosis of the kidney which, in fact, are only part of acute general miliary tuberculosis give no symptoms referable to the kidney other than those of acute degeneration belonging to infectious diseases.

Whether the tubercular nephritis is primary, and the mucous membranes lower down are secondarily infected, or the nephritis itself is secondary, after

¹ Those cases of miliary tubercles of the kidney occurring in acute general miliary tuberculosis are not included.

² Rosenstein: *Nierenkrankheiten*, p. 540.

the disease is well established, there are tolerably well-marked changes in general health, in the function of micturition, and in the character of the urine.

The urine is usually unchanged in quantity and of good specific gravity at first, but contains, more or less constantly, blood, pus, shreds of tissue, and bacilli in varying quantities, depending in great measure on the extent of the lesions of the mucous membranes and on the presence or absence of communications between the foci in the kidney and its pelvis.

Later, when changes have occurred in the other kidney, the specific gravity may fall and the quantity of urine be increased.

Bacilli are not always present; indeed, it is the exception to find them; but, curiously enough, urine in which they cannot be detected is sometimes capable of exciting tubercular peritonitis in guinea-pigs.

There are almost always frequency of micturition and more or less tenesmus; and it is these symptoms which usually lead the patient to seek advice.

There is usually pain, referred to the region of the affected kidney, often increased during the tenesmus which accompanies micturition.

The affected kidney is tender to palpation, and may often be recognized to be considerably increased in size; in exceptional cases one may detect fluctuation or even the nodular outline of the kidney so often present.

In men, particularly, tubercular lesions of other parts of the genito-urinary tract are present, and are of great value in forming a diagnosis; thus one may find tubercular epididymitis or tubercular spermato-cystitis, and with the cystoscope it is possible at times to discover ulcers in the wall of the bladder.

There is more or less fever, which is apt to assume a hectic type and to be accompanied by sweating.

The patient loses flesh and strength.

Later there may be developed the symptoms of pulmonary tuberculosis, tubercular peritonitis, or other local tuberculosis, or at any time the patient may die from acute general tuberculosis.

Prognosis.—Acute general miliary tuberculosis is regularly fatal. Tubercular nephritis is ordinarily slow in its evolution, and usually requires several years to run its course and terminate fatally by one or other of the complicating lesions.

In that form, the so-called ascending type, in which the whole tract is more or less involved from the testis to the kidney, no surgical treatment is likely to avail much; but where the kidney is primarily attacked and the diagnosis made early, and extirpation of the kidney promptly carried out, there is promise of a permanent result.

Treatment.—For acute general miliary tuberculosis there is no treatment.

For those cases in which tuberculosis of the kidney is combined with similar lesions of other organs the treatment must be chiefly medical, and include the consideration of climate, hygiene, and medication. But even in these cases, if the kidney is much enlarged, and what might be described as a tubercular pyonephrosis exists, the patient may be made more comfortable, and his life perhaps prolonged, by drainage of the sac or even its extirpation.

At this place one should emphasize the importance of preventing the development of those forms of ascending tubercular nephritis secondary to tubercular epididymitis by removing the testis at the earliest moment.

It is, however, in cases of primary tuberculosis of the kidney that removal of the kidney offers the most promising results, for here a tuberculosis is to

be dealt with which is purely local, and under these circumstances nephrectomy is most highly recommended.¹

The following figures from Tuffier² will show the results of nephrotomy for tuberculous nephritis, 25 cases :

Mortality	47.8 per cent.
Fistule	18.2 “
Relapses	26 “
Cures	8 “

Primary nephrectomy, 57 cases :

Mortality	32.3 per cent.
Abdominal	36.3 “
Lumbar	28.2 “

That primary nephrectomy may yield lasting cures is shown by the same writer in mentioning : 1 case followed for eight years ; 2 cases, five years ; 3 cases, three years ; 4 cases, two years—all without recurrence.

For the treatment of the complicating tubercular lesions of the other parts the reader is referred to the sections on the organs in question.

RENAL CALCULUS.

The solid constituents of the urine may be deposited in the kidney or its pelvis in the form of sand, gravel, or calculi.

The calculi consist of uric acid or of uric acid with a shell of oxalate of lime, or of phosphates, or of oxalate of lime, or of phosphates, or carbonates ; these calculi are all stony.

Calculi composed of cystine are of a light-yellow color, lustrous, and resemble beeswax more or less ; they are rare. Calculi consisting of xanthine, of fatty or saponaceous matters, or of fibrin, or of indigo are exceedingly infrequent.

In general terms, the number of calculi in a given case varies inversely with their size : when their size is small the number may be very great, as many as two hundred having been found in a single kidney ; conversely, when their size is large the number is usually small, and there are seldom more than four or five ; but small-sized calculi may also occur alone, and large calculi are sometimes found along with considerable quantities of grit, indicating the probable mode of growth of the calculus.

The largest calculi may fill the entire pelvis of the kidney and form very accurate casts of the calyces, pelvis, and more or less of the ureter, and weigh several ounces, but the average large calculus seldom exceeds a hickory-nut in size, while the smaller calculi, occurring in considerable numbers, are usually about the size of peas.

Gravel consists of granules small enough to traverse the ureter without difficulty, and in sand the particles are quite fine.

In outline the calculi vary widely. As we have seen, the largest may be accurate casts of the pelvis and calyces, but the commonest form is irregularly ovoid, with a rough surface which occasionally is faceted at one or two points, or they may be branched in curious ways.

The surface of the calculus is colored by the material which forms its cortex ; thus the uric-acid calculus is reddish or brownish, and the phosphatic are a dirty white ; but in any case the color of the calculus is apt to be

¹ Rosenstein : *loc. cit.*, p. 556.

² *Traité de Chir.*, Duplay et Reclus, vol. vii. p. 575.

modified in its fresh state by adhesion of more or less fibrin or through staining by blood or urine.

In consistency the uric-acid and oxalate-of-lime calculi are comparatively hard, while the phosphatic calculi are soft and friable; and when either of the first varieties is coated by phosphatic material, the latter may be very easily chipped off, and its presence indicates then the course of the disease which produced the calculus and the transition from acid to alkaline urine.

The calculi composed more or less of organic matters, cystine, etc. are usually not stony, but may become so, or may constitute the nucleus about which, subsequently, strata of other composition are deposited.

The different strata in the case of compound calculi are glued together by an albuminous material, which is probably the mucus secreted by the inflamed mucous membrane of the renal pelvis.

Calculi most commonly develop in the calyces or the pelvis of the kidney,



FIG. 201.—Calculous nephritis: 1, calculus *in situ* (Specimen 2677, Museum N. Y. Hosp.).

or, more rarely, in the gland itself; and their presence in either position may not excite inflammation, or, on the other hand, suppuration may occur.

In case the calculus is formed in the parenchyma and is not accompanied by suppuration, very little or no disturbance of the function of the kidney is produced, at least until after the lapse of considerable periods, when the changes belonging to chronic diffuse nephritis develop, and in the end the kidney may be much atrophied.

If, however, the calculus sets up more acute inflammatory changes, and the region is infected either by the blood or by way of the ureter, abscess-formation occurs, and effects a very considerable destruction of renal tissue, and by bursting through the capsule of the kidney may cause perinephritis in one of its forms.

The calculus may be formed in the pelvis of the kidney, and remain there or in one of the calyces, generally adherent to or imbedded in the mucous membrane, without causing any very serious damage; or the stone may lodge in the upper end of the ureter, and by partially blocking its lumen cause gradual dilatation of the pelvis and kidney, and so produce hydronephrosis.

More commonly, however, the calculus excites inflammation of the mucous membrane of the pelvis, which sooner or later becomes infected; the infection extends to the kidney proper, and in the end the condition is one known as calculous pyelonephritis.

Conversely, a pyelitis, originating in one way or another, may cause the precipitation of the urinary salts, and thus provoke the formation of calculi, which are very appropriately called *secondary* to distinguish them from those formed before pyelitis has occurred.

Etiology.—Renal calculi occur at all ages, but in New York, at least, it is comparatively rare to find children suffering from this disease, though it is usually said that, like vesical calculi, they occur most commonly in childhood and middle and advanced life.

Males are more liable to the disease than females, the proportion being ordinarily said to be 3 to 1.

The heredity of the gouty diathesis will serve to explain the curious instances on record of renal calculi developing in father and son or in all of a group of brothers. In fact, it is to the gouty diathesis that the formation of calculi is usually ascribed; and such diathesis may exist at birth or may be acquired by a sedentary mode of life, coupled with the ingestion of rich articles of food, alcohol, etc.

The conditions which cause the precipitation of uric acid in the kidney are not altogether clear: they may exist at birth¹ or apparently develop at almost any period of life, depending, it would seem, upon some error in nutrition which prevents the complete retrograde metamorphosis of the nitrogenous substances of the body and their conversion into urea.

The occurrence of calculi composed of calcium oxalate is equally obscure, though the appearance of this salt in the urine is known to be associated with certain depressed states of the nervous system, included under the name "neurasthenia."

In either case the microscopic crystals are found to be fastened together in the calculus by organic material of an albuminoid character; and for the development of this cement it is stated² that a light desquamative catarrh of the mucous membrane must be assumed to coexist, and that without this "stone-producing catarrh," no matter how abundantly urinary sediments may be precipitated, no calculus can be formed.

The occurrence of phosphatic calculi or those composed of carbonates is much less difficult to understand, especially when they develop as the consequence of pyelitis, for in this case all the elements necessary are at hand.

The phosphates, insoluble in an alkaline menstruum, are precipitated, and the particles are glued together by the organic material exuded from the inflamed mucous membrane. Thus any one of the causes of pyelitis may finally be the cause of calculi.

The inclusion of calculi composed of uric acid in shells of phosphates is of some interest, because it indicates that a uric-acid calculus formed in the kidney, and remaining there with or without symptoms, grows by the addition of more and more uric acid, until from some source—generally from the bladder—the mucous membrane of the pelvis is infected and fermentation of the urine occurs; then phosphates are deposited upon the surface of the stone; and when it is finally examined it is found to consist of a nucleus of uric acid enveloped in a coat of phosphates.

The fact that cases of renal calculus occur more frequently in some regions than in others has called forth a good deal of speculation; but, except in the

¹ Rosenstein: *Path. u. Therapie des Nierenkrank.*, p. 595.

² *Ibid.*, p. 608.

case of Egyptians, nothing very tangible has been discovered. In the calculi removed from the kidneys of persons living in Egypt the nucleus of the calculus is often found to be the ovum of a variety of parasite, the *filaria Bilharzia*.

Symptoms.—Infrequently calculi of considerable size may form in the kidney and give no symptoms at all, or at most only trifling pain referred to the loin from time to time. Usually, however, the patients suffer from the presence of the calculus, from the changes which coexist in the kidney, and from the chronic inflammations of other tissues due to the gouty or other diathesis which is at the bottom of all.

The pain caused by the stone in the kidney varies in intensity in different individuals and in the same individual at different times; it is described as a gnawing, dragging sensation, referred to the region of the affected kidney which the patient attempts to relieve by pressure or by change of position. The pain often radiates toward the sacrum or inguinal region, or more rarely toward the bladder or even the other kidney; but its peculiarity consists in its aggravation by jarring movements, as horseback exercise, and also in its relief by rest or by change of attitude; indeed, for diagnostic purposes it is often of great value to excite increase of this pain by percussion of the kidney region or by bimanual compression of the kidney.

The form of pain which is of most significance in indicating that renal calculi are present is renal colic, which is usually due to the passage of a foreign body through the ureter.

Although the passage of a blood-clot may cause the same symptoms, in most cases the pain is due to a calculus, which may then traverse the ureter or lodge in it somewhere, or be returned to the pelvis of the kidney.

The pain is intense, and radiates from the kidney along the course of the ureter to the bladder or groin; to the testicle, which is then retracted, tender, and often swollen; to the labium majus or to the thigh. Exacerbations of the colic occur at frequent intervals, and the sufferings of the patient are so severe that he may lose consciousness or have convulsions. These attacks vary in duration from a few hours to several days.

Besides the pain, there is often rectal tenesmus, distention of the abdomen, vomiting, and constipation.

During the attack the urine is diminished in quantity, and is sometimes suppressed, as the effect of reflex influences exerted upon the other kidney, or as the result of both ureters being plugged by calculi at the same time.

The kidney is very tender, and may be increased in size, though this feature is difficult to demonstrate; tenderness is felt along the course of the ureter, and persists for some time after the acuter symptoms have subsided.

After the attack the urine is frequently increased in volume, and usually contains blood, mucus, and pus in considerable quantities, and occasionally the calculus escapes *per urethram*.

If the calculus remains in the bladder, it usually grows, and finally gives symptoms which demand its removal; if it remains lodged in the ureter, a tender point remains somewhere in the course of this duct, and a gradually increasing distention of the kidney—hydronephrosis—may develop.

During the height of the colic the appearances sometimes simulate biliary or intestinal colic, intestinal obstruction, or peritonitis, but the pain radiating from the loin, together with the results of the urinary examinations, will generally serve to prevent errors in diagnosis.

The urine, until pyelitis is provoked or bleeding produced, may give very little evidence of the existence of calculi: it may be extraordinarily acid

and precipitate considerable quantities of uric-acid crystals, and, if chronic diffuse nephritis is at all advanced, the specific gravity is apt to be below 1020, and there may be a trace of albumin.

Hematuria is of great significance, and, although not always present, if it occurs, particularly under circumstances to be described, is wellnigh pathognomonic.

Besides the hematuria which accompanies or succeeds the passage of a stone through the ureter blood is usually to be found in the urine of patients suffering from calculi at other times.

The amount of blood is usually not large, nor does it persist for any period, and it seldom presents clots or casts of the ureter; but it does often occur as the so-called blood-casts; and unless the urine is alkaline the red disks are apt to be crenated.

The peculiarity of the hemorrhage, however, is in its causation by movements of the body of a jarring character, as riding over rough pavements, horseback exercise, and the like, or by manipulation of the kidney, and in its cessation afterward upon rest in bed.

In the presence of pyelitis the urine from the affected kidney may be acid or alkaline, and contains mucus, pus, and pavement epithelium, and generally casts, which indicate the extension of the process to the tubules of the kidney or the coexistence of a chronic diffuse nephritis.

Suppression of urine may occur during the course of an attack of renal colic as the consequence of blocking of the ureter of the affected kidney and reflex influences exercised upon the other kidney whose nature is not known, but which are probably due to acute congestion, just as happens after removal of one of the kidneys; under these circumstances the secretion of urine is usually resumed.

In other cases the suppression is caused by plugging of both the ureters at the same time by calculi, or of the only ureter if there is but one kidney: this condition is a dangerous one, and must surely result in death if the calculi do not pass or surgical interference is not practised.

It is interesting to note that patients have recovered after suppression extending over as long periods as twenty-one days;¹ but in general (71 per cent.) suppression ends in death within twenty-five days.²

Patients with suppression for any length of time develop the symptoms of chronic uremia and die in a typhoid state, emaciated with rapid and feeble heart action.

In the diarrheal discharges which accompany this condition, as well as in the sweat, considerable urea may be demonstrated.

In the first class of cases, those in which the stone enters only one ureter and becomes lodged, if the obstruction is incomplete hydronephrosis may follow; but this is rare. More commonly the obstruction is complete, and then atrophy of the corresponding kidney occurs.³

Pyelitis and pyelo-nephritis, or abscess of the kidney, are late complications of those calculi formed in aseptic kidneys—primary calculi; and the development of these diseases in persons already suffering from calculi is indicated by the appearance and persistence of pus in the urine. At the same time pain increases, and, as a rule, the kidney, distended by pus, may be recognized by palpation.

A febrile movement of a septic type is present, with evening exacerbations and morning remissions, and the patient begins to lose flesh and strength.

¹ Delafield: *Lectures on Practice of Medicine*.

² Legneu: *Thèse de Paris*.

³ Delafield: *loc. cit.*

The renal abscess thus formed may pursue the course described under the title of Pyonephrosis, and rupture into any of the contiguous cavities or externally, forming fistulous tracts whose tendency is to persist indefinitely.

The **diagnosis** of renal calculi is occasionally of some difficulty, especially early, before infection has occurred and there is no demonstrable enlargement of the kidney. The pain which calculi cause has sometimes simulated the pain of biliary calculi, of Pott's disease, of lumbago, or of some other disease of the kidney, especially nephralgia (*q. v.*). Bleeding may come from any part of the urinary tract.

The enlargement of the kidney after infection occurs may readily simulate enlargement of the kidney from any other cause.

Suppression of urine may also be due to a variety of causes, which must be excluded before one can be certain that calculi exist in the case in hand.

In a moderate number of cases the diagnosis can only be made after exposure and examination of the kidney through an exploratory incision.

Prognosis.—The existence of a calculus in an aseptic kidney is in itself of no very great moment: it is rather through secondary phenomena that renal calculi threaten life or produce suffering; for it would seem that the chronic diffuse nephritis which so usually accompanies the development of renal calculi is only another result of the gouty or other diathesis, which is also at the bottom of the stone-formation.

Renal colic is commonly recovered from, and if the calculus afterward escapes from the body, a spontaneous cure may be said to have occurred.

Infection of the kidney is far more grave, and not only increases the patient's suffering, but may cause death by chronic sepsis or by invasion of one of the neighboring cavities; but the process is ordinarily a slow one, and may persist for several years without seriously affecting the general health.

Suppression of urine of course is the most dangerous complication, and in particular that form due to plugging of both ureters at the same time: the temporary reflex suppression subsides spontaneously, but the obstructive type is regularly fatal.

Treatment.—In discussing the treatment of renal calculi one should refer to the management of the gouty diathesis with the view of preventing the formation of calculi, as well as the immediate treatment of the calculi already formed and the various complications to which they give rise.

The conditions under which calculi are formed in the kidney will indicate the mode of life which the susceptible individual must adopt to avoid them.

Regular exercise must be taken, and an out-of-door life pursued as far as possible; tobacco and alcohol should be eschewed; the diet must be simple and restricted, particularly in the matter of nitrogenous foods, and should include the use of much water.

In this way not only is the tendency to calculus-formation diminished, but those other obscure ailments dependent upon the gouty diathesis are also materially modified.

But certain medicinal agents are often of value in supplementing the dietetic regimen, and of these those spring-waters which are more or less diuretic and feebly alkaline are the best: they must, however, be taken in quantity, for it would seem that the salts alone are not sufficient for the purpose unless accompanied by the ingestion of large volumes of water; and it is upon this basis that the lithia waters are of benefit, for none of them contain lithia in sufficient quantity to produce any effect if only small amounts of the water are drunk.

The salts of lithium are alleged to possess the property of facilitating the excretion of uric acid by forming easily soluble compounds with it, and for this reason they may be exhibited from time to time in addition to the waters above referred to.

Piperazin is another drug recently introduced, which is said to possess similar characteristics.

The treatment of persons with the disposition to form oxalate-of-lime calculi is based upon much the same principles, but in this class of cases particular attention must be directed to the nervous system and to the stomach.

Patients who are likely to have primary phosphatic calculi are those whose urine usually contains an excess of phosphates, which may depend upon the mode of life or upon disturbances of digestion, especially of the functions of the liver; and in any case precipitation of these phosphates is greatly favored by pyelitis, whatever its cause may be, by alkalinity of the urine, and by concentration of the urine.

In such cases the general hygienic treatment is about that for gouty individuals—out-of-door life, exercise, and temperance in matters of food and drink. In addition, digestive derangements must be corrected, and for this purpose Carlsbad salts, the mineral acids, etc. are of signal service.

The treatment of renal colic consists in relieving the extreme pain and in promoting the passage of the stone through the ureter. For the pain morphine in large doses, hypodermically, is indicated, but occasionally even this does not suffice, and under these circumstances one is obliged to administer ether or chloroform, but, as a rule, not up to the point of complete anesthesia; or both morphine and ether may be used.

The use of prolonged hot baths is of service in many cases, and appears to relieve the pain somewhat and to favor the passage of the calculus.

It is also conventional to encourage the patient to drink large quantities of water during the attack; but this would seem of questionable value in any instance, even if vomiting were absent, for the accumulated urine dammed back in the pelvis of the kidney probably very soon exerts enough pressure to prevent any further secretion from the tufts.

Suppression of Urine.—The management of suppression of urine during a renal colic depends upon whether it is due to reflex influences or to the synchronous plugging of both ureters: the first form will usually subside as the colic diminishes, and requires no special treatment, but the obstructive type is fatal unless the stones traverse the ureters within a reasonable period; so that every effort must be made to hasten their passage. But interference should not be long delayed, nor should one postpone relief too long because some doubt as to diagnosis may exist, nor should one temporize by opening the bladder to discover the condition of the ureters.

The kidney and ureter in which the colic began should be explored through a lumbar incision, and, if the calculus is accessible, it should be removed, together with any others present, or adequate provision made for the escape of urine.

The treatment of calculi existing in the kidney without giving symptoms, or even when there are occasional attacks of pain and hematuria, had best be directed to attempts to prevent the formation of more calculi by regulation of diet and mode of life; for the disability suffered by the patient is hardly enough to warrant surgical interference, though the decision of this question may very properly be submitted to the patient himself.

If, however, inflammation of the kidney or its pelvis develops, or the

patient suffers from frequently repeated attacks of renal colic, or the pain is severe and intolerable, nephrolithotomy must be done. This operation, really a variety of nephrotomy, and originally signifying the removal of a concretion from a kidney otherwise practically sound, is employed also for the removal of calculi from kidneys the site of suppuration, and is described among the Operations upon the Kidney.

It is desirable at this place, however, to discuss some of the details of the operation peculiar to individual cases, and to quote some of the statistics of results obtained.

The removal of calculi from an aseptic kidney is carried out as described under the title of Nephrolithotomy in general terms—viz. exposure of the kidney, exploration of the kidney by palpation, acupuncture or incision of the convex border, extraction of the stone, and possibly closure of the incision of the kidney by suture.

The question sometimes arises, in case the kidney is found to contain a multitude of calculi and to be very extensively changed, whether to perform nephrectomy or not.

It would seem the part of prudence not to perform an immediate extirpation of the kidney; for in no inconsiderable proportion of cases both kidneys contain calculi, so that disaster might result if the entire work of the kidney were thrown on to one of them suddenly, and that one possibly also more or less diseased; again, every bit of kidney-tissue is of value, and by leaving this behind the performance of the functions of the kidneys is so much facilitated.

On the other hand, if a urinary fistula persists and the urine escaping into the bladder from the other kidney is of fair quality, a secondary nephrectomy may be very properly done.

The removal of calculi from suppurating kidneys ceases to be an operation performed solely for the extraction of the stones, but is rather done to supplement drainage, and is therefore described under Nephrotomy. The actual extraction of concretions under these circumstances is apt to be an undertaking of some difficulty, for the stones are usually soft and friable and accompanied by a good deal of detritus, and to occur in numerous pockets. Nevertheless, patient search of the pockets and the use of forceps and scoops, with free irrigation, will in the end serve to clear out the kidney entirely.

The question of primary nephrectomy sometimes comes up for decision here also, but in the writer's judgment should not be done, and only practised as a secondary expedient.

The removal of calculi from aseptic kidneys is done either by incision of the pelvis or of the kidney, and, so far as its mortality is concerned, is a safe operation. Among 40 cases collected by Legneu¹ there were but 3 deaths, and Newmann² found no deaths among a group of 42 cases.

The difference in results between operations done by incising the kidney-substance and those done by incising the pelvis is quite marked; Tuffier³ arranges them thus:

Nephrolithotomy, 43 cases:	Mortality (operative)	6.1 per cent.
	Fistule	3.33 "
Pyelotomy, 12 cases:	Mortality (operative)	16 $\frac{2}{3}$ "
	Fistule	20 "

These figures are probably more or less misleading, unless one considers that the great majority of these nephrolithotomies were performed before the

¹ Legneu: *loc. cit.*

² Newmann: *Surg. Dis. of the Kid.*, p. 285.

³ Tuffier: *Traité de Chir.*, Duplay et Reclus, v. vii. p. 516.

idea of entering the pelvis of the kidney through the convex border became generalized, and that they therefore represent those cases of small stones imbedded in the parenchyma and removed by direct incision.

The removal of calculi from suppurative kidneys has not been so successful an operation ; thus, of 114 cases analyzed by Tuffier,¹ 38 died, arranged as follows :

Nephrotomies, 114	Cured, 76 = 66½ per cent.	{	Complete, 50 = 43.8 per cent.,	{	Nephrectomy, 8 ;	
			Fistulae, 26 = 34.2 per cent.,		Curetting, etc., 1 ; cures, 1.	
Deaths, 38 = 33½ per cent.	{	{	{	{	Untreated, 17 ; deaths, 4.	
					Cancer of operated kidney	4
					Septicemia	3
					Peritonitis	2
					Tuberculosis of lungs	1
					Pneumonia	2
					Cachexia	1
					Nephritis	4
					Calculus of other kidney	9
					No autopsy	12
					38	

HYDRONEPHROSIS.

Distention of the pelvis and calyces of the kidney by urine is called hydronephrosis : it differs from pyonephrosis in that in the latter the kidney is distended by urine in which more or less pus is present, and in its etiology.

It is possible for hydronephrosis to become pyonephrosis, but recently the term "infected hydronephrosis" has been introduced, and seems to express the natural history of the change and to leave the terms hydronephrosis and pyonephrosis to be applied to conditions quite distinct.

Lesions.—The congenital type of hydronephrosis has been described under Malformations of the Kidney.

In the acquired form the pelvis of the kidney may be dilated, along with its calyces, without any very great change in the gland itself. In more severe cases the kidney is also involved, and the resulting change varies from simple flattening of the papillæ to almost complete disappearance of the cortex of the kidney ; but even in the mildest cases the kidney is finally apt to show the changes of chronic diffuse nephritis. The resulting tumor may sometimes reach great size, containing many quarts of fluid and occupying almost the whole abdomen.²

In rare instances of kidneys provided with two ureters one has become obstructed, and half the kidney has been the site of hydronephrosis, and the same thing has happened in fusion of the kidney ; but these curiosities have little or no practical significance.

The fluid distending the sac should consist of normal urine, but, as a matter of fact, and especially after the condition has existed for some time, the fluid contains a very small percentage of urea, and later this may entirely disappear and leave no evidence of the origin of the fluid ; indeed, the fluid may be found to contain mucus and to be of brownish color, or it may contain colloid material or cholesterin, and make the distinction between this condition and ovarian cyst one of great difficulty.

Hydronephrosis may involve one or both kidneys, and where unilateral the opposite kidney is apt to be hypertrophied.

¹ Tuffier : *loc. cit.*

² Sutton : *Tumors, Innocent and Malignant*, p. 381.

Etiology.—Renal calculus is only rarely a cause of hydronephrosis, but a few cases have been reported in which repeated temporary obstructions of the ureter during renal colic have finally led to very appreciable changes in the pelvis and calyces of the kidney.

Most cases of unilateral hydronephrosis, however, are due to partial obstruction of the ureter by pressure from without; thus it is not rare to find dilatation of the pelvis of the kidney developing with carcinomatous or other tumors of the pelvic viscera; and in one instance the writer saw dilatation of the ureter and pelvis produced by adhesions due to salpingitis. The same effect is produced by tumors developing in the bladder itself and involving the mouth of the ureter.



FIG. 202.—Hydronephrosis: dilatation of pelvis and calyces of kidney (Specimen 1346, Museum N. Y. Hosp.).

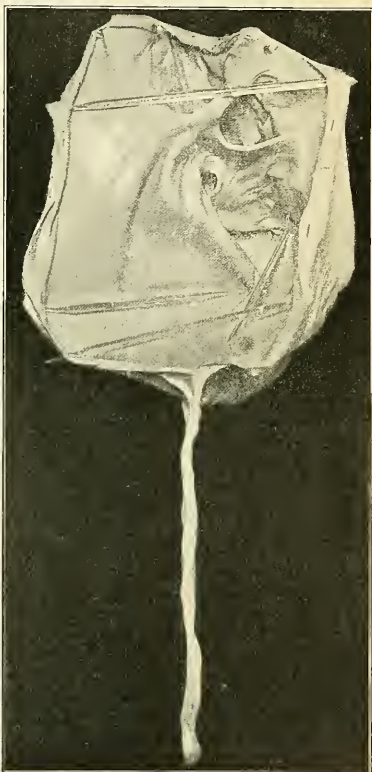


FIG. 203.—Hydronephrosis: kidney converted into sac (Specimen 3032, Museum N. Y. Hosp.).

Anomalies of the ureter also obstruct the escape of urine, as strictures due to ulcerations from any cause or kinking of the ureter in case of movable kidney, or there may be congenital obliteration of one of the ureters or the ureter may join the pelvis of the kidney at an acute angle and form a valve. For fuller details the reader is referred to the section on Diseases of the Ureter.

Bilateral dilatation of the pelvis of the kidney may be due to any of the conditions before mentioned acting on both ureters, but more often is caused by obstructions of the urethra, as phimosis, congenital or acquired stricture, or absence of the urethra, or enlargement of the prostate.

Symptoms.—Moderate unilateral dilatation of the pelvis of the kidney may give no symptoms at all, and is found at autopsy in persons who have died of other diseases; thus in an autopsy upon the body of a woman who had died of intestinal obstruction by a band due to old pelvic peritonitis, dilatation of the right ureter and pelvis of the kidney of moderate size was found, and, so far as could be learned, there had been no symptoms referred to the kidney during life.

But in those cases in which the hydronephrosis reaches a higher degree of development the existence of the tumor becomes the chief complaint; indeed, in many cases the only thing which the patient observes is the enlargement of the abdomen. The **diagnosis** then depends upon the recognition of the renal origin of the tumor.

These tumors, unless very large, occupy one or other of the lateral regions of the abdomen: they are usually smooth in outline; more rarely they are lobulated; there may be a misleading degree of mobility; in most instances the colon lies in front of the mass; fluctuation is usually easy to make out; finally, the introduction of the exploring needle and the examination of the fluid withdrawn will not only identify the character of the cyst, but will serve to distinguish it from pyonephrosis, which it most closely resembles.

The tumor with which hydronephrosis is most apt to be confounded is cyst of the ovary; and here, particularly if the latter happens to be fixed, it is sometimes impossible to differentiate without the aid of an exploratory incision.

In so-called intermittent hydronephrosis the symptoms are more characteristic. The tumor develops or increases in size quite rapidly; and this increase in size is accompanied by severe pain, simulating in many of its features renal colic, but never accompanied by the appearance of blood in the urine.

The urine then suddenly escapes from the pelvis of the kidney, and with this escape there is a well-marked increase in the quantity of urine passed, diminution in size of the tumor, and almost complete subsidence of pain.

Then the secretion of urine goes on regularly enough until some time when all the symptoms of obstruction redevelop: this occurs at greater or shorter intervals, varying in different individuals, and not infrequently at tolerably regular periods.

It is possible for the pelvis of the distended kidney to become infected from one source or another, becoming an "infected hydronephrosis." Under these circumstances the increase in pain, the appearance of pus in the urine, and the development of fever will indicate pretty clearly what is going on.

The recognition of the cause of the distention of the kidney is always of great importance in determining the treatment; for if the cause be a removable one, the treatment to be carried out is obviously to relieve the hydronephrosis by removing its cause.

Prognosis.—Hydronephrosis may exist indefinitely without endangering life, and may only affect health by its interference with the functions of the neighboring organs.

The tendency of the tumor is to increase in size, though it is said that occasionally it has gradually disappeared and spontaneous cure occurred.

The danger lies in the possibility of infection in the unilateral form, and, in addition, in the bilateral form, of uremia.

Treatment.—The treatment of hydronephrosis depends in great measure upon its etiology, and further upon the involvement of one or of both kidneys.

If the distention is due to partial obstruction of the ureter by an impacted calculus, to compression of the ureter by a tumor or inflammatory deposit, or to kinking of the ureter as in movable kidney, the treatment of the hydronephrosis would consist in relieving the obstruction by removing its cause, by extracting the stone through an incision of the ureter, by extirpating the tumor, or by suturing the movable kidney in place.

If, on the other hand, no definite or removable cause can be discovered, the cyst itself must be attacked, and then the procedure will be decided by the implication of one kidney or of both. If one kidney only is involved, the fluid may be removed by aspiration, but this in most cases is only palliative.

Nephrotomy will certainly reduce the size of the tumor, but is almost invariably followed by a fistula, which continues to secrete indefinitely, and is a source of almost as much annoyance as the original tumor itself, and generally requires a secondary nephrectomy for its cure.

Nephrotomy, however, as a preliminary to extirpation of the kidney has a distinct place, and, especially in case of very large tumors, is of no small value; for by drainage, continued for even a short time, the sac shrinks so much that it may then be removed, with decidedly less laceration of the surrounding tissues, through a smaller wound of the abdominal wall, and especially because nephrectomy may then be done through the loin; whereas to remove the distended sac would require opening the peritoneum. Nor would aspiration of the sac through an incision in the loin and its immediate removal answer as well; for even then a much larger raw surface would be left behind than if the extirpation was postponed till shrinking of the sac had occurred; nor is shock so great under the latter conditions.

Further, nephrotomy may prove curative if the ureter is still permeable. If, however, the tumor is only of moderate size, and yet demands removal for some special reason, and the condition of the other kidney is not known with certainty, abdominal nephrectomy may be performed in order to search for the cause and remove it if possible, and to explore the condition of the opposite kidney.

Tuffier¹ analyzes 58 cases of nephrotomy and nephrectomy for hydronephrosis, as follows:

Nephrotomy :	Mortality	18.8	per cent.
	Fistulae	66 $\frac{2}{3}$	"
Nephrectomy :	Mortality	13.1	"
	Abdominal	25.8	"
	Lumbar	6.4	"
Secondary nephrectomy :	No deaths.		

TUMORS OF THE KIDNEY.

Both cysts and solid new-growths are included in the group of tumors.

I. **Cysts.**—Cysts of the kidney occur in one or other of several forms:

1. In kidneys otherwise normal there are one or more cysts filled with clear or brownish serum or colloid matter. These cysts vary in size from a walnut to considerable dimensions, and rarely may become very large; they arise in any part of the kidney, but occur most frequently in one or other of the poles. They are unilocular and smooth; the cyst-wall is delicate and transparent, and is continuous with the kidney-tissue; it consists of fibrous

¹ *Loc. cit.*, p. 600.

tissue and is lined by flattened epithelium. In rare instances the wall may be thickened and infiltrated by the salts of lime.

2. In kidneys the sites of chronic diffuse nephritis, groups of tubes are dilated: such cysts are usually microscopic in size, and give no symptoms apart from the disease which they accompany, and are of only pathological interest.



FIG. 204.—Serous cysts of kidney (Specimen 1577, Museum N. Y. Hosp.).

3. Both kidneys, or more rarely one, are much enlarged and converted into a mass of cysts containing clear or colored serum or colloid matter. The walls of the cysts, which are usually about the size of marbles, consist of connective tissue supporting a small amount of kidney-tissue, and are lined by pavement epithelium. The contained fluid holds urea in solution.

Kidneys thus changed are found in the fetus, at times associated with similar cysts in the liver or fetal malformation. In other instances the cysts are apparently retention-cysts due to obstruction of the tubules by uric-acid salts, or obliteration of these tubules by fetal inflammations, or atresia of the pelvis of the kidney or ureter, or to absence or stricture of the urethra.

In the adult such kidneys occur also, and may then be congenital and due to one or other of the above causes or exist without assignable cause.

4. Hydatid cysts are very rare in this country: they present the same anatomical features as elsewhere. One kidney only is affected as a rule, and the cyst may be located anywhere in the organ.

Adhesions may form between the cyst and the neighboring viscera. The sac may rupture into the pelvis of the kidney, into the lung, or into the intestine.

Etiology.—Nothing very positive is known in regard to the development of the larger single cysts of the kidney. They occur in persons between the ages of twenty and forty-five years, and more often in females than in males; of 20 cases collected by Tuffier, but 3 were in males.

The causation of the large multicystic kidneys is equally obscure: it is perhaps congenital. The condition is found more often in males than in females.

The etiology of the hydatid cysts is self-evident.

Symptoms.—The minute cysts of chronic diffuse nephritis give no symptoms apart from the lesion with which they occur.

The larger single serous cysts, the "cystic kidney" and hydatid cysts, give no other symptoms, as a rule, than the appearance of the abdominal tumor and the interference with the function of the neighboring viscera to which it may give rise.

The exception to this statement is the "cystic kidney," which sometimes gives the clinical history of chronic diffuse nephritis with little or no exuda-

tion—namely, lowering of the specific gravity of the urine and the presence of a trace of albumin from time to time, and later attacks of uremia.

The diagnosis, then, depends upon the identification of the tumor in hand.

The single cyst occurs most often in women; it is usually unilateral; its surface is smooth and fluctuation distinct; it is connected with the kidney. The exploring needle will often, though not always, serve to distinguish the condition by the character of the fluid evacuated.

The tumor formed by the hydatid cyst is generally smooth, situated in the flank, and gives the signs of renal tumor. In consistency it varies from the characteristics of fluid to those of a solid neoplasm; but in either case the so-called hydatid fremitus should be elicited upon percussion. The exploring needle withdraws fluid containing scolices.

If the cyst ruptures into the pelvis of the kidney, the patient suffers from renal colic and evacuates fluid containing the hooklets; rupture into the intestine or lung may occur and give symptoms indicative of the character of the accident and the nature of the tumor in each case.

The large "cystic kidney" is almost always bilateral, so that in a patient giving a history of chronic diffuse nephritis, if the kidneys are at all enlarged, and particularly if their surfaces are nodulated, one must think of cystic kidneys.

Prognosis.—In all of these conditions the cysts are of very gradual growth, and, except in the case of the hydatid and the single cysts, the danger to health and life lies in the associated chronic diffuse nephritis.

In the single serous cysts the only damage likely to be done is through compression of, and interference with, the function of neighboring organs. Hydatid cysts also produce pressure-symptoms, but they are dangerous to life in that rupture in one or other direction may be fatal, or through suppuration.

Treatment.—For the minute cysts of chronic diffuse nephritis, and for the large multicystic kidneys, there is no treatment other than that of the symptoms of the nephritis.

The single serous cysts, however, if they are large enough to give symptoms, demand interference either by aspiration, drainage, or partial or complete nephrectomy.

Aspiration is not to be recommended except as a palliative measure, for in nearly every case in which it has been attempted the sac has refilled.

Incision and drainage is the procedure of choice, for several reasons: The operation is sometimes curative, though in the majority of the cases fistulæ persist; but in the event of fistula a secondary nephrectomy may be performed.

In case, for any reason, nephrectomy, partial or complete, is decided upon, it may very well be preceded by drainage with the view of reducing the size of the sac, and thus not only facilitating nephrectomy, but making a very extensive wound unnecessary.

But primary nephrectomy has often been performed for this condition, and with fair success. Tuffier¹ has collected 31 cases; and of these 7 were lumbar, with a mortality of 11 per cent.; 24 were transperitoneal, with a mortality of 46 per cent., divided as follows: peritonitis, 2; purulent infection, 2; hemorrhage, 1; collapse, 1; nephritis of remaining kidney, 1; not stated, 4.

Complete nephrectomy has usually been done, but Tuffier² advises partial

¹ Tuffier: *Traité de Chir.*, Duplay and Reclus, vol. vii. p. 581.

² *Loc. cit.*

nephrectomy as a decidedly more preferable measure where any considerable part of the kidney remains unaffected.

Hydatid cysts are to be treated as they are in the liver, by incision and drainage, preferably through the loin.

II. The **new growths** of the kidney may be arranged upon an anatomical basis or from a clinical standpoint, and divided into *malignant* and *benign* tumors; and of these latter groups the first is vastly commoner than the second, and also of more significance both to the physician and the patient.

The *malignant tumors* in the kidney, as elsewhere, are those prone to local recurrence and to generalization—the carcinomata and the sarcomata.

By some writers the carcinomata are included among the adenomata, and *vice versa*; but, although the transition from adenoma to carcinoma is often hard to define to the microscopist, the clinical behavior of the two classes is very distinct.

All the varieties of carcinoma occur in the kidney as primary or secondary deposits, but most often the primary growth assumes the medullary type and



FIG. 205.—Author's case of renal sarcoma (Sutton), adenoma (Delafield and Prudden), carcinoma (Lubarsch). Tumor composed of adrenal tissue.

is richly cellular. It arises generally in the cortex of the gland, either as a single encapsulated growth or may be infiltrating from the first; or a number of tumors may develop in different parts of the kidney at the same time.

In size the tumors vary inversely with their numbers, so that as many as twenty may be found in a single kidney, each of small size, or in other cases a single tumor may be present and reach the dimensions of a man's head or larger. In either case the affected kidney is enlarged, and may be nodular or smooth in outline.

Occasionally parts of the tumor are found to have undergone retrograde changes and to be replaced by fluid material, generally gelatinous.

The origin of the new epithelium is disputed, and perhaps varies in different cases; but the trend of opinion seems to lean toward the cells of the tubules as the source of the growth.

The tumor may spread to the pelvis of the kidney, and give rise thus to more or less bleeding; or masses of greater or less size may separate from the tumor and escape with the urine.

The renal vein or the vena cava may be involved in the growth, and thus convey secondary deposits to the lungs.

The lymph-vessels and glands at the hilus may be implicated, and form tumors large enough to compress the vena cava or the ureter.

The surrounding structures may be involved by contiguity; thus the peritoneum, the liver, the intestine, or the abdominal wall may be the site of carcinoma.

Cases have been reported in which carcinoma of the kidney was complicated by hydronephrosis, by renal calculus, or by nephritis.

It is only necessary to mention the secondary carcinomata occurring in the kidney, for they possess no surgical interest and are not amenable to treatment.

Etiology.—Primary carcinoma of the kidney is rare compared with similar growths of other tissues: it occurs more often in men than in women, and most often between the ages of fifty and seventy years.

The right kidney is the site of the tumor oftener than the left, and least often both kidneys are attacked at about the same time.

Secondary carcinoma of course is conveyed to the kidney from some other part of the body by the blood in the shape of emboli.

Sarcomata, like carcinomata, occur in the kidney as primary and as secondary growths, and, like carcinomata also, the primary growths alone are of

interest to the surgeon from the standpoint of treatment, inasmuch as the secondary deposits usually occur in both kidneys, while in the case of primary sarcoma one kidney only is affected, as a rule.

Both round and spindle-celled sarcomata are found in the kidney as primary growths, and not infrequently in combination with each other or with other forms of sarcoma.

In some of the cases reported muscle-fibers have been found in the tumors, and their presence is explained on the ground of fetal inclusions.

Sarcoma occasionally is blended with carcinoma or with adenoma.

The kidney-tissue is generally destroyed by the infiltration of the sarcomatous tissue, but occasionally foci of glomeruli and tubules are found in the new growth itself.

The effect of sarcoma upon the gross appearance of the kidney is to con-



FIG. 206.—Sarcoma of kidney (Specimen 2019, Museum N. Y. Hosp.).

vert it into a mass of variable size, which may be irregular in shape, but which not infrequently conforms more or less closely to the outline of the kidney. The tumor may reach great size; it is generally lobulated or nodular.

The mass, if it reaches any size, almost always contains one or more cysts, the effect of hemorrhage into the substance of the tumor.

Secondary growths appear most often in the lungs, and less frequently in other parts of the body.

The exact causation of sarcoma is as little known as that of carcinoma. This form of tumor occurs oftenest in children between birth and the age of six years; next between forty and sixty years; and least frequently between six and twenty years.

Of 24 cases collated by Rosenstein,¹ the left kidney was the site of the tumor in 14; the right in 8; both in 2.

Females are oftener attacked than males.

Symptoms.—Malignant tumors, whether carcinomata or sarcomata, give about the same symptoms, and hence it is convenient to describe them together: they may be arranged as the tumor, pain, hematuria, cachexia, combined or occurring separately.

The tumor only attracts attention on account of its size after it reaches some proportions; it may reach considerable dimensions, but usually is not very large.

The symmetry of the abdomen is not disturbed, except in those cases in which the tumor attains great size or the abdominal walls are very thin and retracted.

In any case the tumor arises in the flank and may retain the outlines of the kidney, or the shape of the mass may become irregular, particularly after adhesions to other organs have occurred.

The surface of the growth may be smooth or lobulated; its consistency varies, but is usually elastic or even semi-fluctuating. Mobility is sometimes marked, and especially as the effect of respiration.

Pain is referred to the region of the affected kidney, but is not constant; in other cases pain is severe, and occasionally occurs in attacks simulating renal colic. These attacks of colic are likely to occur in those patients in whom bleeding and the separation of pieces of the tumor are prominent features, and then are due to the passage of clots or of tumor-masses through the ureter.

Hematuria is present in about half² the cases at some period in their courses. Tuffier³ says that this symptom occurs in three-quarters of the cancers, one-half of the sarcomata.

It may appear early or late in the disease, or reappear at intervals of days or weeks. The amount of blood varies from quantities so small as only to be detected by the microscope to profuse hemorrhages dangerous to life.

Bleeding in tumors of the kidney differs from that of calculi in that the former is spontaneous, and is little or not at all influenced in its production by jarring or in its subsidence by rest, while in the latter the reverse happens.

What is characteristic of bleeding from the kidney, and oftentimes serves to identify the source of the blood, is the appearance in the urine of clots of long, slender shape, formed by coagulation in the ureter and forming accurate casts of this canal.

Loss of flesh and strength, cachexia, is sometimes long deferred in tumors of the kidney, but develops sooner or later, and with it there are often symptoms of interference with the function of the organs of digestion.

¹ *Loc. cit.*, p. 391.

² Delafield: *loc. cit.*

³ Tuffier: *op. cit.*, p. 606.

Prognosis.—It is a singular fact that patients suffering with malignant diseases of the kidney often survive for periods far greater than those suffering with similar diseases of other viscera; but they are inevitably fatal, in the case of adults, in from three to five years, and in infants much sooner.

Death may be due to generalization, to cachexia, to repeated hemorrhages, or to implication of the large veins and pulmonary embolism.

Treatment.—The only method of treatment likely to prove curative here, as elsewhere, is extirpation performed according to the rules governing the removal of malignant tumors from any part of the body—namely, early and thorough extirpation.

Nephrectomy for tumors may be done either through the loin, or the route to the kidney may be transperitoneal, and the excision may be total or partial.¹

The lumbar route should be used where possible, and the abdominal operation chosen only for those cases not suited for the operation in the loin, as indicated in the description of Nephrectomy (*q. v.*).

But the fact that statistics show the lumbar operation to be less fatal should not determine its choice for every case, for tumors of the kidney occur that are of such size and connections that removal by the loin is impossible; or, in other cases, renal tumors may simulate tumors of other abdominal organs so closely that the diagnosis can only be made by an exploratory incision.

The mortality is high in any case, and recurrences frequent: Chevalier² gives the figure as 62.5 per cent. for all cases. Siegrist, quoted by Tuffier, gives 57 per cent. as the mortality of abdominal and 25 per cent. as the mortality of lumbar nephrectomy; but recurrence is more common after lumbar nephrectomy (41 per cent.) than after the abdominal operation (5.26 per cent.).

Partial nephrectomy will prove very rarely practicable, and can only be done in those rare cases, as Abbe's, in which the growth probably originates in the capsule and simply crowds the kidney tissue before it.

Operations for malignant disease of the kidney, so far, have not given much reason for encouragement: the mortality is high, recurrence is very common. But it would seem as though here, as elsewhere, early operation would afford better results than those indicated by the present statistics.

The **benign tumors** of the kidney include adenoma, lipoma, and fibroma of the gland itself, and papilloma of the pelvis.

The *adenomata* are usually of small size, encapsulated, situated in the kidney substance, and occur singly or there may be several in each kidney.

In structure the adenomata approach the carcinomata very closely at times, and indeed by some writers no attempt is made to distinguish one from the other; but clinically, at least, the natural history of the two tumors is certainly distinct; The tumors are limited by a capsule of connective tissue, within which the epithelial cells are arranged to simulate roughly the appearance of the tubules.

The *fibromata* are also found in the kidney substance occasionally, associated with chronic diffuse nephritis. In structure they consist of fibrous tissue enclosed by a capsule; they are ordinarily of small size.

The *lipomata* which occur in the kidney are usually of small size and of only pathological interest.

Besides these forms of benign tumors, mention must be made of myxomata, angiomata, lymphangiomata, gliomata.

Papilloma of the pelvis of the kidney presents the characters of papilloma

¹ Abbe: *Ann. of Surg.*, Jan., 1894.

² Chevalier: *Thèse de Paris*, 1891.

of the bladder, and indeed they may coexist.¹ The tumor is usually pedunculated, dendritic, of variable size, and consists of a fibrous stroma overlaid by epithelium.

The symptoms of benign tumors, owing to their small size and trifling interference with function, are exceedingly obscure and are seldom recognized.

Occasionally it has happened that the tumor has reached some size, and then has been detected and submitted to treatment either by partial or total nephrectomy.

Tumors of the kidney capsules, fibrous or fatty, are sometimes separately described in systematic treatises upon the kidney, but lack of space will prevent more than mentioning the fact in this place that from the fibrous capsule fibromata, sarcomata, and fibro-sarcomata may arise, and from the fatty capsule lipomata, myxo-lipomata, fibro-lipomata, and myxo-sarcomata.

The whole number of such cases so far reported is not large, and the natural history of such tumors is, therefore, but imperfectly known.

Their peculiarity appears to consist in the fact that, however great the tumor may become, and they reach great size, the kidney remains practically unchanged. But, unfortunately, it has been found impracticable in most of the cases reported to preserve the kidney when the tumor was submitted to extirpation.

MOVABLE KIDNEY.

Under a variety of circumstances it is possible for the normal range of motion of the kidney to be increased; but the title of movable kidney has now been restricted to a condition of the kidney in which its abnormal mobility is due to causes other than displacement by tumors of other abdominal organs or as the effect of tumors of the kidney itself.

The term "floating kidney" is commonly used as synonymous with "movable kidney," but, for accuracy's sake, should be confined to those exceedingly rare states in which the kidney is actually surrounded by peritoneum and suspended in the abdominal cavity by a distinct mesonephron.

Lesions.—According to Morris, the fatty capsule which normally invests the kidney snugly may be of lax texture and allow the kidney to move within it; or the attachment of the fatty capsule to surrounding parts, and especially to the peritoneum, may be so slack that both the kidney and its capsule move freely behind the peritoneum; in either case fat is less abundant in the capsule than usual.

The kidney itself, excluding those cases in which disease of the organ is the cause of mobility, is usually normal, or, more rarely, there may be a certain degree of dilatation due to repeated distentions by urine retained as the result of kinking of the ureter.

The vessels entering the hilus are often elongated to a surprising degree.

Associated with movable kidney it is not rare to find enteroptosis, or, at any rate, dilatation of the stomach and chronic gastritis; and it would seem that at least in a certain proportion of cases the mobility of the kidney was secondary to the first condition, especially when the movable kidney happens to be the left one.²

Dilatation of the gall-bladder is occasionally combined with mobility of the right kidney, and is probably due to obstruction of the common duct produced by the kidney's dragging on the descending duodenum.

Etiology.—Movable kidney occurs at all ages and in both sexes, but

¹ Murchison: *Trans. Path. Soc.*, vol. xxi. p. 241.

² Tuffier: *Congrès de Chir.*, 1889 and 1891.

more often in women than in men in the proportion of 7 to 1,¹ and between the ages of twenty-five and forty years.² The right side is more frequently affected than the left—least often, both.

As to the absolute frequency of movable kidneys opinions vary widely: pathologists place the proportion much too low, while clinicians in search of movable kidneys discover them with astonishing regularity.

Morris, quoting Skorekewsky, fixes the ratio at 32 among 1422 patients, or about 1 in 44.

The fact that abnormal mobility of the kidney develops most frequently in women who have borne children at short intervals, and particularly in those whose circumstances have obliged them to resume severe manual labor shortly after parturition, has pointed out the chief causes of movable kidney—namely, disappearance of the perirenal fat, prolonged expulsive efforts, and the rather sudden diminution of intra-abdominal pressure.

The effect of diminution of fat is to withdraw at least one of the agents by which the kidney is retained in place, and to throw the support of the kidney upon its vessels and the adhesions which exist between it and the peritoneum in front and the transversalis fascia behind.

If under these circumstances prolonged expulsive efforts are made, and the kidneys thrust downward by the diaphragm acting directly upon the kidney on the left side and upon the kidney through the liver on the right side, the attachments of the kidney are stretched inordinately. If, now, the patient gets up and goes about, and especially if she performs manual labor, there is no opportunity for the attachments of the kidney to contract, as they would probably do if the kidney were allowed to remain in its natural position by recumbency of the patient. Thus the kidney is loosened, and remains so, not only because of the assumption of the upright position of the patient, but also because intra-abdominal pressure, greatly diminished by the evacuation of the uterus, allows the kidney to move freely behind the peritoneum and to glide forward into the abdominal cavity.

Mobility of the kidney occurring with enteroptosis—displacement of most of the abdominal organs downward—owes its development to the same condition that has resulted in dislocation of the other organs, and whose causation is as yet not fully understood.

The origin of movable kidney has occasionally been traced to injury—either direct injury of the kidney region or to displacement by falls upon the feet or buttocks.

The influence of tight lacing upon the kidney is often referred to as a cause of mobility of the organ, but whether it has this effect or not cannot be decided with precision. Most women are in the habit of constricting the abdomen and lower chest, but comparatively few have movable kidneys; and it is in just the class who do not lace tightly that movable kidney occurs with greatest frequency—namely, women of the working classes.

Symptoms.—With some movable kidneys there are no symptoms at all, or only very slight pain, referred to the loin of the affected side. In other cases, however, the symptoms are well marked and often most distressing: they may begin suddenly or more gradually, but when established there are usually three sets of symptoms besides the existence of the tumor.

The pain is most often of a dull, dragging character, felt in the back and referred to the affected side; it is sometimes severe, and may be aggravated by changes of position or by effort.

At intervals, which are sometimes variable or which recur at regular

¹ Newmann: *Surg. Dis. of Kidneys.*

² Delafield: *Lectures on Practice.*

periods, the patient suffers from attacks of pain simulating renal colic very closely. These attacks are precipitated by a variety of causes, as fatigue, etc. The pain is exceedingly severe, and may radiate from the loin to the epigastrium, to the intercostal spaces, to the shoulder, down the ureter to the testicle, labium majus, or thigh. There are usually nausea and vomiting, and the abdomen may be distended and tender. There may be a slight rise in temperature.

Micturition is increased in frequency, and may be accompanied by urgency and tenesmus, but there is very rarely or never blood. As the crisis subsides there may be marked increase in the quantity of urine evacuated, and it is apt to be pale and of low specific gravity.

These attacks correspond quite accurately to the symptomatology of intermittent hydronephrosis; and that this is their true character in many cases the recognition of enlargement of the kidney during the attack will attest; in others, however, the facts do not harmonize so well, and then the pain is said to be neuralgic.

Disturbances of the function of the alimentary canal are very frequently associated with movable kidney, and are especially marked in those cases combined with enteroptosis or with gastric dilatation; thus the patient may suffer from gastric and intestinal indigestion, from constipation, etc.

If this disturbance of the stomach were due alone to pressure upon the duodenum, such symptoms should be absent if it happens to be the left kidney which is movable; but dyspepsia is also present in this condition, so that some other explanation must be sought.

Patients with movable kidneys suffer from a variety of nervous symptoms, conveniently called by the name "neurasthenia," which are often out of all proportion to the lesion present. Thus these patients may have areas of anesthesia, neuralgias of various kinds, and even hysterical seizures.

The tumor, upon the detection and recognition of which the diagnosis depends, is not always easy to discover or to identify, and it is often necessary to examine the abdomen several times before one is able to palpate the kidney at all.

The displaced kidney is usually found lying close behind the anterior abdominal wall, below the free border of the ribs; it is of firm consistency, rounded borders, and freely movable, and disappears in dorsal decubitus or may be reduced into the loin, and there gives renal ballotement, and reappears on the assumption of the erect position.

The tumor formed by a movable kidney must be differentiated from those of the pylorus, spleen, pancreas, ovary, mesentery, omentum, and from distention of the gall-bladder.

Prognosis.—While in the majority of cases movable kidney constitutes only a cause of more or less intense suffering, and does not threaten life, in other instances the general health is impaired, not alone by the repeated attacks of pain, but also by the disturbance of the functions of the stomach and bowel.

In those cases in which an intermitting hydronephrosis develops, a chronic diffuse nephritis may be set up, and the patient suffer from its symptoms.

Treatment.—In the mildest cases no other treatment is required than the avoidance of the over-exertion which causes the pain of which the patients complain.

In the more severe cases the problem to be solved is to devise a means of keeping the kidney in its place: this it is possible to do in either of two

ways—by proper support or by suture; and of these means the former will naturally be tried first.

Support to the displaced kidney may be afforded by a variety of bandages, in all of which the essential parts consist of a pad held in place by a belt. The shape of the pad and its size vary a good deal with the size and configuration of the abdomen, but the belt in every case should be broad enough to take its support from the crests of the ilia.

The apparatus should be applied during recumbency, with the kidney in its normal position; it must be worn during the day, but at night may be discarded.

In those cases in which enteroptosis, rather than movable kidney, is the cause of the symptoms, firm support of the abdominal wall often gives very prompt relief; and it is in just this group of cases that support, and not operation, is indicated.

On the other hand, in those cases in which there is no special prolapse of the viscera, and in which pain, whether neuralgic or due to retention of urine by kinking of the ureter, is the chief symptom, nephrorrhaphy is indicated, and has given gratifying relief in many instances. Delvoic¹ has collected 363 cases, and analyzes but 215, as follows:

	Cures.	Improved.	Failure.	Relapse.	Death.
Suture of fatty capsule	4	3	2	5	0
Suture of fibrous capsule	10	3	4	5	2
Suture of parenchyma without stripping of capsule	75	14	11	8	2
Suture of parenchyma, after stripping capsule	9	0	1	0	0
Special methods	5	5	0	0	0
Operations of uncertain character	32	5	7	2	1
	<u>135</u>	<u>30</u>	<u>25</u>	<u>20</u>	<u>5</u>

Thus it appears that the mortality of nephrorrhaphy is very low, and that suture performed through the kidney substance after stripping the capsule is a fairly successful operation.

Extirpation of the movable kidney is rarely done, and then only after failure of all other means to control the pain.

NEPHRALGIA.

Under the caption of Nephralgia there have been grouped a considerable number of cases in which the patients suffered from pain referred to the kidney, and in whose kidneys no appreciable change existed,

The pain suffered by such patients is often severe, simulating renal colic in some instances, occurs in attacks like those due to renal calculus, and rarely has been accompanied by the appearance of blood in the urine.

The nature of the conditions giving rise to this pain are little known, and, indeed, are probably widely diversified.

In a certain proportion of cases the pain seems to be of reflex origin, and to be due to lesions of other parts of the genito-urinary tract, as the prostate, bladder, ureter, or the other kidney, or to lesions of more remote parts of the body, as the nervous system, intestine, etc.

In another group, on which Tiffany² lays particular stress, the lesion lies in the fibrous capsule of the organ.

In other cases the patients suffer a pure neuralgia; unaccompanied by any

¹ *System of Surg.*, Dennis, vol. iii. p. 473.

² Tiffany: *Ann. Surg.*, 1889, p. 104.

demonstrable change, and as obscure in its nature as similar conditions in other parts of the body: not a few of these cases have given the history of pre-existing malaria or syphilis or suffer from anemia.

The close resemblance of the symptoms of kidney neuralgia to those of other conditions of the kidney renders the diagnosis exceedingly difficult; indeed, in many of the cases reported operation was undertaken in the belief that a renal calculus was to be dealt with.

This similarity of symptoms becomes wellnigh indistinguishable when hematuria is added.

The kidney is often tender to pressure.

The indications for **treatment** of kidney neuralgia are almost unknown.

Relief from the attacks of pain has followed exploration of the kidney through the loin, with simple palpation or needling or incision, but in other cases no benefit has followed.

It would seem as though the possible causes of the neuralgia should be first attended to; thus cystitis, etc. should first be treated with the idea that the pain may be reflex and due to the obvious lesion.

If pain is not relieved in this way, then the kidney itself must be attacked by exposing it in the loin and splitting its capsule along the convex border. A considerable number of cases have been cured by this procedure, but others have not been improved at all.

In the latter instance nothing remains but nephrectomy, which should be performed by the extra-peritoneal method.

OPERATIONS.

The kidney is accessible for operative procedures through the posterior abdominal wall, by incisions in the loin or through the anterior abdominal wall; but, while in the former the peritoneum is never designedly wounded, in the latter the route to the kidney lies through the peritoneal cavity.

Of these methods there can be no question that the extra-peritoneal operation is less dangerous than the trans-peritoneal, for, notwithstanding that wounds of the peritoneum are far less dreaded than formerly, the possibility of peritonitis should make the lumbar operation preferable wherever no special contraindication exists.

Aside from nephorrhaphy, which is always done in the loin, and nephrotomy, also done here, many tumors even of some size may be removed by this route, for it is found that growths of the kidney push the reduplication of the peritoneum from the abdominal wall to the mesocolon forward, and thus increase materially the space possible for manipulations.

The form of the incision in the loin may be varied considerably to meet the particular requirements of the case in hand; but in any instance the patient is placed upon his sound side, with a pad of suitable size beneath the flank to separate the costal margin from the iliac crest of the affected side.

In some cases it will be found advantageous to place the patient in a semi-prone position or to have an assistant crowd the kidney toward the loin by pressure upon the anterior abdominal wall.

The vertical incision of Simon is made from the eleventh rib along the outer border of the erector spinæ muscle to the iliac crest; the subcutaneous fat and latissimus dorsi are divided to the same extent, and the quadratus exposed by dividing the middle layer of the transversalis fascia from the twelfth rib to the lower angle of the incision; its fibers are retracted toward the spine by blunt hooks, or the iliac portion of the muscle cut through close

to the ileum, and the anterior layer of the transversalis fascia exposed with the ilio-inguinal and ilio-hypogastric nerves and some of the lumbar vessels: these structures are pushed to one side or cut, and the fascia split up when the fatty capsule comes into view.

By carefully tearing through the fatty capsule the kidney is exposed in the lower half of its posterior surface.

While this form of incision answers the purpose in many cases, in others it does not yield sufficient space for manipulation of the kidney, and hence various means have been employed from time to time to secure more room.

Resection of the twelfth, and even of the eleventh, rib has been performed in a few instances, but the danger of opening the pleura, together with the fact that retraction of the rib by blunt hooks is equally good, has led to the very general desertion of this plan and to the invention of modifications of the form of incision to afford more space.

The oblique incision, practised by Czerny, is made a finger's breadth below the twelfth rib and parallel to it, from the outer border of the erector spinæ downward and outward for a variable distance, depending upon the circumstances: when necessity requires this incision to be of considerable length, as the iliac crest is approached the incision should be curved and carried forward toward the umbilicus; the latissimus dorsi and the three flat muscles of the abdomen are divided to a variable extent, and the quadratus and anterior layer of the transversalis fascia treated as in the vertical incision to expose the kidney.

The incision devised by König, however, will be found most generally useful in almost all the lumbar operations upon the kidney, in that it yields the maximum working space and can be enlarged at will. It consists of division of the skin along the outer border of the erector spinæ from the twelfth rib to the level of the umbilicus, when the incision curves forward and may be prolonged to the umbilicus, and the peritoneal cavity opened if occasion requires; the quadratus and anterior layer of the transversalis fascia are exposed by dividing the latissimus dorsi and the flat muscles of the abdomen; the iliac portion of the quadratus is cut and the muscle retracted; the fascia is split, and the fatty capsule of the kidney comes into view, and also the line of reduplication of the peritoneum, which it is often of importance to locate accurately.

In closing this incision, as well as the Czerny incision, the divided muscles must be accurately united by suture to ensure restoration of function as well as to prevent hernia; and for this purpose some kind of absorbable material is much to be preferred, for even where primary union has occurred silkworm gut has often caused the formation of troublesome sinuses.

The wound of the skin may be sutured wholly or in part, or may be packed with gauze or drained by tube.

Operations upon the kidney conducted through the peritoneum by incisions of the anterior abdominal wall may sometimes be necessary, either for the removal of tumors too large for extraction by the lumbar route, or where doubt exists in regard to the presence or condition of the kidney not immediately concerned, or finally where the abdomen is opened in the belief that tumors of other organs are to be dealt with.

In the great majority of cases the peritoneum will only be opened for the removal of very large tumors.

The incision may be made in the linea alba or in the linea semilunaris, as advised by Langenbuch; and of the two positions, the lateral one is found most generally useful in providing access to the renal tumor, which is usually

situated to one or other side of the median line, and in facilitating its separation from surrounding parts, particularly the colon, which must always be pushed inward.

The incision is made through the linea semilunaris from the costal cartilages downward to as near Poupart's ligament as may be necessary, and in some cases of very large tumor a second incision, carried outward from the first in a horizontal direction to a variable extent, may be made.¹

The bleeding from the thinned abdominal wall in this extensive wound is ordinarily inconsiderable, but should be stopped entirely before the peritoneum is opened.

After entering the abdomen the posterior layer of peritoneum covering the tumor is divided to the outer side of the colon, and the tumor separated from its attachments, cutting vessels between two ligatures, until the pedicle is reached; the latter is tied provisionally *en masse* and divided, and then its elements separately ligatured and the ureter specially treated as the case may require; or the renal artery may be tied through a separate incision before separation of the tumor is undertaken.²

In most instances it is found advantageous to perforate the lumbar region and to drain the site of the kidney tumor in this way, either by drainage-tube or by gauze.

The wound in the posterior layer of the peritoneum is next closed, the membrane wiped clean, and the wound of the anterior abdominal wall accurately sutured.

Puncture of the kidney is usually done for explorative purposes to determine whether an enlarged kidney contains fluid, and, if so, the character of the fluid. The position of the puncture may vary, but where possible should always be extra-peritoneal, and for this reason, except in very large tumors, should be made in the loin, with the patient in the usual semi-prone position.

Nephrotomy—incision of the kidney—is done for exploratory purposes, and for drainage either of hydronephrosis or of abscess of the kidney, and is always conducted through the loin.

The kidney may be exposed by any one of the lumbar incisions above described, but preferably by König's, especially in those cases in which the condition of the kidney is to determine the treatment of the organ itself.

Some trouble may be experienced in case the fatty capsule is much thickened or very closely adherent to the kidney; but patient dissection will usually suffice to separate the capsule, and in only exceedingly difficult cases is it necessary to split and peel off the fibrous capsule.

In any event, the posterior surface and external border of the kidney should be well exposed, and in the case of abscess the location of the pus should be sought by palpation, or by puncture at various points with the exploring needle; and the pelvis of the kidney should be examined to determine whether distention exists or not; for it is practically impossible to say in a given case whether the pus occurring in the urine is derived from the pelvis of the kidney or from an abscess of the gland itself.

If an abscess of the kidney be present, the overlying kidney tissue is incised at its thinnest point, and the finger introduced to explore the cavity and to locate any additional pockets or collections of pus; septa should not be broken down further than is necessary to ensure drainage, for all the renal tissue is of value: a drainage-tube is carried to the bottom of the cavity, and the external wound closed at its angles and packed at its center, where the drainage-tube emerges.

¹ Abbe: *Ann. of Surg.*, Jan., 1894.

² Stimson: *Op. Surg.*, 3d ed., p. 478.

If distention of the pelvis of the kidney be present, or the pelvis of the kidney be found to contain calculi, the position of the incision of the kidney becomes of importance; and, while formerly the pelvis of the kidney was entered by an incision into its posterior surface or by an incision through the posterior surface of the kidney, to-day it is found that an incision into the pelvis of the kidney through its outer border possesses many advantages.¹

Bleeding from such a wound is not generally so free as might be expected, and is quite readily controllable by gauze packing or by deep sutures.

In case drainage of the pelvis is desired, the tube is carried through the wound to the pelvis of the kidney, and the external wound treated as above indicated.

If, on the other hand, the pelvis contains one or more calculi and is free from suppuration, and more or less protracted drainage is unnecessary, after removal of the stones the kidney wound may be sutured, and then is found to heal very rapidly.

If hydronephrosis is the disease to be dealt with, and drainage is decided upon, in case the tumor is of considerable size the incision may be made farther from the spine than the outer border of the erector spinæ, but, at all events, the drainage-tube may be introduced at any convenient point, for in cases of any severity the kidney tissue is so thoroughly thinned and atrophied that no material destruction of it occurs through incision of any part of the sac. After evacuation of the sac and the insertion of the drain the external wound is sutured at its extremities and packed about the tube.

Nephro-lithotomy consists in the performance of nephrotomy for the removal of renal calculi, and for this purpose the kidney is exposed in the loin by the König incision, separated from its fatty capsule, and brought well down from beneath the ribs for examination.

The index finger is passed over its surface, and if at some point, generally paler than the surrounding tissue, the consistence indicates the presence of a stone, the overlying tissue is incised and the calculus extracted by proper forceps.

If, on the other hand, no stone is palpable, and repeated punctures of the kidney by a fine needle yield no information, it remains to explore the pelvis, either by incision directly into it, or indirectly by an incision through the convex border of the kidney; and of these methods the latter would seem to be preferable, not only because fistulæ are less likely to follow, but also because exploration of the cavity of the pelvis by this route is far more thorough and the damage to the calyces less extensive.²

The hemorrhage is often free, but may be prevented by digital compression of the artery or controlled by gauze pressure. The finger is then passed into the wound, and the pelvis of the kidney and its calyces thoroughly explored, and the stone, if discovered, removed, even if it has already descended for some distance into the ureter.

The stone having been removed, the wound of the kidney is united by deep and superficial sutures and the organ replaced, and the external wound closed with or without drainage.

If the stone be associated with abscess of the kidney, drainage of the abscess becomes the predominating feature, and the treatment is described under the head of Nephrotomy.

After drainage of the kidney or its pelvis for any cause, if the fistula

¹ *Ann. des Mal. des Organ. genito-ur.*, June and July, 1891.

² Tuffier: *Études exper. sur la Chir. du Rein*, p. 88.

persists and continues to discharge urine in any quantity, the condition is an exceedingly annoying one, and to relieve it a variety of procedures have been proposed and practised, largely dependent upon the permeability of the ureter and the state of the opposite kidney.

The permeability of the ureter may be judged roughly by the estimated quantity of urine escaping through the fistula, more accurately by cystoscopic inspection of the mouth of the ureter of the affected kidney, or by catheterization of the ureter.

If no urine finds its way into the bladder from the previously drained kidney, and the ureter is thought to be occluded, and the urine from the other one is found to be of fair quality, there would seem to be no good reason for not proceeding to nephrectomy, provided the patient's general condition will warrant so severe an operation; and the more so if at the original nephrotomy the kidney has been found so extensively disorganized as to possess but little secreting tissue.

On the other hand, if permeability of the ureter can be demonstrated and the kidney be in a fine state of preservation, every effort to close the fistula should be made before nephrectomy is resorted to.

Many such fistulae close spontaneously within six months of operation: it happens occasionally that a calculus overlooked or inaccessible at the time of operation causes the persistence of a fistula, and then is found, as a rule, at the bottom of the tract, and may be easily removed.

But if no very good reason appears for the persistence of the fistula, its closure may be brought about by actively euretting or splitting it up, and by careful packing inducing healing from the bottom, and, only as a last resource, extirpating the kidney.

Nephrectomy—total removal of the kidney—is performed for certain injuries of the kidney or ureter, for tumors of the kidney that remain confined to the organ, for intractable renal fistulae, for grave forms of suppuration such as surgical kidney, for tuberculosis, and, rarely, for floating or movable kidney; and under this heading, too, are included the cases of partial removal or resection of the kidney.

The experiments of Tuffier¹ have proven conclusively that after the removal of the whole or a part of a kidney the remaining kidney tissue is capable of carrying on the renal functions, and that it rapidly hypertrophies—so much so that in the course of a fortnight he was able to remove at repeated sittings an amount of kidney substance equal to the weight of the normal organs, without producing death.

The chief question to be decided before any contemplated nephrectomy, then, concerns the existence and condition of another kidney to perform the functions of both if either is extirpated; and this question ought to be determined with absolute certainty, for if an individual with but one sound kidney possesses only half the resources in the way of potential renal functioning of one with two, how much more badly off is he with but a single kidney, and that more or less damaged, even if the kidney in the latter case suffice to carry the patient through the crisis that inevitably follows nephrectomy!

The question becomes most grave when the congenital absence or rudimentary development of the kidney comes up for decision. However rare it may be, it is well known that congenital absence of the kidney does occur—1 in 3992 $\frac{2}{3}$ (Morris); and it is equally well known that persons have perished as the consequence of the removal of a single kidney.

There are, too, acquired conditions in which the secretion of urine is per-

¹ *Études exper. sur la Chir. du Rein.*

formed by one kidney alone, which must be excluded before nephrectomy can be undertaken.

Further, the possible presence of malformation of the kidney, particularly of fusion of the two kidneys or of misplacement of the kidney, demands the serious thought of the surgeon.

To establish the absence of all of these conditions requires most painstaking investigation. Abdominal palpation will many times serve to detect the presence of the kidney even when displaced, particularly if an anesthetic is used; and under favorable circumstances, as in case of thin and relaxed abdominal walls, malformations of the kidney have been recognized.

In other abdomens, however, palpation cannot be successfully carried out, and it is necessary to employ some other plan; and the digital exploration of the kidneys through a small incision in the linea alba has been practised many times with good result, especially in those cases in which abdominal nephrectomy is to be done.

But certain cases occur in which it is impossible to determine the existence of a second kidney, or in which it is impracticable, as in severe injuries, either from lack of time or facilities, or because extirpation of the wounded organ is imperative to prevent death from hemorrhage.

The cystoscope will show whether urine escapes from both ureteral orifices, but obviously this does not exclude the existence of fusion of the kidneys.

As to the determination of the state of the kidney not designed to be attacked much difficulty also presents itself. Kelly's method of catheterization of the ureters in the female is of immense value, but as yet no very generally applicable plan has been devised to obtain the urine separately from each kidney of the male unless by suprapubic cystotomy.¹

In cases of renal fistula in which nephrectomy is to be performed because impermeability of the ureter exists the investigation becomes quite simple.

Finally, one should remember that some of the affections for which nephrectomy is occasionally performed are usually bilateral—*i. e.* cystic kidney.

The kidney may be removed through any of the lumbar incisions previously described, but König's is found most generally useful because of the maximum space afforded, and because by extending its horizontal limb the operation originally planned to be extra-peritoneal may readily be converted into an intra-peritoneal one.

The kidney or the tumor is exposed by teasing through the fatty capsule as usual; the next step consists in separating it from contiguous tissues by blunt dissection until the hilus and the pedicle are reached; the latter is provisionally tied *en masse* and the kidney removed, after which the renal artery and vein are separately ligatured and the ureter subjected to any further treatment required.

If the extirpation is done for renal fistula or for any condition in which thickening of the capsule or adhesion of the latter to contiguous parts exists, it is recommended to remove the kidney by shelling it out of its fibrous capsule, and leaving the latter, together with the fatty capsule, behind; indeed, in some instances it has been found impossible to remove all the kidney tissue—adherent, for example, to the vena cava—and portions of it have been allowed to remain.

Partial nephrectomy or resection of the kidney, where admissible at all,

¹ The recent invention of a combination cystoscope and catheter makes it possible for the trained observer to catheterize the male ureters and obtain urine from the two kidneys separately.

possesses the advantage of preserving more or less of the kidney tissue, and, although difficult of performance, has been done for certain injuries of the kidney, for some cysts of the kidney, and for benign tumors of either the gland itself or of its capsule, and at least once for sarcoma.¹

The operation itself, as described by Tuffier,² consists in exposing the kidney through the loin and separating the fatty capsule completely to allow examination of the kidney on all sides, to facilitate its dislocation into the field of operation, and, equally important, to make digital compression of the artery possible during subsequent maneuvers.

The tumor and the affected portion of the kidney are next removed by an incision wide of the growth, and which may run 1 to 2 cm. from the hilus without danger, and which may open the pelvis.

Tuffier advises, then, that deep sutures of catgut be passed down to the mucous membrane of the pelvis, and reinforced by a few superficial stitches, and the constriction of the artery gradually relieved; in most cases no bleeding will occur, but, if it does, gentle pressure for a few moments, he says, will readily control it. The external wound is then closed with or without drainage.

Nephrorrhaphy, devised by Hahn³ in 1881, consists in the fixation of a movable floating kidney in its normal position by sutures. Hahn exposed the fatty capsule of the kidney by a vertical incision in the loin, and sutured it to the margins of the wound, which was then packed and allowed to granulate. The result was not entirely satisfactory, so that in later cases the sutures were made to pass through the fibrous capsule and even the parenchyma of the kidney.

A great variety of detail has been introduced by different operators in placing the sutures, in suture material, etc., but the following method, described by Edebohls, will be found as satisfactory as any:

The patient is placed upon the table in the lateral position. Two small, firm pillows or cushions are so placed upon the table as to press into the lateral and anterior regions of the abdomen, crowding the viscera upward to the site of operation, and putting the latter well upon the stretch by separating, as far as possible, the twelfth rib from the crest of the ilium. The same antiseptic and aseptic precautions are observed as at a celiotomy. The incision, made along the outer edge of the erector spinæ muscle, should in all cases extend the entire distance between the lower edge of the twelfth rib and the crest of the ilium. It should be made more or less oblique according to the lesser or greater distance between these points. The superficial fat, the tendon of the latissimus dorsi, and the conjoined tendon of the internal oblique and transversalis are successively divided along the whole length of the cutaneous incision until the perirenal fat is reached. The outer fibers of the quadratus lumborum occasionally overlap the line of incision, and are then cut through along their length. The fatty capsule is penetrated by a small incision until the kidney with its capsula propria is detected at the bottom of the wound. Palpation of the kidney with one or two fingers through the wound of the fatty capsule will enable us to get our bearings and determine the extent to which the length of the incision in the fatty capsule should be increased in both the upward and downward directions. The fatty capsule is incised along the whole length of the convexity of the kidney, after which it is drawn out of the wound as far as it will go, and the redundancy of the fat-sac is cut off on either side at a level with the bottom of the wound.

¹ Abbe: *Ann. of Surg.*, Jan., 1894.

² *Ann. des Mal. des Organes genito-urin.*, Dec., 1895.

³ *Am. Journ. Med. Sci.*, Mar. and Apr., 1893.

In doing this care must be exercised not to open the peritoneum at the lower pole of the kidney. The trimmed edges of the fatty capsules are secured with a small pair of T-shaped forceps for guidance in the subsequent suturing. The delicate part of the work now begins. The capsula propria of the kidney is incised along the whole length of the convexity of the organ in the mesial line. To do this successfully the kidney must be moved up and down so as to expose successively, at the bottom of the wound, the lower and upper halves of the organ. A pair of tenaculum forceps or two are of material aid in this and the subsequent parts of the operation. They must, however, be used with exceeding gentleness, as the kidney substance is exasperatingly friable, and they readily tear out. During this and subsequent steps of the operation it is of paramount importance that the kidney be pressed well into the bottom of the wound, so as to be readily accessible. If the two cushions spoken of at the beginning have been well placed under the left loin, nothing further is generally necessary, the kidney being well sustained in place, merely moving rhythmically upward and downward with respiration. If the cushions are not properly placed or prove insufficient, the hand of an assistant pressing upon the abdomen so as to crowd the kidney into the wound must be made to take their place or to supplement them. After the capsula propria has been incised it is stripped off from the kidney substance on either side until about $1\frac{1}{4}$ cm. of the kidney substance are exposed on either side along the whole length of the incision through the capsule, thus making raw a surface 10–12 cm. long by $2\frac{1}{2}$ cm. wide for union with the deep parts of the lumbar incision. It is just here where nephrorrhaphy performed by stitching the fatty capsule alone, or by stitching the kidney without opening its capsula propria, has failed, both the fatty capsule and the capsule proper being tissues in no way adapted to firm cicatricial union with contiguous parts. The stripped-off capsula propria is not removed, but is doubled backward upon the still adherent portion like the lapel of a coat.

Thus far, the steps of the operation have been identical in all my cases. In the method of suturing, however, I have made slight variations. At first the writer sewed with silkworm gut, embracing on either side, in each suture, skin, superficial fat, the tendons of the abdominal muscles, the cut and trimmed edges of the perirenal fatty capsule, the reflected as well as the still adherent capsula propria. The loop of the suture penetrated the kidney substance to the depth of $1-1\frac{1}{2}$ cm. Five or six such sutures were usually passed and tied upon the skin, after a rubber drain had first been passed to the bottom of the wound and caused to lie along the raw kidney substance its whole length, with an end emerging at either angle of the wound. In later cases he attached the kidney to the deeper and firmer tissues of the abdominal walls, the muscles, and aponeuroses by buried sutures of kangaroo tendon or silkworm gut, passing a drain composed of ten or twelve silkworm strands along the raw kidney surface, instead of the rubber drain. The purpose of the drain is twofold: first, to remove from the depths of the wound all secretions which might interfere with primary union; and secondly, to favor firm cicatricial union by mild irritation of the raw kidney substance and the contiguous deep tissues of the abdominal wound. In tying the deep buried sutures, whether of silkworm gut or of kangaroo tendon, care must be exercised not to draw them too tightly, as they readily cut through the friable kidney substance. The skin and superficial fat are closed over the deep buried sutures by a running suture of catgut. Union by first intention has been the rule. The dressings are changed for the first and last time on the eighth day, when the drain is removed. The patient is kept upon the

back for three weeks, and then allowed to sit up and go about as she pleases.

Accidents.—Any operation upon the kidney through the loin may be complicated by wounds of the pleura, and, although this accident is usually not serious, it may become so if the pleura is inoculated by infectious pus.

It is extremely advisable, as a preliminary to all operations upon the kidney, to count the ribs, and thus eliminate the possibility of wounding the pleura that follows mistaking the eleventh for the twelfth rib.

Should the pleural cavity be opened, however, the wound must be blocked by a bit of gauze or sponge at once, and then closed by a continuous suture of fine catgut.

Wounds of the peritoneum are dangerous at times for the same reasons, and must be managed in the same way.

Profuse bleeding occurs from the wounded kidney tissue occasionally, but is usually arrested by gauze pressure maintained steadily for a few moments.

Bleeding from the vessels at the hilus only occurs as the dissection approaches this region; it is severe, and can only be controlled by clamping the bleeding vessel.

Hemorrhage from the rent in the vena cava has always proved fatal, either at once or subsequently as the effect of thrombosis or embolism; but it is at least conceivable that a lateral ligature or suture might be applied to a wound of moderate size in the vena cava.

The shock of kidney operations, particularly of nephrectomy, is sometimes severe, and appears to be exaggerated in those cases in which the remaining kidney is not entirely sound.

After operations upon the kidneys, and especially nephrectomy, the kidney is usually acutely congested, and in addition, in the latter case, the kidney tissue available for secretion is much diminished; therefore, it is not surprising that a considerable reduction in the volume of urine secreted occurs, or that the urine should contain more or less blood and albumin. But in most cases this condition is transitory, and after a few days the amount of urine increases, and becomes normal as the congestion subsides and hypertrophy of the functioning kidney occurs.

FUNCTIONAL DISORDERS.

BY JAMES PEDERSEN, M. D.

Definitions and General Considerations.—The generative act in the human male, to be normal and complete, requires, as in all the other higher animals, first, successful copulation, and, second, the deposition of fertile semen in the vagina of the female. Any lack of power to accomplish the former constitutes impotence; any inability to effect the latter constitutes sterility. The two should not be confused; either may exist without the other or they may coexist. Eunuchs and those men in whom a double epididymitis has occluded both vasa deferentia maintain, often for a long time, strong sexual craving and the power of erection and of ejaculating a semen-like fluid, accompanied by the usual pleasurable sensations; nevertheless, such men, though potent, are absolutely sterile.

To the successful performance of copulation a perfect erection of the penis is essential, while the second requirement demands the existence of fertile semen, no obstruction to its discharge at the proper instant, and the co-ordinate action of the muscles having to do with the function of ejaculation. Erection and ejaculation are reflex acts the mechanism of which is complex, the nervous, muscular, and vascular systems all playing a part. Any lack of harmony in the operation of these component parts constitutes a functional disorder of greater or less degree, to a clear understanding of which at least a general comprehension of the physiology of the mechanism is necessary.

The nerve-mechanism consists of two spinal reflex centers—one for erection and one for ejaculation—both situated in the lumbar enlargement of the cord, and, to a certain extent, presided over by the cerebral genital center, the exact position of which is not known. Of the fibers passing between these spinal centers and the higher one, some transmit exciting and others inhibitory impulses. The afferent nerves of the reflex center for erection are the sensory nerves of the penis and contiguous parts; the efferent are vaso-dilator fibers—the *nervi erigentes* of Eckhard—which supply the vascular system of the penis, and motor fibers supplying the ischio-cavernosi, the deep transversi perinei, and the bulbo-cavernosus—the muscles of erection, one chief effect of whose contraction is to compress the veins of the penis during erection. The anterior fibers of the bulbo-cavernosus (which part Houston has named the *compressor venæ dorsalis*) compress the dorsal vein of the penis and the bulb of the urethra, while the remaining muscles constrict the deeper veins. The veins of the corpora cavernosa and of the corpus spongiosum are compressed, as they emerge, by the involuntary muscle-fibers of the trabeculae of these bodies. The afferent nerve of the reflex center for ejaculation is the dorsal nerve of the penis; the efferent are motor fibers which pass first to the sympathetic and then to the vasa deferentia, and a second set to those fibers of the anterior division of the bulbo-cavernosus which, by their contraction, eject the semen from the bulb of the urethra.

Thus erection is caused in response to the necessary peripheral or central stimulus, by an increased volume of blood in the erectile tissue of the corpora cavernosa and corpus spongiosum, brought about principally by active dilatation of their arterioles, and partly by the venous stasis produced by mechanical obstruction of the outflow, which serves to strengthen and maintain the rigid condition. As the muscles concerned in producing this obstruction are partly under the control of the will, erection may be voluntarily strengthened. The prostatic body, being an erectile as well as a muscular and glandular organ, participates in the general engorgement of the sexual apparatus at these times. Examples of *peripheral excitation* which give rise to erection (aside from the normal one of copulation) are—morning fulness of the bladder, inflammation of the prostatic urethra, prostatitis, seminal vesiculitis, various irritating affections of the rectum, friction of the clothing against the penis or inner surface of the thighs, and the various means employed in masturbation. Examples of *exciting factors of central origin* are—sexual desire, lascivious thoughts, the sight of a beautiful woman or of a certain woman, certain odors, and, in some individuals, certain sounds. *Inhibitory impulses* are of central origin only, and are generated, for example, by mental perturbation, by the dread of an inability to perform the sexual act, and by certain emotions, as modesty, disgust, fright, and grief. Thus, though partly under the control of the will, erection may take place independently of it, or erection may fail owing to some intercurrent emotion, in spite of the strongest mental effort.

Ejaculation takes place normally when the penis is in full erection, and in consequence of the impulse produced reflexly through stimulation of the sensory nerves at the periphery; very rarely by an impulse proceeding from the brain. The only example of the latter is the ejaculation which sometimes takes place when the penis has been in prolonged erection during violent sexual excitement without gratification. In every case the exciting cause is usually the same one which produces the erection, with this limitation—that those from the periphery must be such as stimulate the dorsal nerve of the penis. Not every excitation causing erection will bring about ejaculation. Up to a certain point ejaculation may be controlled by the will, but, once the sensory stimulation has passed this point, the completion of the reflex act by the discharge of motor impulses to the muscles concerned in the mechanism is irresistible and the semen is ejected. The degree with which this control can be exercised varies greatly in different men; in some it is developed to a remarkable extent. The majority lose this control when the semen, mixed with the prostatic fluid, has been poured into the bulb of the urethra. There it reflexly excites spasmodic contractions of the bulbo-cavernosus muscle, and is forcibly expelled from the urethra in a corresponding series of spurts. Immediately preceding and during normal ejaculation is experienced the voluptuous sensation peculiar to this function.

During erection the orifices of the ejaculatory ducts are directed forward, the caput gallinaginis as a part of the prostatic body swells in conjunction with the engorgement of that organ, and the muscular fibers of the latter contract, thus closing off the bladder from the urethra and preventing the escape of the urine, while permitting and facilitating the discharge of semen. The vascular excitement preliminary to complete erection causes Cowper's glands and the urethral follicles to pour out their secretion, thus lubricating the urethra in readiness for the discharge of seminal fluid which is to follow.

The capacity for copulation is most marked between the ages of twenty and forty-five; after that it gradually declines. The age at which it entirely

ceases normally cannot be stated: men with a fair amount of sexual desire and fertile semen have been found at the age of eighty-six.

IMPOTENCE.

Impotence is defined as a more or less complete inability to copulate or perform the sexual act, due to imperfect or absent erection or to congenital or acquired physical deformity which makes intromission of the penis impossible. Clinically considered, it has, for convenience, been variously classified. Taking the fundamental etiological factor in the case as a basis, Gross recognized four varieties, as follows: *Atonic impotence*, when the reflex excitability of the erection center in the cord is diminished or abolished, while that for the center of ejaculation is exalted; *psychical impotence*, when, owing to some mental perturbation, the inhibitory power of the brain over the center is in action; *symptomatic impotence*, when due to the use of drugs or when it occurs as a symptom or in consequence of acute or chronic general disease; *organic impotence*, when it depends upon congenital or acquired physical deformity of, or defects in, the genital organs.

The frequency with which these varieties occur is in the order in which they are named, by far the largest number belonging to the atonic class.

Atonic Impotence.—In this form the reflex center for erection fails wholly or in part to respond to the usual normal stimuli—its reflex excitability is deficient or lacking. On the other hand, the center for ejaculation is hypersensitive—its reflex excitability is exalted. In the vast majority of cases of atonic impotence the primary cause is a subacute or chronic inflammation of the prostatic urethra, but in a few cases it occurs without any such lesion. With the subacute or chronic inflammation above mentioned is associated the usual hyperesthesia of the urethral mucous membrane. According to its degree, atonic impotence is subdivided by the same author as follows: In the first erection is feeble, therefore imperfect and of short duration, but coitus is possible. Ejaculation is premature, taking place either before the climax, before intromission, simultaneously with erection, or before erection. Sexual desire is present. In the second erection is extremely feeble or entirely absent, and coitus is therefore impossible. Sexual desire is present. In the third all power of erection and all sexual desire are absent. The first of these three subdivisions is also known as prospermatism and spermaspasmus.

Etiology.—Foremost among the causes are—masturbation continued over a period of years during the developmental period of the patient's life, frequently repeated sexual excitement without gratification, and excessive sexual indulgence, whether in married life or out of it. Chronic posterior urethritis and prostatitis from whatever cause, stricture of the urethra, whether the result of masturbation or repeated attacks of urethritis, narrow meatus, and a redundant prepuce are among the remoter causes. All of these act directly or reflexly by originating and maintaining an hyperemic and hyperesthetic condition of the prostatic urethra, which, after a while, becomes chronic and leads to exhaustion and increased excitability of the reflex centers respectively, causing them to respond to very slight stimuli. Varicocele and neuralgia of the testicle, both or either of which may be merely secondary to masturbation, have been mentioned in this connection. In patients of a highly excitable temperament atonic impotence can occur not only without discoverable lesion in the urethra, but also without apparent cause.

Symptoms.—These are somewhat dependent upon whether the cause is

masturbation, sexual excess, or the remains of a gonorrhœal infection (chronic posterior urethritis). Aside from those symptoms which are manifested when coitus is attempted, there may occur the following: Frequent nocturnal emissions of true seminal fluid (polyspermia) or of fluid from the prostate only (azoospermia), prostatorrhœa, and, therefore, one or more of the signs usually ascribed to spermatorrhœa, more or less insomnia or the complaint that sleep is unrefreshing, cold hands and feet, poor appetite, coated tongue, epigastric distress, flatulence, palpitation, headache, vertigo, and constipation. Many of these last-named symptoms occur with lithemia and oxaluria, and these conditions, as might be expected therefore, are often present also. More or less neurasthenia is always present; often a greater or less degree of hypochondriasis. Melancholia is possible. The more usual neurasthenic symptoms are—pain in the lumbar region, increased by exercise, by exposure to atmospheric changes, and by attempts at coitus; weakness of the limbs, in the sense that they tire easily, denoting an asthenic condition of the lumbar cord; dull frontal headache and pain in the occipital region, neck, and shoulders, denoting an asthenic condition of the upper cord; impaired memory and mental debility, depression, apprehension, irritability, and asthenopia, denoting cerebral exhaustion.

Diagnosis.—Except in the rare cases already noticed (those in which there exist no lesions), exploration of the urethra will disclose hyperesthesia of its entire length, especially marked in the prostatic portion, and frequently the presence of stricture, organic or spasmodic. Either a *bougie-à-boule*, or a moderate-sized sound, gently used, will determine the urethral sensibility. Examination for stricture is to be made with the *bougie-à-boule* and care must be observed not to mistake a spasmodic stricture for an organic one. The endoscope will reveal, in some cases, an intensely hyperemic mucous membrane in the bulb and deep urethra, including the verumontanum. The mucous membrane will have lost its normal pinkish color and smooth, shining surface, and will present instead a cherry-red color and a swollen, sodden look, with possibly a granular patch here and there. The gentlest introduction of the instrument will excite hemorrhage. Digital rectal examination will reveal tenderness on pressure along the membranous and prostatic portions of the urethra, especially the latter. If prostatitis be present, the gland will be found more or less symmetrically enlarged or one lobe will be larger and fuller than the other. The consistency will be normal or firm or hard, or there will be a hard, fibrous region, sometimes in the form of nodules, in one lobe or the other, not unlike those met with in tubercular disease of the gland. Such localized induration is especially apt to occur in the posterior portion of the lateral lobes. The gland will be unusually sensitive to pressure—sometimes exquisitely so—and the patient may faint when the manipulation is made. If, after such pressure or massage, the patient be directed to urinate, the bladder having been evacuated immediately before, he will pass from a few drops to a dram or two of prostatic fluid containing a little pus.

Prognosis.—The younger the patient and the more definite and accessible the causal lesion the better the prognosis. Cases without tangible lesion yield with greater difficulty, and hypochondriacal cases with the greatest.

Treatment.—This will depend upon the cause, and will be governed and regulated by the physical condition and character of the patient—that is, whether he be of the sthenic or the asthenic type. Between these two as extremes there occur various degrees and combinations of both.

Atonic impotence is most commonly found in the first-named type, sthenic subjects, in whom hyperemia and consequent hyperesthesia of the prostate and urethra can exist for a long time before any symptoms of neurasthenia and exhaustion of the spinal centers (myelasthenia) become manifest. This is a class of cases in which local treatment alone is sufficient. The opposite type is composed of patients of nervous and sensitive temperament and of more or less depressed vitality. They form a class in which diminished excitability of the lumbar genital centers appears to be induced before the inflammatory condition of the urethra has had time to develop. Symptoms referable to the exhausted condition of the central nervous system predominate in them, and vary from slight degrees of neurasthenia to profound degrees of hypochondriasis and melancholia. Here scarcely any, usually no, local treatment is required, but the most vigorous of general measures must be used to build up the patient and restore the normal excitability of the nerve-centers. In the intermediate types, urethral irritability (hyperemia and hyperesthesia) requires sedative treatment, both local and general; at the same time the general health must be maintained at the highest point and improved if possible.

Local Treatment.—A careful examination of the penis, urethra, bladder, prostate, seminal vesicles, and rectum should be made in the search for possible lesions and for direct or indirect causes of the impotence. The urine also should be examined, as oxaluria often gives rise to symptoms of impotence, if not to impotence itself. If there be a redundant prepuce, circumcision should be done; in case of a narrow meatus, meatotomy. Either is capable of setting up hyperemia and hyperesthesia of the prostatic urethra, or they may of themselves cause impotence by reflex excitation—the so-called “reflex impotence.” In such cases their removal alone is sufficient to effect a cure. Stricture of the urethra should be removed, and lesions of the bladder, rectum, and contiguous parts should be cured.

The contributing causes having been removed, the hyperemia and hyperesthesia of the urethral mucous membrane, especially of the posterior urethra, remain to be treated. The means to this end are the cold sound and applications of solutions of nitrate of silver through either the syringe-sound or the endoscope. A steel sound one or two sizes smaller than the one which the urethra will accommodate should be used at first. Later on, by gradually increasing the caliber, the full size may be used if necessary. The sound should be perfectly smooth, surgically clean, and well lubricated. As in all instrumentation of the urethra, gentleness and care should be practised. A too frequent repetition of the treatment should be studiously avoided, otherwise an aggravation of the condition results. Once in five days is the proper average; exceptionally once in four days the treatment may be repeated. At first the sound should be at once withdrawn. Later, in proportion as the sensibility is reduced, the instrument may be left in from two to five minutes. In some cases of this class 20 to 30 minims of a 4 per cent. solution of cocaine may have to be injected into the anterior urethra, and retained there from four to six minutes to avoid the extreme pain experienced, especially at the outset of the course of instrumentation.

Of greater value than the sound alone in the average case is the syringe-sound (Fig. 207), which not only opens out the urethral folds as the sound does, but, in addition, gives the means of treating the damaged mucous membrane by instillations of astringent solutions into the urethra. Of these solutions, by far the safest and best are those of nitrate of silver. The strength to commence with is 1:1000 of distilled water. With the point of the

instrument at the spot where the solution is to be applied slowly inject from 10 to 30 minims from the syringe attachment, and wait a moment before withdrawing the instrument. Here, again, once in five days is often enough to repeat the treatment. The strength of the solution may be increased gradually, but solutions stronger than 5 grains to the ounce are not advised for use by this means.

When the condition is complicated by granular patches or erosions in the urethra, the endoscope is of greatest service, as it admits of applications directly to the lesion by the aid of sight. Nitrate-of-silver solutions, 10 to 20 grains to the ounce, applied by means of cotton swabs, are proper here.



FIG. 207.—Bangs' syringe-sound.

According to the specifications of Dr. Bangs, who devised it, this instrument has two parts: the *barrel* consists of a glass tube, graduated to hold m_{xxx} , set in a metal frame and fitted with a piston, in all respects like the barrel of a hypodermic syringe, except that the distal end is shaped to fit into and make an air-tight joint with the proximal end of the *sound*. The *sound* is of silver, hollow, given the Beniqué curve, and numbered according to the French scale, like the regulation steel sound. Traversing its length and opening at the beak is a tube of small caliber through which the solution in the barrel is discharged when the piston is pushed home. The instrument admirably fulfils the double purpose for which it was designed: when passed it not only opens out the folds in the urethral mucous membrane to receive the instillation, but also produces the mechanical effect obtained by the ordinary cold sound. Thus the urethra is spared a double instrumentation in stricture cases—for example, where, in addition to dilatation of the stricture, treatment specifically directed to the neighboring mucous membrane is required.

It is to be noted that the base of the lubricant for this instrument should be glycerine or some other material soluble in water, so that when the instrument is passed the urethral mucous membrane will not be covered with a coating impervious to the aqueous solution used for instillation.

Massage of the prostate as an aid to the above means or practised independently has yielded very gratifying results. It is in cases of simple hyperemia that it gives its best results as an independent means of treatment. The deficient power of erection improves under it, and ejaculation becomes less premature. It should be practised once in seven days by means of the finger introduced into the rectum. But not all of the simple cases are benefited by this treatment alone; often one of the foregoing means has to be employed in conjunction with it.

Cold applications to the prostate by means of the psychrophore of Winternitz, introduced into the prostatic urethra, are of special service according to Gross, in cases of premature ejaculation. Similarly, cold applied to this gland by the more convenient rectal psychrophore has proved of value.

General and Constitutional Treatment for Reducing Hyperemia.—In every case there should be absolute abstinence from all forms of sexual excitement. The patient should be restrained from masturbation and from dallying or toying with women. If married, the patient should occupy a separate room while the treatment is being carried out: there should be no coitus nor attempts at it. Indulgence in lascivious thoughts and literature is to be equally prohibited. To secure obedience to these conditions hold the sexual propensities in abeyance by occupying the mind and exercising the body.

Something *agreeable* to the patient should be the subject of mental application; the exercise may be anything short of horseback riding or cycling, unless with a properly fitting saddle, driving over rough pavements, and the like forms of exercise, all of which tend to pelvic congestion and thus to aggravate the trouble. But neither mental application nor bodily exercise is to be carried to the point of fatigue. In all cases a hygienic mode of life is requisite, and should be prescribed as a part of the treatment; as much open-air life as possible; perhaps travel and change of air. Sea-bathing is often of service; as a substitute, a daily bath followed by a brisk rub. Regular hours of sleep and a wholesome and unstimulating diet, without coffee or alcohol in any form, are of importance. Equally so is abstinence from tobacco. The bowels should be kept regular by avoiding constipating articles of diet. Relieve constipation, if possible, by massage of the abdomen and by regulating the diet; if necessary to use drugs, select the milder laxatives and, best of all, the various mineral waters. Glycerine suppositories or a soapsuds enema may be substituted. The warm water used in the latter serves the double purpose of assisting to allay the chronic inflammation of the prostatic urethra and the chronic prostatitis which is a frequent complication. The patients should sleep on a hard mattress and be not too warmly covered. The bladder should be emptied before retiring and immediately on awaking, to avoid, if possible, the more or less complete erection which occurs with morning fullness of that viscus. A warm sitz-bath (95° F.) for fifteen minutes each morning and evening, or a sponge wrung out in water and applied to the perineum and back, should be tried. Blisters to the perineum have been found useful.

In the way of medication the following have been advised: Bromide of potassium alone or combined with quinine or with a diuretic. In the experience of good authorities quinine increases the sedative effects of the bromides. In robust subjects tincture of veratrum viride or tincture of gelsemium may be added to the bromides. Bromide of potassium and infusion of digitalis is a recommended combination. Monobromide of camphor is sometimes substituted for the bromide of potassium, but it is less efficacious. If the patient is anemic, iron and allied tonics are indicated. When the penis in the flaccid state has a certain degree of firmness, atropine is given to overcome the contraction of the muscular fibers of the trabeculæ of the corpora cavernosa and to relax the spasm of the arterioles, to which factors the firmness is due.

The urethra and the urethral mucous membrane having been restored to a normal condition, there may still remain an exhausted or depressed condition of the genital centers in the cord. The tonics recommended for this phase are—tincture of the chloride of iron, tincture of nux vomica, and sulphate of quinine in combination, and the syrup of the hypophosphates of iron, quinine, and strychnine. The following is said to be of special value:

℞. Quinæ sulph.,	
Ferri sulph.,	ʒij;
Zinci phosphidi,	gr. ij;
Strych. sulph.,	gr. $\frac{2}{3}$.—M.
Ft. pil. No. xl.	
Sig. Two q. 8. h.	

At least two observers have had good results with from 2 to 4 drams of the fluid extract of damiana every eight hours. The fluid extract of ery-

throxylon coca also would seem to be of value. General measures include cold bathing, cold douches, and cold sprays to the lumbar region and perineum, followed by brisk rubbing.

Electricity in the treatment of atonic impotence is more or less praised by most writers on the subject. The galvanic current is mentioned first. The anode or positive electrode should be of large size, and is to be applied over the lumbar spine, while the cathode is carried over the genitals and perineum. The current should not be so strong as to cause pain. The sittings should be limited to three minutes every two days at first; later they may be lengthened to five minutes daily. The faradic current is indicated where there is deficient erectile power, and it may be tried where the galvanic current has failed. It should be applied to the erector muscles. Some cases do best by local faradization and galvanization of the spinal cord on alternate days. Central galvanization and general faradization have been advised when the symptoms are those of cerebral and spinal exhaustion. When the skin of the penis is deficient in sensibility the electric brush is indicated.

Psychical Impotence.—This variety of impotence—called also “imaginary” or “false” impotence—is that which results from disturbing emotions which excite the inhibitory power of the brain over the reflex genital centers. In its purest form it is seen in young, newly-married, perfectly normal men, who never were guilty of any sexual excesses or abuses, but who, on undertaking coitus for the first time, unexpectedly find themselves unable to accomplish the act because of absent or incomplete erection and premature ejaculation. In them inexperience or some such emotion as embarrassment, fear of inflicting pain, impetuosity and a high degree of excitement, or vague, unfounded apprehension that they cannot perform the act, is the cause. Other like emotions are mental preoccupation, extreme delight or joy, grief, fear, fright, disgust, indifference, and suspicion. Indifference on the part of the wife will often render the husband impotent at the moment of attempting intercourse.

Less distinctive than the above are those causes where the consciousness of previous vicious habits, such as masturbation and sexual excess, gives the patient ground for imagining himself lacking in sexual power or as unable to copulate. Such a patient is very prone to look upon some existing condition, such as a small penis, phimosis, varicocele, hydrocele, a chronic urethral discharge, and nocturnal emissions, as a direct consequence of his former excesses, and to regard them as positive proofs of his impotence, whereas in reality he is not impotent. Failure in an illicit intercourse undertaken with a view of testing the power before contracting marriage will sometimes unsettle the patient's confidence in himself to a degree which will be very difficult to overcome.

Good thinks many cases classed as psychical impotence, and as due to the patient's apprehension because of early masturbation, are really cases of atonic impotence from that cause. He therefore advises a careful exploration of the urethra in every case of apparent psychical impotence to ascertain whether there is not some lesion there which is the true cause and requires treatment.

The prognosis is good in the purely psychical cases; it is less so where the patient has become retrospective and more or less hypochondriacal.

Treatment of the former class is comparatively simple. General instructions as to the nature of the sexual act and what constitutes sexual hygiene, and the assurance that successful coitus will follow after properly repeated attempts, are sufficient. A placebo may be added if thought necessary. The second class requires more detail. It is useless to try to convince

these patients that their difficulty is imaginary. They are very watchful of themselves, and very often it will be found that they have read up on the subject. The indication, therefore, is to remove the source of their dread, even though such treatment is not specifically indicated, and thus to influence and relieve the patient's mind. This done, the instructions and reassurances will be listened to. Under all conditions absolute abstinence from coitus until married should be insisted upon.

Symptomatic Impotence.—By this is meant impotence due to the prolonged use of drugs, or impotence as a symptom of lesions in the brain or spinal cord, or of some exhausting disease, acute or chronic. According to Gross, the sexual power is greatly diminished, if not absolutely destroyed, by the continued use of opium, morphine, chloral, the bromides, cannabis indica, the iodides, alcohol, and tobacco, and by the administration of, or exposure to, arsenic, antimony, lead, bisulphide of carbon, and iodine. Another authority adds conium and camphor to the above. Phthisis, diabetes, and nephritis are among the chronic exhausting diseases mentioned, while pneumonia and typhoid fever will stand as examples of the acute.

The prognosis is not good when impotence follows injuries to the brain or spinal cord.

The treatment in these cases calls for tonics, cold douches to the back, and galvanization of the spinal cord and testicles. When the result of the excessive use of drugs, the prognosis is better, as on withdrawing the cause the sexual power will return in the majority of cases.

Organic Impotence.—This is due to some congenital or acquired physical abnormality of the penis which makes intromission impossible, or to some lesion in the testicle which, by causing sterility, secondarily induces impotence. Under the former head belong the following: an unusually large size of the penis; adhesion of the penis to the scrotum; distortion of the penis from various causes—among them inflammatory thickening in the body of the penis consequent upon traumatism or upon a careless urethrotomy—gumma of the corpora cavernosa; shortness of the frenum, and a varicose condition of the dorsal vein of the penis. Under the latter heading occur congenital or acquired bilateral anorchism, progressive atrophy of the testicles, syphilitic orchitis, and new growths, as carcinoma, sarcoma, and tuberculosis affecting both testicles.

STERILITY.

Sterility is an inability to fecundate the ovum of the female because of some physiological or pathological change in the semen itself, or because of some anomaly in, or physical deformity of, the seminal tract. Classified according to the generic and fundamental causes, it presents three varieties, as follows:

Azoöspemia: absence of spermatozoa, either because none are secreted or because there is some hindrance to their escape from the testicles. Ability to copulate and to ejaculate is usually present, and may be perfectly normal as to its respective mechanisms.

Aspermia: no discharge of seminal fluid from the urethra at the time of ejaculation, either because none reaches the urethra or because some obstacle situated anterior to the orifices of the ejaculatory ducts prevents the expulsion of the fluid. Copulation and ejaculation up to that point are as in the preceding variety.

Malemission: normal seminal fluid is ejaculated and expelled, but is not lodged within the vagina, owing to some deformity of the penis.

The changes possible in the semen itself affect either the spermatozoa or the *liquor seminis*.

1. As the result of frequent coitus or of sexual abuses, such as masturbation and prolonged sexual excitement with or without gratification, the semen becomes thin and watery and the spermatozoa either diminish in number, become undeveloped and lacking in vitality, or entirely disappear. The fluid ejaculated here will be found to consist chiefly of the prostatic secretion mixed with that of Cowper's glands and the urethral follicles. This condition is temporary and physiological when consequent upon unduly frequent coitus, in the newly married, for example; under these circumstances, after a period of sexual rest, healthy spermatozoa will again be produced. It does become pathological, however, when the result of long-continued abuses which have depressed the patient's vitality and brought on some degree of impotence as well. In these cases not only are the spermatozoa themselves affected in their development, but the altered secretion of the prostate and seminal vesicles, brought about by the associated chronic inflammation of those organs, destroys what little vigor the spermatozoa may happen to have retained. Several investigators have demonstrated that in proportion as *seminal* emissions become more frequent the spermatozoa become smaller, less numerous, less vigorous, and therefore more susceptible of destruction. Finally, they are not to be found at all, or, if present, they are motionless, stunted, or otherwise deformed.

2. Of much rarer occurrence is an increased consistency in the semen, probably due to a quantitative insufficiency of the accessory secretions by which it is normally diluted. These are the secretions of the seminal vesicles, prostate, Cowper's glands, and urethral follicles respectively. In a case of this kind reported by Biegel and quoted by Gross the addition of tepid saline solution aroused the vitality in the motionless spermatozoa. The injection of a small quantity of this solution into the vagina after coitus was prescribed, and the woman subsequently became pregnant.

3. Constitutional diseases have a deteriorating effect upon the secretion of semen in proportion to the age of the patient and the chronicity of the disease. Phthisis, diseases of the nervous system, diabetes, and nephritis are the most active in this direction. Syphilis, as such, does not appear to exert much direct effect. Indirectly it may have an effect by lowering the patient's vitality, and by an orchitis it can produce decided pathological changes in the semen.

4. Age interferes with the function of the testicles, as it does with other glands and organs of the body; but, according to the investigations quoted by Gross, spermatozoa were found in one patient eighty-six years of age.

5. Pus is destructive to the life of the spermatozoa; hence its presence in the seminal fluid renders the same infertile. Prostatitis, unilateral or bilateral vesiculitis, suppurative inflammation of the vasa deferentia and of the epididymi are the usual sources of the pus. The fact that pus destroys at least the vitality of the spermatozoa is one explanation why impregnation cannot occur in endometritis, and Sims is of the opinion that "catarrh of the prostate" is as deleterious in its effect upon spermatozoa as is uterine catarrh.

6. In bloody seminal fluid (hematospermia) the spermatozoa are diminished in number, and often motionless or dead or entirely absent, depending upon the source of the blood and the length of time they have been in contact with it. Four to five hours is said to be the limit of their vitality here. When the blood is from the prostate or urethra, and therefore becomes mixed with the semen at the instant of ejaculation, little or no harm results; but the

contrary is the case when the seminal vesicles or the ampullæ are the source of the hemorrhage. Hematospermia as the result of gonorrhœal epididymitis is said to have a somewhat less effect upon the spermatozoa than when it is due to a vesiculitis. Hemorrhagic seminal fluid in appearance is rusty or dark brown or chocolate-color.

AzoöspERMIA.—This is sterility due to an absence of spermatozoa. It may be either temporary or permanent.

Etiology.—It is doubtful whether this condition occurs idiopathically. Aside from such changes in the semen and seminal fluid as give rise to the absence of spermatozoa, the following are the causes: 1. Bilateral anorchism, congenital or acquired; 2. Congenital bilateral absence of the epididymis and vas deferens; 3. Monorchism, if the testicle is the seat of destructive disease or has been permanently damaged—by traumatism, for example; 4. Bilateral cryptorchism, provided it be a case of long standing, so that atrophy has taken place, or a unilateral cryptorchism under the same conditions when the opposite testicle has, by injury or otherwise, been rendered useless; 5. Certain affections of the testicles: examples of those causing *temporary* azoöspERMIA are a large double hydrocele and a syphilitic orchitis if the treatment be begun early and is pushed vigorously, while advanced atrophy from whatever cause, new growths, extensive tubercular disease of both testicles, and occlusion of both epididymi by old fibrous thickenings consequent upon inflammation, produce *permanent* sterility. Two authorities assert that sterility can follow a *unilateral* epididymitis which has resulted in occlusion, because of the intimate reflex connection between the two testicles. If this be so, it is most fortunate that not every epididymitis results in occlusion. 6. An occlusion of both vasa deferentia by inflammatory deposits the results of gonorrhœal infection or of traumatism, or by the pressure of a tumor.

Diagnosis.—Congenital or acquired abnormalities are usually easily diagnosed. In cases of cryptorchism, repeated examinations of the seminal fluid are necessary to determine positively the question, because many of these patients are not sterile at first. Repeated examinations will be necessary also to establish the diagnosis in sterility suspected because of masturbation, sexual excess, ungratified desire, prostatitis, seminal vesiculitis, suspected obstruction of the vasa deferentia, and epididymitis (unilateral or bilateral), as in such cases the seminal fluid may undergo, from time to time, the various changes already noticed, some of which are transient only and amenable to treatment.

In normal seminal fluid a white precipitate slowly forms which constitutes from one-third to one-half the total bulk; the formation of spermatic crystals does not take place for two or three days and their number is small; but seminal fluid devoid of spermatozoa rapidly precipitates a scanty, light sediment, and crystals appear in the course of an hour. In *elderly* men the presence of spermatozoa in the semen may be inferred, according to Gross, if the ejaculated fluid has a more or less transparent grayish tint and is thick, viscid, and abundant; but if scanty and either watery or gelatinous, it is probably azoöspERMIOUS. According to Ultzmann, the following varieties of semen will be found lacking spermatozoa: 1. Watery, transparent semen, which is normal in quantity and becomes gelatinous immediately after expulsion, as does the normal secretion, but which resumes its fluid state when thoroughly cooled, and presents a whey-like appearance; 2. Colloid semen, which differs from the normal in the absence of spermatic crystals and spermatozoa only, and in that it contains quantities of epithelium which has undergone colloid degeneration, and

laminated spherical masses of various dimensions; 3. Catarrhal and purulent semen which deposits an abundant whitish or yellowish sediment on standing.

Prognosis.—In most cases this is not good. In congenital or acquired defects of the testicles, in progressive atrophy and atrophy due to varicocele, in parenchymatous inflammation, tuberculosis, and new growths either of the testicles or of the epididymi, azoöspemia, and therefore sterility, are, with few exceptions, complete and permanent. In cryptorchism (especially if unilateral) and in cases of arrested development of the testicles the prognosis should be guarded, as under the physiological stimulus which the sexual functions receive in married life a normal development may take place and the normal activity may be established. In gonorrhæal epididymitis the probability of occlusion, and hence the prognosis, would seem to depend upon the degree of inflammation as measured by the duration of the acute swelling and by the persistence of the induration afterward. The disappearance of swelling and induration is not positively indicative of a return to fertility, however; the lumen of the epididymis may remain occluded, or at least strictured nevertheless.

The prognosis is good when the affection arises from masturbation, sexual excess, ungratified desire, and epididymitis from ordinary causes, including mumps. It is good in syphilitic epididymitis and orchitis if the treatment is begun at once and is vigorously followed up.

Treatment.—To the few congenital or acquired physical abnormalities which admit of treatment the proper surgical procedures should be applied. In cryptorchism the function of the testicles may be developed if their descent is fostered by gentle traction systematically carried out during childhood. The same means may succeed in adolescents also, but scarcely later, as retained testicles usually have become fixed by the time early adult life is reached. The possibility of a late descent is to be borne in mind, however. When the azoöspemia is due to simple sexual excess or to diminished vitality following long-continued abuses, sexual hygiene should be enjoined, and is to be maintained after the functions have become restored, as there is danger of relapse. If recognized early, antisiphilitic treatment, vigorously pushed (yet not so far as to reduce the patient), will prevent azoöspemia in syphilitic orchitis. Syphilitic epididymitis yields even more readily. In these conditions a suspensory bandage should be worn until there is no longer any indication for treatment. In gonorrhæal and simple epididymitis rest in bed, support to the testicles, light diet, saline laxatives, and antiphlogistic soothing applications are indicated. For the induration remaining, the iodide of potassium, mercury, mercurial ointment, and the oleate of mercury are advised. The treatment should be persisted in, as some very obstinate cases will yield finally and spermatozoa will again develop. When the semen is too thick the injection of a small quantity of tepid alkaline solution into the vagina after coitus has been efficacious.

Aspermia.—This variety of sterility is characterized by a total failure to expel any fluid during ejaculation. It may be either temporary or permanent, and presents the following forms, as classified by Gross: organic, atonic, anæsthetic, and psychical.

Organic Aspermia.—*Etiology.*—1. Seminal fistulæ, the result of wounds or of surgical operations. The ejaculated semen follows the fistulous tracts, which may lead into the perineum or inner side of one or the other thigh. 2. *Congenital* absence, occlusion, stricture, or deviation of the seminal ducts. The conditions are rare, but have been met with. With the last-named lesion the semen is discharged into the bladder and afterward escapes with

the urine. 3. *Acquired* obliteration, stricture, or deviation of the seminal ducts or their orifices, resulting from inflammation or traumatism. One case is reported where the ducts were entirely destroyed by surrounding tubercular deposits reaching from the seminal vesicles to their point of entrance into the body of the prostate. Hypertrophy of the prostate has been found to cause a narrowing of the ducts, but in these cases semen can be forced through by making pressure upon the vesicles with the finger in the rectum. The ducts may become occluded by the products of inflammation in gonorrhœal prostatitis, or strictured secondarily by the contraction of cicatrices following abscess. Cicatrices in the deep urethra after gonorrhœa or injuries to the perineum have caused the mouths of the ducts to be directed backward toward the bladder. Vesiculitis, by producing sympexia which may plug one or both ducts, may be the cause of a temporary organic aspermia. One duct thus obstructed may occlude the other by pressure through inflammatory swelling and the accumulation of secretion behind the sympexion. Painful ejaculation is a characteristic symptom here, and sometimes the sympexia will be forced out with a feeling in the deep urethra as though a laceration had occurred. A drop or two of blood may thus become mixed with the seminal fluid which follows when the obstruction is thus removed. These sympexia are usually composed of spermatozoa, inspissated mucus, epithelial cells, and granular particles, some of which refract the light. Rarely they are hard concretions of different sizes up to that of a cherry, the organic constituents of which are found to be spermatozoa; the inorganic, phosphate and carbonate of lime. These make up some of the prostatic concretions occasionally met with. Enlargement and distortion of the *caput gallinæ* following gonorrhœal inflammation of the posterior urethra or due to chronic hyperemia from any of the usual causes may bring about aspermia by deflecting the semen into the bladder. 4. A stricture of the urethra which will yet allow urine to pass may, during erection, become so narrowed in its caliber by participation in the general engorgement as effectually to prevent the escape of semen. In such cases the semen oozes out of the urethra after erection has subsided; it can be forced out during erection by pressing along the line of the urethra with the fingers. Spasmodic stricture and spasm of the urethra from any of the usual exciting causes operate in the same way. 5. Inflammatory thickenings and cicatricial indurations in one or both corpora cavernosa are sometimes causes of aspermia. They produce curvatures of the penis, and thus bendings or twistings of the urethra which prevent the expulsion of the seminal fluid. The gouty diathesis appears as a frequent cause of these formations, second to which is injury during coitus, then gonorrhœal inflammation, and lastly violent erection. 6. A final cause of organic aspermia is marked phimosis, by which the seminal fluid is retained in a bag-like prepuce.

Atonic Aspermia.—This condition is dependent upon lack of expulsive power in the ejaculatory apparatus—the ampullæ, the seminal vesicles, and the muscles, which, by contracting, exert pressure upon these organs to aid them in discharging their contents, the ejaculatory ducts, the prostate, and the urethra.

Etiology.—The primary cause would seem to be an absence of reflex excitability in the center for ejaculation, from the fact that this form of sterility occurs most commonly in those who have been confirmed masturbators, or who have over-indulged in sexual intercourse, or who have subjected themselves to sexual excitement without gratification. As may be expected from a consideration of the causes, chronic inflammation with its

associated hyperesthesia of the prostatic urethra usually will be found upon instrumental exploration.

Symptoms.—No ejaculation during coitus nor at any time when the patient is awake characterizes this variety of aspermia. In consequence, there is no climax to the sexual act; the patient desists from simple exhaustion. Nocturnal emissions do occur occasionally, accompanied by the usual pleasurable sensations and lascivious dreams. The general symptoms, when present, are those of neurasthenia.

Anesthetic Aspermia.—This form is rarer than the preceding. It is due to failure of the sensory nerves in the reflex arc to respond to stimulation; hence coitus, and equally so masturbation, do not end in ejaculation. Nocturnal emissions, however, because not dependent upon stimulation of the peripheral nerves, may occur at the regular intervals.

Etiology.—As causes there have been enumerated injuries of the spinal cord, old syphilitic lesions and wounds of the penis, which in healing have replaced the normal skin with cicatricial tissue; inflammatory deposits in the corpus spongiosum, which, by preventing the glans from becoming turgid during erection, deprive it of the extra sensibility it has in that condition, and obtunded sensibility of the prostatic urethra, which some authorities regard as the seat of the voluptuous sensations experienced during coitus. Congenital absence of the prepuce was noted in one case recorded.

Psychical Aspermia.—This is relative or temporary only, and is dependent upon the ability some men have of inhibiting ejaculation, and upon the effect mental perturbation of various kinds has in preventing ejaculation in the same way that it does erection, thus giving rise to sterility.

Diagnosis.—To determine the particular form of aspermia under consideration the history of the case should be considered, and a thorough examination of the external and internal organs of generation should be instituted, together with repeated examinations of the urine.

Prognosis.—When the affection is due to obstruction of the ejaculatory ducts by sympexia, or when either stricture of the urethra or phimosis is the cause, the prognosis is good. It is equally so in atonic aspermia dependent upon hyperesthesia of the prostatic urethra, but a guarded prognosis should be given where this does not exist and when the aspermia is of the anesthetic form. The psychical form usually yields readily to treatment.

Treatment.—In the organic cases any surgical procedure which offers a chance of relief should be undertaken. In the atonic the usual measures should be used to subdue the hyperesthesia of the prostatic urethra, after which an effort should be made to restore the lost tone of the muscles. In these cases the treatment is essentially that of atonic impotence. In those cases where no hyperesthesia is present merely a tonic course without any local treatment is indicated. For anesthetic aspermia the use of the faradic brush over the penis, the anode being applied to the spine, is recommended. Should this measure fail, the glans may be blistered with some prospect of success. Psychical aspermia calls for no particular material treatment.

Malemission.—This term is used to designate a faulty deposition of the ejaculated semen. Some malformation of the penis, either congenital or acquired, is generally the cause. The commonest are hypospadias, epispadias, and fistulæ of the urethra the result of injury, abscess, or stricture, especially when the opening is situated so far back that the walls of the vagina during coitus cannot supply the deficiency. In exceptional instances the vaginal walls have done this and enabled the semen to reach its proper destination.

Plastic operations give some prospect of relief, but the *prognosis* is not good.

Less frequent are malpositions of the meatus, due to congenital or acquired shortening of the frenum. In these cases the semen is ejaculated backward and downward or to one or the other side. Division of the frenum is here indicated. Rarely the meatus opens on one side of the glans, or the penis is so rotated as to give the meatus such a position. Depending upon the case, operation may or may not correct this deformity.

PROSTATORRHEA.

Definition.—Prostatorrhea is characterized by an excess of prostatic secretion, and its discharge from the gland, either continuously or intermittently, at other times than during ejaculation. The quantity varies from a few drops in the course of a day to a dram or more. Under certain conditions the secretion will escape from the urethra continuously or intermittently; but usually it flows backward into the bladder and is voided with the urine.

Occurrence and Etiology.—Prostatorrhea is rarely an isolated condition. It exists more frequently as one of the common symptoms of subacute and chronic prostatitis (passive congestion). It usually occurs in young and middle-aged men, in the married as well as the unmarried; more frequently in the latter, as normal, physiological sexual intercourse (sexual hygiene) is both a prophylactic and in many cases a curative measure. The anemic and neurotic seem particularly predisposed, and in this category two observers have included any subject of depressed vitality, weak tissues, and poor reparative power. The gouty and rheumatic, because of their predisposition to pelvic and, therefore, prostatic hyperemia, seem especially susceptible to the effect of such causes as masturbation, sexual excess, and intemperance in eating and drinking. Prostatorrhea often figures as a prominent symptom in one or more of the forms of impotence, because the cause and pathological conditions underlying both so closely correspond. On the other hand, the prostatic fluid escaping at the meatus has often been mistaken for semen, especially when it occurs with failing erections and premature ejaculation, or with complete impotence, or with sterility, and has led to an erroneous diagnosis of spermatorrhea. Thus the false impression has arisen that cases of true spermatorrhea are of frequent occurrence.

Anything leading to repeated or persistent hyperemia of the prostate, and so, finally, to a chronic prostatitis, may eventuate as a cause of prostatorrhea. An acute inflammation of the prostate may or may not have pre-existed, nor is it a necessary precedent. Mere passive congestion is sufficient as a starting-point. Chronic posterior urethritis, diseases of the bladder, especially those accompanied by frequent urination, whereby the prostate and prostatic urethra are called upon to functionate very frequently, and stricture of the urethra, are prominent among the causes. Prostatic hyperemia is usually an accompaniment of stricture of small caliber, but stricture of large caliber, even of the penile urethra, may excite this condition reflexly, though there be no appreciable obstruction to the outflow of the urine. Rectal diseases, both irritative and inflammatory, but especially such chronic affections as polypi, stricture, and tumor, by their reflex effects, and hemorrhoids by obstructing the venous circulation, are frequent causes of passive congestion of the prostate. Excessive horseback riding and cycling with a poorly-adjusted saddle, persistent use of drastic cathartics, intemperance in eating

and drinking, and sedentary habits act by determining blood to the pelvic organs. One authority asserts, however, that in his opinion, with the exception of chronic posterior urethritis, rectal diseases, and stricture of the urethra, the above are contributing causes only, and do not take effect unless there be a chronic inflammation of the prostatic urethra already existing as the primary cause. Blows upon the perineum and wounds of the prostate are among the rarer causes.

A number of cases have their origin in abuses of the sexual function, as all forms of sexual excitement, whether normally or abnormally induced, produce physiological hyperemia in the prostate, which, if made to occur too frequently, becomes pathological and results in chronic hyperemia and prostatitis. Foremost among these abuses would seem to be frequent, prolonged sexual excitement without gratification. According to Bangs and Lydston, this is a prolific source of prostatic hyperemia and prostatitis, so much so that they are convinced that it figures as an important element in the etiology of prostatic hypertrophy later on in life. Such excitement without gratification may be either mentally or physically brought about. Erotic thoughts furnish an example of the former means; a man physically continent may yet be so given to letting his mind dwell upon sexual matters that he keeps his sexual organs in a constant state of erethism, keeping the penis in a condition of partial, occasionally complete erection for an hour or more at a time, and the prostate in a corresponding degree of engorgement. The physical means by which excitement without gratification is produced is dallying or toying with women. It operates in precisely the same way: coitus not being had, the prostatic engorgement is not followed by a physiological emptying of the blood-vessels, which takes place when the laws of sexual hygiene are observed, and gradually a chronic engorgement is established.

In this category belongs also a form of sexual onanism known as withdrawal or "pulling out." It is practised by the husband just before ejaculation takes place, the object being to prevent conception. The sexual act is therefore not only never completed, but is never harmonious; the excitement does not fully subside because the circulation does not return to its normal equilibrium, as it otherwise would. The persistent excitement leads to frequent repetitions of the act in the effort to get relief, which only aggravates the trouble, and chronic hyperemia, later chronic prostatitis, are the results. This form of venereal excess more quickly effects the damage of the prostate than does excessive intercourse normally practised, either in married life or out of it, though this also is a well-recognized cause of prostatic trouble.

Masturbation, because it can so easily and therefore so frequently be indulged in, is as prominent and as direct a cause here as in impotence. When practised irregularly or with moderate frequency during the first two or three years of puberty it cannot be said to leave behind any permanent damage; but when persisted in during the developmental period, its effect is, if not directly, at least remotely, responsible for later pathological changes in the prostate. Similarly, excessive sexual intercourse, in unmarried life as well as out of it, and the age at which it was entered upon, are causative factors always to be thought of in a case of prostaticorrhea.

Symptoms.—The patient sometimes complains first of a constant, more frequently of an intermittent escape from the urethra of a thin, watery, more or less milky fluid, accompanied by an unpleasant feeling of wetness in the canal, or by a dripping sensation, or by a peculiar tickling in the region of the prostate or along the urethra, or by voluptuous and lascivious sensations. The above are more marked the greater the quantity of the escaping fluid,

and, depending upon the same and the degree of relaxation in the sphincter vesicæ, there may be merely a gluing together of the lips of the meatus or a continuous annoying dripping which keeps the linen more or less wet constantly. When continuous the flow is temporarily increased in quantity by any causes which bring pressure to bear upon the prostate; among which straining at stool, the pressure of a fecal mass, the muscular effort made in expelling the last drops of urine, horseback riding, and cycling with a poorly-adjusted saddle are the most common, while sneezing, coughing, and laughing less frequently effect the same result. The intermittent prostaticorrhea is regularly induced by these causes and any others which produce the necessary pressure. Here should be repeated those causes, given above, which directly excite the genital apparatus. Their second immediate effect is to produce a discharge or "leaking from the urethra," or to increase the quantity of the discharge in those cases in which the flow is constant. But under the operation of these causes the temporary discharge or the momentary increase in the quantity of that already existing is seldom due to true prostatic fluid, but to mucus from the urethral follicles and Cowper's glands. Any excess of *prostatic* discharge thus excited runs back into the bladder and is washed out by the urine, unless there be the pathological relaxation of the sphincter vesicæ.

The second group of symptoms which the patient speaks of are those connected with the sexual feelings. These are erotic sensations, sensations of impending orgasm, a tendency to frequent erection, especially when asleep, and frequent, sometimes painful, nocturnal emissions. Ejaculation sometimes is painful, and there may be a sense of discomfort after sexual intercourse. In other cases coitus is beneficial: this points to simple hyperemia of the prostate. Sexual desire may be exaggerated or diminished or wanting. Some form of impotence usually exists, with premature ejaculation, the erection being vigorous or feeble. On the other hand, there may be complete absence of erection. There may be sterility, due either to occlusion of the ducts, the result of inflammation, or to pathological changes in the prostatic fluid which either kill the spermatozoa or prevent their normal power of propulsion. Rust-colored semen is one of the rare symptoms: the color is due to the presence of blood. Its occurrence indicates the existence of a complicating chronic seminal vesiculitis.

The remaining symptoms are those which may be found in nearly every case of chronic prostatitis. Chief among them is frequency of urination, which may vary from twice the normal up to a very marked frequency; occasionally there is urgency. Sometimes the stream is small or feeble; at others it is lame or hesitating. There may be an uneasy feeling after urination or a sensation of burning or scalding along the whole urethra; sometimes a drop or two of blood follows the stream. This is due to an extreme degree of inflammation in the mucous membrane of the posterior urethra. The burning along the urethra may be persistent and accompanied by abnormal sensations referred to the perineum. These are variously described as an uneasiness, a feeling of heat and fulness, a dull aching or actual pain, especially after exercise, by some described as a neuralgic pain shooting into one or the other testicle. A similar dull aching or sense of weight is often referred also to the root of the penis, to the suprapubic region, the groins, testicles, thighs, anus, rectum, and lumbo-sacral region. If the prostate be much engorged, the patient may complain of frequent desire to defecate. This is especially noticeable after exercise. Often, however, there is constipation.

One or more of the usual symptoms referable to the nervous system in

cases of prostatitis are almost invariably present. In some these are so slight as to scarcely require attention; in others they assume a severe form of neurasthenia. Often they amount to melancholia, either because of the intimate relation between the nervous system and the prostate as an important part of the genital apparatus and the constant irritation of the nervous system by the chronically inflamed gland, or because of the psychical effect produced by one or more of the symptoms of impotence and the loss of a fluid which, mistaken by the patient for semen, leads him to think he is going on to sterility. Especially is this true in neurotic and anemic subjects. Impaired appetite, loss of flesh and strength, irritability of temper, and indisposition to mental exertion are among the lighter of the nervous symptoms. Incapacity for mental application, moroseness, and despondency are among the graver ones.

Diagnosis.—The history of the case is, of itself, often sufficient to establish the diagnosis without any difficulty, but as a routine practice the voided urine should be studied, the fluid should be examined under the microscope, the urethra should be explored, and the condition of the prostate ascertained by digital rectal examination. A cystitis having first been excluded, the patient should then pass his urine in three portions. If prostaticorrhea exist, the first will be found to be slightly milky or cloudy, having washed out the secretion lodged in the prostatic urethra. The second, therefore, will be quite clear or nearly so. The third will be clear also in the mild cases, but in marked cases it will be cloudy or opalescent, the muscular contraction at the end of urination having squeezed the prostatic follicles empty of their contents. When the prostaticorrhea is intermittent one means of obtaining the fluid is to let the patient carry a small bottle and catch in it whatever appears at the meatus after straining at stool. Another is to massage the prostate, as advocated by Von Schlen and quoted by Taylor. The patient, with his bladder full, partly empty, or entirely so, should stand with the feet separated and the trunk bent forward at right angles with the lower extremities. (An angle of 45° will in some patients make the prostate more accessible.) The surgeon now introduces the index finger into the rectum and feels the prostate. The massage is best done by making a rotary motion with the end of the finger, first over one lateral lobe and then over the other, finishing the manipulation by pressing along the median line from the posterior border of the prostate to its apex. The amount of pressure must be regulated by the sensibility of the gland; hence the finger is preferable to any instrument devised for this purpose. The gland is often so peculiarly sensitive that at first the gentlest pressure causes extreme suffering and sometimes induces syncope. In many cases the prostatic fluid will drip away from the meatus during the massaging. If not, it can be washed out by having the patient pass the urine he has retained in the bladder for the purpose, or by having him wait a few moments, when enough urine will have collected to flush out the urethra when voided.

The fluid thus obtained from a case of uncomplicated prostaticorrhea presents under the microscope, mucus, amyloid bodies having concentric strata, cylindrical epithelial cells, and innumerable colorless refracting granules of lecithin (Gross) about half the size of red blood-globules. Allowed to dry on the slide, the spermatid crystals of Böttcher are formed. Taylor quotes Fürbringer as saying that these crystals can be developed in a couple of hours by adding to the fluid under examination a drop of a 1 per cent. solution of the acid phosphate of ammonia. By some observers these crystals are regarded as composed of phosphate of magnesium, by others as ammonio-

magnesium phosphate (triple phosphate). The above characteristics serve to distinguish true prostatic fluid from other urethral discharges. Provided sterility does not exist the presence of *seminal* fluid is excluded by the absence of spermatozoa. As a result of strong sexual excitement or of pressure upon the distended ampullæ and seminal vesicles—when straining at stool, for example—a little semen may be forced into the prostatic urethra if the mouths of the ejaculatory ducts are relaxed or patulous, and thus some spermatozoa may appear in the prostatic fluid; but this is comparatively rare. The accidental discovery of such an occurrence has led to a false diagnosis of spermatorrhea, to avoid which error repeated microscopical examinations should be made at intervals. In the majority of cases, however, the fluid will not be as simple as described above. A chronic posterior urethritis is usually present also, and the microscope will reveal the elements of the same.

At the same time that the massaging is being done the condition of the prostate can be ascertained. Usually it is found enlarged, sometimes to a considerable degree even in young subjects; but it is possible to have a marked hyperemia of the gland with but little if any appreciable increase in size. The former condition points to follicular prostatitis, the latter to a parenchymatous form. In both there is more or less tenderness on pressure, sometimes to a very marked degree. With follicular prostatitis there is likely to be some thickening and tenderness of the seminal vesicles and vasa deferentia (Lydston), all consequent upon infection. This form, therefore, is more commonly found in younger men, while the parenchymatous occurs in older subjects of gouty and rheumatic diathesis, in whom intemperance in eating and drinking and excessive venery are apt to be the prominent causative factors as opposed to gonorrheal infection. Pressure along the median line over the course of the prostatic urethra will invariably elicit tenderness, even if the lateral lobes are but very slightly tender.

If, now, a moderate sized *bougie-à-boule* be gently passed through the urethra, a hypersensitive condition of the mucous membrane will be found everywhere, but especially in the deep urethra. When the instrument has been withdrawn some of the prostatic fluid will often be seen adhering to the shoulder of the bulb, and, if the hyperemia of the mucous membrane be marked to any degree, some blood will follow. At a subsequent visit the urethra should be examined for strictures, and by means of the endoscope for polypi, granular patches, and other possible lesions.

Prognosis.—This is better the earlier the treatment is begun and the less the mental disturbance. Under the best of conditions, however, progress is slow. The case is difficult to manage if the patient has become hypochondriacal.

Treatment.—Broadly, the treatment for prostaticorrhea is the same as that for chronic prostatitis and impotence. It is given in detail under the latter head. It includes both local and general measures, the patient's general health being kept continually in mind. The first step is to remove any contributing causes of the prostatitis, such as phimosis, narrow meatus, stricture, cystitis, hemorrhoids, and fissure of the anus. The next indication is to cure the chronic urethritis if one exists, and the prostatitis. The means to the former are the use of the cold sound, allowed to remain in the urethra a little longer at each sitting, and instillations of nitrate-of-silver solutions or applications of stronger solutions (10 grains to the ounce) by means of cotton swabs through the endoscope. The means to the latter are the same with digital massage of the prostate added. Any one of these means should not be

repeated oftener than once in five days. Warm hip-baths twice daily and blisters to the perineum are advised by Gross.

If the discharge still persists after all signs of irritability have been removed by such a course of treatment, it points to a dilatation of the mouths of the prostatic follicles. Here Gross uses still stronger solutions of nitrate of silver for instillation or application to the prostatic urethra (not over 20 grains to the ounce are advised), blisters to the perineum, cold sitz-baths in place of warm, and atropine and ergot. Winternitz advises the urethral psychrophore for this condition, while Uitzmann recommends the induced current, one pole in the rectum.

As to the general measures: all vicious habits and unnatural practices must cease. Even sexual intercourse at normal intervals must be forbidden if it aggravates the symptoms. It should be allowed if the patient is married and experiences a sense of relief after the act. Alcohol, tobacco, and coffee should be abstained from. The diet should be simple and unstimulating. The bowels should be so regulated as to avoid straining at stool. Any exercise tending to prostatic congestion—as, for example, riding horseback, cycling, carriage riding over rough pavements, and too much walking—should be prohibited.

In the way of drugs, bromide of potassium with atropine is advised. If there be frequency of urination, drugs to make the urine about neutral are indicated. The patient's general health should never be lost sight of, and a tonic course of treatment should be observed if necessary.

SPERMATORRHEA.

Analogously to prostatorrhœa, the term "spermatorrhœa" has been used to denote any excessive or pathological escape or discharge of semen; but recent writers have restricted its application to the condition implied in its literal interpretation—a condition so rare that some authorities would discard the term altogether. The term seems to have become fixed by repeated errors in diagnosis; other conditions having been mistaken for it, an erroneous impression as to the frequency of the literal condition became established.

The subjects of this so-called "spermatorrhœa" are almost invariably hypochondriacs—patients who, having developed some derangement of the sexual function as the result of masturbation, ungratified sexual desire, dallying with women, and sexual excess, notice and magnify the symptoms, and through ignorance regard physiological manifestations as evidences that they are losing their "manhood."

The concomitant mental distress produces disturbances of the digestive organs, headache, vague muscular pains, aching in the limbs, pain in the back, general debility, and kindred symptoms of a neurasthenic type. The few drops of clear mucus which appear at the meatus during erection of the penis and immediately after it, especially if the urethra is the seat of chronic hyperemia, are regarded by these afflicted men as an escape of semen. The muco-purulent drop so characteristic of the last stage of chronic urethritis; the fluffy shreds found in the urine with this lesion; amorphous phosphates, because of their "milky-white" appearance; amorphous urates, because of the "thick" appearance they give to the urine; and even the normal flocculent cloud of mucus precipitated in urine which has stood awhile,—are credited by the overwrought imagination with being semen. The presence of pus in the urine is less likely to occasion this suspicion of seminal loss,

inasmuch as pyuria is accompanied by unmistakable symptoms referable to the possible source. Chyle and cystine in the urine are two occurrences which, if frequent, would certainly be prominent among the misleading conditions. Prostatorrhœa is the most fruitful source of error, the opalescent fluid which appears at the meatus after straining at stool, for example, having a close resemblance to semen. Especially is it deceptive when the microscope reveals the presence of spermatozoa. This is a rare occurrence, however, and is explained by the knowledge that under certain conditions—notably over-distention of the seminal vesicles and ampullæ and a patulous state of the orifices of the ejaculatory ducts—a few spermatozoa in a little seminal fluid may be squeezed out into the prostatic urethra by pressure on the vesicles, and thus be made to appear at the meatus or in the urine subsequently voided. Hence the necessity of repeated examinations of the urine before making a diagnosis of "spermatorrhœa." Such a forcing out of the contents of the vesicles and ampullæ may take place equally well without coexisting prostatorrhœa. It may follow some unusual sexual excitement. It may also occur just at the end of the act of micturition. Spermatozoa may be found also in the urine passed next after coitus or after nocturnal emissions, the stream having washed out whatever semen remained in the urethra.

True spermatorrhœa—also called seminal incontinence and spermorrhagia by Gross, who firmly believes in its existence—is, like prostatorrhœa, not a distinct disease, but one of many symptoms of certain general and local affections. It is defined as a passive escape of semen, oftentimes without the knowledge of the individual. Gross speaks of it as a neurosis. The general affection would seem to be a functional derangement indicated by increased susceptibility and diminished tone of the cerebral and spinal genital centers. Not only do they respond to very slight and unusual stimuli, but they respond prematurely as well. The local affection is an hyperæsthetic condition of the peripheral nerves, especially those of the prostatic mucous membrane.

The etiological factors and local exciting causes would appear to be identical with those of prostatorrhœa and impotence. The urethral lesion also is the same, but to a greater degree, having progressed to dilatation of the ejaculatory ducts, thereby rendering the escape of fluid from the vesicles an easy matter.

The **diagnosis** can be made positive only by the aid of the microscope.

The **prognosis** may be stated as in prostatorrhœa and impotence.

The **treatment** is practically identical with that of those analogous conditions. It includes local and general measures; sedative measures first, and tonic second being strongly urged. Galvanism is advocated by some authorities; should it fail, faradism may be tried.

Diurnal Emissions.—These may justly be regarded as a tangible form of seminal incontinence. They are invariably pathological, occurring as they do when the patient is awake and as the effect of very slight peripheral excitation or in response to a psychical impulse set free, for example, by lascivious thoughts, indecent pictures, perhaps merely the sight of a woman.

Nocturnal Emissions.—From puberty on, every healthy man, when continent, should have, at intervals which will depend upon his temperament, vigor, environment, and habits, involuntary emissions of seminal fluid during sleep, accompanied by erotic dreams, complete erection, and the characteristic pleasurable sensations. Authorities agree in saying that these may occur as often as once in ten days without being detrimental to the patient; but when they occur more frequently, with a partial erection or none and with little or

no sensation, they are symptoms of some pathological condition which requires treatment. In the more aggravated cases the patients are totally unconscious of their occurrence, the stain on the linen being the only evidence.

Broadly speaking, the effect upon the patient is the surest indication as to whether the frequency of the nocturnal emission in his case is normal or not. If followed by an agreeable sensation of gratification and quietude, the frequency may be regarded as normal; but if such symptoms as languor, headache, backache, mental apathy, and the like supervene, the frequency, even though not great, may be regarded as excessive. In estimating the value of these symptoms, however, we should take account of the patient's previous habits and the probability that from brooding over them he has become morbid and hypochondriacal.

Pathologically, frequent nocturnal emissions are very apt to be found in those who in childhood suffered from nocturnal enuresis, in patients of lowered vital resistance and nerve-exhaustion from whatever cause—in the anemic and neurotic. They occur as symptoms of certain spinal and cerebral lesions, and often in consequence of hyperesthesia of the prostatic urethra brought about by masturbation practised for a number of years, or some other form of abuse or excess, sometimes with impotence or prostaticorrhea or both as associated conditions. Frequent nocturnal emissions often occur with sterility, but the emitted fluid is of course deficient in spermatozoa or entirely without them, and sometimes consists solely of the secretion of the prostate and of the urethral follicles.

In general, therefore, in the majority of cases met with, *frequent* nocturnal emissions are to be referred to the same etiological factors as are impotence and prostaticorrhea, and the prognosis and details of treatment, as given under those headings, all find their application here also. In addition to carrying out the local and general measures there set down, the patient should be reassured and instructed as to the nature and significance of nocturnal emissions. He should be told that they are a sign of the proper functional activity of the genital apparatus. Provided the physician fails to discover the usual symptoms of over-frequency, the patient should be told that their frequency is not abnormal in his case. He should not be led to practise illicit intercourse for their relief, but should be encouraged to remain continent until he can marry. The highest authorities concur in the opinion that sexual intercourse in the unmarried is not a physical necessity, and that absolute continence is perfectly compatible with perfect health.

ACQUIRED SYPHILIS.

BY JAMES S. HOWE, M. D.

SYPHILIS is an infectious disease affecting the entire human economy, and may be acquired either by direct or mediate contagion or by inheritance. It is chronic in its course, and may invade every organ and tissue of the body. While displaying its characteristic symptoms in a somewhat definite order, the latter may, at times, show marked changes, while the specific symptoms themselves may appear in one or several organs and tissues at the same time. It belongs, with leprosy, tuberculosis, glanders, and mycosis fungoides, to a class of diseases known as chronic infectious granulomata. These diseases have many points in common, being similar in their pathological anatomy, all being inoculable, and each of them, in all probability, being caused by micro-organisms. That syphilis is caused by some special virus or morbid secretion which gains access to the system is an undisputed fact, but what this virus actually is has not yet been definitely ascertained. The specific virus having gained access to the system so far as any local or constitutional evidences can be made out, it shows for a time no manifestations of its presence. From the moment, however, that the virus has effected its entrance it may be confidently asserted that the patient has syphilis.

What minute pathological changes are taking place, either at the point of entry or in the system at large, are at present unknown; but that such changes are taking place will be evidenced later by the appearance at the point of infection of a papule or sore which is characterized by induration and an adenopathy of the lymphatic glands in direct communication with this indurated sore. The period of time which elapses between the date of infection and the appearance of the initial lesion is known as the first period of incubation. This first period of incubation ends with the appearance of a primary lesion, and is followed by a second period of incubation, lasting from the appearance of the initial lesion to the first outbreak of cutaneous manifestations. Authorities differ as to whether syphilis is a purely local or constitutional disease at the time of the appearance of the initial lesion, but the consensus of opinion seems to be in favor of its being already a constitutional affection, extirpation of the initial lesion, and even of the indurated glands connected with it, being followed, with perhaps rare exceptions, by evidences of general systemic poison. The author believes that a general infection has taken place very soon after the poison has entered the system.

Experiments with bacilli of various infectious diseases has proved that the presence of these bacilli at some point in the living tissue for only a few hours at the most is sufficient, even though the point of inoculation be destroyed or totally extirpated, to cause profound systemic infection. If this be the case, why, then, should we suppose that a person has escaped general infection from the syphilitic virus merely because the virus lies quiescent for a while as regards symptoms which we can observe, or because its first mani-

festation is at one particular point, and that the point of entry? It seems fair to assume—as, indeed, is shown by the whole process of syphilitic infection—that the germinative process, as we would call it, of the specific virus is a very slow and gradual one, but one which takes place, nevertheless, steadily and surely. That this process has been going on from the very beginning is manifest from the appearance of the initial lesion and the adenopathy which accompanies it, and, though for a while no other symptoms of constitutional infection appear, such infection has surely taken place, and further proofs of it will soon follow. These proofs appear, as a rule, toward the end of the second period of incubation, and consist of malaise, anemia, loss of appetite, rheumatoid pains in the muscles, bones, and joints, cephalalgia, synovial effusions, a general adenopathy of the lymphatic glands, febrile disturbances, and other varying symptoms which point unmistakably to general systemic intoxication. The late Ricord, in considering the evolution of syphilis, divided it into three stages, which he called the primary, the secondary, and the tertiary. The primary stage embraced the two incubation periods mentioned above, and lasted from the moment of infection to the outbreak of the first cutaneous lesions. The secondary period lasted for about a year, during which time we might expect various skin and constitutional manifestations, the skin lesions being superficial in character. The tertiary stage followed, and was marked by the involvement of the deeper tissues and structures as well as of the viscera. If syphilis pursued this course in the regular manner, we should have no difficulty in ascribing every manifestation of the disease to a particular period; but clinical experience and observation teach us that such is not the case. If it were so, we might expect a regular course in the manifestations of the disease. Thus we should expect macules, and after them papules, and in course of time pustules, tubercles, gummata, ulcers, and a successive involvement of all the organs and viscera of the body. Such a course, happily for the patient, rarely takes place. Indeed, the accidents of tertiariism are of uncommon occurrence now-a-days, provided the patient is naturally healthy and has proper treatment. On the other hand, lesions which under Ricord's classification properly belong to the tertiary period are not uncommonly found during his so-called secondary period. Taylor, in speaking of the chronological arrangement of the manifestations of syphilis, says: "While it is often impossible to draw sharp lines of difference between the secondary and the tertiary stage, we can hold fast in most cases to the following course in our clinical studies and in regulating our therapeutics—namely: To consider superficial lesions of the skin and mucous membranes, and various systemic symptoms and conditions known to be of early development, as evidences of the secondary period and claiming appropriate treatment; and to look upon deep-seated lesions of the connective tissues and those of bones and viscera as belonging to the tertiary period, and requiring treatment for advanced stages." From the foregoing it will be seen that the primary period is constant and regular as regards its appearances and symptoms, but with the first cutaneous outbreak and from the beginning of the secondary period the manifestations, both as regards regularity of appearance and chronological arrangement, may be of a most varying type. The course of the disease from this time, in the average case and under proper treatment, is usually mild, marked by erythematous and papular rashes and mucous patches, with slight constitutional disturbances, and ending, in a period of time varying from six to eighteen months, in a total disappearance of all symptoms, the patient finally dying, having lived the course of his natural life without any further signs of the disease. On the other

hand, evidences of profound trouble may appear from the very first, and marked symptoms of systemic poisoning may follow each other in rapid succession, involving the deeper tissues and organs of the body, producing cachexia, loss and destruction of tissue, with much disfigurement, and even endangering the life of the sufferer. Again, some cases may be so mild as to pass away with symptoms of the most transitory character, and between these extremes all types of the disease may be encountered. Unfortunately, we cannot predict, from the appearance of the initial lesion, the gravity of the symptoms which follow, a sore of the simplest form being followed at times by a grave type of the disease; while, *per contra*, a lesion formidable in appearance may be followed by symptoms of a very transitory character. Again, a person with malignant syphilis, having transferred the disease to another, the symptoms which follow such inoculation may be of a very mild type; while, on the other hand, a light case of the disease, transferred to another, may produce symptoms of the most severe character. It thus appears that the condition of the individual affected is largely responsible for the type of the disease which follows. It is hence among the low and depraved and those suffering from want and privation, as well as from alcoholism and various constitutional diseases, that the worst ravages of syphilis are observed. Young adults of both sexes, with good constitutions and proper treatment, rarely suffer from the severe accidents of the disease, while the very aged and very young commonly suffer more severely.

Etiology.—That syphilis is caused by a specific virus has been universally conceded. Of late years, since such important work has been done in bacteriology, the theory that syphilis is caused by some definite micro-organism has been pretty generally accepted by those whose clinical experience has made them the most competent judges in regard to the matter. When we consider the various and widely differing symptoms that are caused in diseases of known bacterial origin by the microbes and their toxins, it seems only reasonable to suppose that the profound systemic poisoning of syphilis is likewise caused by some special microbe. Several observers in the past have claimed to have found and differentiated the specific microbe of syphilis; and, although by different methods of staining certain micro-organisms have been found in limited numbers in syphilitic lesions, their appearance has been so variable and their constant presence so uncertain that no definite results have been obtained. Then, again, these micro-organisms have not borne the test of culture and subsequent inoculation; but when we consider that animals cannot be inoculated with syphilis, we can readily see what an obstacle stands in the way of the experimenter. In the future, however, when the science of bacteriology has been further developed, and better and more accurate methods of staining have been discovered, the author firmly believes that we shall discover a definite microbe as the cause of syphilis. In the infective diseases caused by definite microbes we see local symptoms produced by the microbes and systemic disturbances caused by the toxins resulting from the presence in the tissues and blood of the microbes themselves. Now, in syphilis it seems not beyond the range of probability to assume that the initial lesion is caused by some specific microbe, and that the symptoms following this initial lesion, such as anemia, debility, fever, headache, pains in the muscles and joints, together with erythematous rashes and lymphatic involvement, are a direct result of an invasion of the blood by the toxins of this microbe.

Sources of Syphilitic Contagion.—What element or elements are bearers of the syphilitic virus properly demands our attention at this point.

It is a generally recognized and undisputed fact that the secretions from the initial lesion itself are directly responsible for by far the largest number of cases of syphilis; and while these secretions are not perhaps more contagious than some others, still, they are most commonly the exciting cause of syphilitic infection, inasmuch as exposure to infection from this source is more common than from any other. Although not so common as a source of contagion, the secretions from the secondary lesion known as the mucous patches and condylomata lata are quite as active, as infecting agents, as the secretion of the initial lesion itself. Indeed, many observers claim that condylomata lata afford by far the largest number of cases of syphilitic infection where the disease is acquired by males in sexual intercourse. The secretions from the papules and tubercules and ulcerations of the earlier stages of syphilis are also contagious, and particularly so if uninfluenced by treatment. The blood itself is also a vehicle of contagion in the early stages of the disease, although far less so than either of the above. It becomes, however, much less virulent as a source of contagion during active mercurial treatment and during the so-called periods of latent syphilis; while its danger as an infecting agent grows less and less with time, so that it has probably lost its power to produce syphilitic infection in two or three years, provided active treatment has been pursued during this interval. The physiological secretions, such as the tears, milk, saliva, urine, and semen, unless contaminated by syphilitic secretions, do not produce syphilis even when inoculated upon a healthy subject. The milk of a syphilitic woman has been claimed as the source of syphilis in several cases; but it is extremely doubtful if this can be proven; yet the fact that some observers have claimed this to be the case should never be lost sight of. The saliva itself is innocuous, but, since it can be, and so often is, contaminated by the secretion of mucous patches of the buccal cavity and throat, it may become a very dangerous source of contagion. The semen, too, although *per se* not a source of contagion, may still, according to many authorities, infect the offspring of a father who begets a child while in the active stage of the disease. The so-called cases of syphilitic infection from vaccination with crusts or lymph taken from a syphilitic child are not due to the lymph or crusts themselves containing the virus, but to an admixture of blood or other syphilitic secretion with them.

Modes of Contagion.—As has been previously stated, syphilis is acquired by direct or mediate contact or by inheritance. Syphilis acquired by inheritance will be properly treated in another section, so we have here only to consider contagion by direct or mediate contact. By far the largest number of cases of syphilis are acquired during the act of sexual intercourse. That inoculation may take place there must be a solution of continuity in the epithelial covering in order that the virus may gain access to the system, and at the point or points where such entrance occurs we shall invariably find the initial lesion of the disease. The delicate character of the mucous membrane of the genitalia, the abrasions which so commonly occur during coitus, and the not uncommon presence of herpes, eczema, and other diseased conditions of the parts, favor, in a large measure, the absorption of the syphilitic virus. Perversion of the sexual act has likewise been responsible for many cases of syphilis, the initial lesion appearing on or about the anus, in the rectum, the axillæ, the folds of the breast, the mouth, and the tonsils. Kissing is a prolific source of syphilitic contagion, by far the largest number of chancres of the mouth, tongue, and lips being traceable to this cause. Accidental inoculation has frequently occurred from the wounds produced by bites, as well as from those received in street-fights. The surgeon and

medical student not infrequently acquire chancres of the hand or finger from operations upon syphilitic patients, from autopsies, and from the examination of syphilitic lesions. The obstetrician and midwife are sometimes infected in the practice of their calling, the chancres being usually on the fore finger, and often upon the side of the nail. The infected finger may thus become the source of additional cases of syphilis, several small epidemics of the disease having thus been traced to the carelessness of the midwife. Chancres and condylomata lata of the breast and nipples have many times infected the nursing infant, while the child itself, having mucous patches of the mouth, has oftentimes conveyed the disease to its nurse, the initial lesion appearing upon the nipple or breast. Syphilis when acquired by mediate contact is the result of inoculation received by virus from some intermediate object. The number of cases thus acquired are very large; but it will serve our purpose to mention briefly the principal causes of such infection. Cups, knives, forks, spoons, and other utensils in common use at the table have been not infrequently the bearers of the virus, which has resulted in syphilitic inoculation. So, too, articles of linen in general use, cigars, cigarettes, and food or candy, conveyed from one mouth to another, have given rise to infection. The tobacco-pipe, the blow-pipe of the glassmaker, whistles, and musical instruments have each and all conveyed the virus from one mouth to another. The disease has likewise been conveyed from one person to another by the lancet of the vaccinator, by different instruments used by the physician and dentist, by cupping, tattooing, skin-grafting, and catheterization; and even the practice of taking the penis of the child in the mouth to stanch the flow of blood in ritual circumcision has caused several cases of the disease. From the foregoing it will be seen that syphilis may be acquired in many and various ways, and those who are interested to study the question further should read the admirable work by Bulkley entitled *Syphilis Insontium*.

Immunity from Syphilis.—The poison of syphilis occurs only in the human organism, and is reproduced nowhere else. The syphilitic virus, transplanted into a non-syphilitic organism, excites inflammatory processes of the widest diversity, from simple, localized, and fugitive hyperemia to the formation of enormous exudations or granulomatous growths, or even extensive fibrous hyperplasia. The virus or contagious element of syphilis, having gained access to the system of a person previously free from the disease, a chancre invariably results at the point of entrance. In order that the virus may thus infect the recipient, there must be a break in the continuity of the skin or mucous membrane, although Hutchinson asserts that it is not at all improbable that the virus can penetrate the unbroken but soft and moist mucous structures of the parts where chancres are usually found. An individual that has once had syphilis is rarely thus infected a second time, and a large majority of the cases reported as acquiring the disease after a previous attack are open to much doubt. Some well-authenticated cases of a second infection, however, prove that absolute immunity is not always secured by an antecedent infection.

The Chancre.—The lesion which results at the point of infection is known as the chancre, the initial lesion, the primary sclerosis, etc. Its chief characteristics are those of a circumscribed inflammation which in time becomes indurated, which may or may not be attended by ulceration, and furnishes a secretion which is capable of producing a similar lesion by inoculation upon a person who has never had syphilis. Again, the initial lesion is characterized by an enlargement of the lymphatic glands in most intimate connection with it, such enlargement being known as the primary

adenopathy. After the inoculation of the syphilitic virus there is no sign of its presence at the point of entrance for several days. The abrasion or break in the continuity of the skin or mucous membrane through which the virus enters disappears entirely, unless there has been a pyogenic infection, which may produce a simple suppuration at such point of entrance. Unless this happens, we have no evidence for a time, either local or constitutional, that syphilitic infection has taken place. From the foregoing it will thus be seen that the virus remains for a varying period of time inactive, so far as any local manifestation is concerned. This lapse of time which intervenes between the moment of infection and the first appearance of local symptoms is known as the first period of incubation, and lasts, on an average, twenty-one days. This period of incubation is, however, much shortened or lengthened at times, having lasted only three or four days in very exceptional cases, while in others it has been prolonged for forty or fifty days, and in a few recorded cases even longer. As a rule, however, we shall rarely see this incubation period shorter than twelve or longer than thirty days, and between these two periods we may confidently look for the appearance of the initial lesion, the average lapse of time, as has been previously stated, being about twenty-one days.

Number of Lesions.—Although the initial lesion of syphilis is nearly always single, multiple lesions do at times occur, so that the assertion that the chancre is multiple and the chancre single is by no means always true. The syphilitic virus having entered at the same time at two or more points, as in the case of multiple abrasions at the site of a herpes progenitalis or a balanoposthitis, multiple lesions will probably appear. The initial lesion is, however, practically non-autoinoculable, and multiple lesions are always due to infection taking place at the same time at several points; or, a person being already infected, fresh exposure within a short time of the previous infection may lead to another infection, and so produce a multiplicity of lesions. Immunity from a second infection probably exists after the lapse of a few days at most.

Induration.—Induration is nearly always present in the initial lesion, and is known as the initial sclerosis and is almost diagnostic of syphilitic chancre. That induration may take place in a simple non-syphilitic chancre due to irritation or the application of caustics must always be borne in mind, but this induration is not so sharply limited or so firm to the touch as is the true syphilitic induration. The induration of the initial lesion commonly begins within a week or ten days after the first appearance of the chancre, and varies greatly in degree, sometimes being hardly appreciable to the touch, while, again, it appears like a hard tumor in the skin, feeling like wood or cartilage. It varies also in form, being usually rounded or oval in contour, though at times it feels like a thin, resilient disk imbedded in the chancre, and presents in this form the so-called parchment induration. If the tissues are soft and lax and the lesion easily accessible, the induration can readily be made out by rolling the chancre gently between the fingers. The amount of induration present is determined somewhat by the looseness of the tissues upon which the chancre rests, lesions of the prepuce, lips, and labia majora being, as a rule, more markedly indurated than similar lesions upon the glans penis, the os uteri, and the fingers. Involution of the initial sclerosis takes place slowly, lasting in exceptional cases for months or even years, although it commonly disappears in five or six weeks. After its complete disappearance it may in the course of time reappear on the cicatrix, the cicatrix becoming ulcerated, and so presenting the appearance of the primary lesion. The site

of the initial lesion is usually marked for a while after the induration has disappeared by a spot of brownish pigmentation, which, in its turn, disappears completely, leaving either no trace or a light discoloration of the skin or a white cicatricial spot, either of which may persist for years.

Clinical Appearances.—The initial lesion is first seen as a papule, either flat or slightly elevated, imparting a slight sense of resistance to the touch, or else with the complete absence of such infiltration. When first seen it may be dry and shining or slightly scaly or abraded, or even ulcerated, and secreting a slight serous or sero-sanguinolent discharge, which upon drying forms a crust or scab. These signs, however, are not sufficient to enable us to make a positive diagnosis until further developments take place, such as induration, adenopathy, etc.

Varieties of the Initial Lesion.—Variations in the form of the chancre may be due to accidents of inoculation, to the susceptibility of the person infected, to the character of the tissue affected, and to the processes of inflammation and gangrene. The simplest form of the initial lesion is called the dry, scaling papule. This varies in size from a pea to a bean, is brownish-red in color, and the surface is dry and usually slightly scaly. The commonest form of the initial lesion, uncomplicated with purulent infection, is known as the superficial erosion. It is circular or oval in shape, with an eroded, raw-looking surface, having a thin serous or sero-purulent secretion, or it may be covered with a thin grayish pellicle. It may be flat or slightly raised above the surrounding surface, or centrally depressed if slight ulceration is present. The ulcerating lesion or Hunterian chancre is marked by ulceration, with more or less loss of tissue, producing a crater-like or funnel-shaped excavation having hard, prominent borders and marked by extensive induration. The ulcerative process may, however, cause the induration to disappear in a large degree, although careful palpation will always detect its presence. The sloping, adherent edges of this form of initial lesion cannot easily be confounded with the rough, undermined borders of the non-specific chancre; and although, to all appearances, there may be considerable loss of substance, the resulting cicatrix is generally insignificant and not at all like the cicatrix resulting from a simple chancre.

Another rare form is the so-called infecting balano-posthitis, in which the mucous membrane of the prepuce is much reddened, slightly excoriated, and thickened, the induration in such case being broad and uneven and not very clearly defined. The vaccinal chancre is due to the inoculation of the syphilitic virus at the time of vaccination, and four or five weeks after the usual development of the vaccine vesicle the syphilitic virus manifests itself by the appearance of a small, reddish papule, which increases in size, becomes indurated, and commonly inflammation and suppuration take place later. It leaves behind, as a rule, a deeply pigmented scar. The so-called mixed chancre is the result of inoculation at the same point with the virus of syphilis and the chancroidal virus. Such a sore exhibits, in its development and subsequent course, the characteristics of both the chancre and the chancroid. At first the simple venereal sore develops, and later induration of its base, with specific glandular engorgement and general syphilis, follows. If the initial lesion appears first, and is subsequently inoculated with the chancroidal virus, ulceration takes place and the induration disappears more or less completely. If this should happen, and the physician does not see the lesion until such a change has taken place, the sore, lacking induration and having all the appearances of a chancroid, would be considered a non-specific venereal ulcer; but indolent lymphangitis would point to the true nature of the lesion.

Site of Chancre.—As the initial lesion may appear upon any part of the body, and the virus may gain access to the system through the integument as well as through the mucous membranes, it is well to classify the initial lesions according to their situation, as genital and extra-genital. As by far the largest number of cases of chancres are acquired during the sexual act, we shall find the genitals the seat of such lesions in the majority of cases. In the male the inner surface of the prepuce, the sulcus, the glans penis, and the frenum are most commonly the site of the chancre; while the meatus, the preputial orifice, the canal of the urethra, the scrotum, the skin of the penis, and the peno-scrotal angles are not infrequently the point where syphilitic infection occurs. Lesions of the sulcus, the inner surface of the prepuce, especially where the prepuce is long, owing to the moist condition of the parts and uncleanness, are apt to be of a moist and ulcerating type. When the lesion is situated on the mucous membrane of the prepuce, cartilaginous induration is usually present, and on retracting the prepuce the smooth glistening surface of the induration presents a marked contrast to the surrounding tissue. Where the glans penis is uncovered habitually by a short foreskin, the chancre commonly appears as a dry papule; while, on the other hand, if the glans is habitually covered, a superficial erosion is the usual form of the lesion. When the meatus or urethral canal is the site of the chancre, considerable obstruction to the flow of the urine may occur, and induration may be detected by a careful palpation of the parts. The site of the chancre on the female genitals and the relative proportion of the parts affected occurs, according to Fournier, in the following order: the labia majora and minora, the fourchette, the uterine neck, region of the clitoris, vestibule of the vagina, meatus urinarius, upper commissure of the vulva, and vagina. The vaginal walls enjoy a remarkable immunity from infection, owing to their thickness and elasticity, which render them comparatively free from danger of abrasion, and also to the fact that abundant secretions tend to interfere with the absorption of the virus.

Chancres of the female genitals, owing to their situation upon parts more or less concealed from observation, and to the trifling discomfort to which they commonly give rise, often escape observation. On the other hand, owing to the moisture of the parts, to irritating secretions, and to uncleanness, they are often transformed into the mucous patch, condylomata lata associated with the initial lesion being a much more common occurrence in females than in males. Chancres of the female genitals are rarely accompanied by pain, and, owing to the difficulty of properly reaching the parts affected, palpation to detect induration is often ineffectual. The initial lesion is far more often multiple on the female genitals than on the male, and is often very transitory in character, and even when present offers many difficulties at times to a proper diagnosis.

The initial lesion of syphilis occurs far more frequently extra-genitally than does the simple venereal sore, and is more frequent in women than in men. The mouth, next to the genital region, is the most common site of the initial lesion, and inoculation may take place either by direct or mediate contagion. This statement seems natural enough when we consider the frequency of mucous patches of the lips and buccal cavity, the virulent properties of their secretions, and the ease with which these secretions become mixed with the saliva and transferred from mouth to mouth by kissing or by articles contaminated by a syphilitic person. The nursing infant contaminated by a syphilitic nurse commonly presents a chancre of the lips or mouth contracted from some specific lesion of the nipples, and perversion of the sexual

act furnishes a small proportion of cases of the initial lesion of the mouth. The lips are naturally the most common site for chancres of the mouth, while the tongue, gums, and tonsils follow next in order. Inoculation occurs at the site of a fissure or of a herpetic vesicle, and the resulting lesion may be at first mistaken by the patient for a cold sore. The induration may be slight in character and the lesion may disappear quickly, leaving only submental and submaxillary adenopathy as a sign of syphilitic infection, although in a majority of cases there is a decided development of the initial lesion, with marked sclerosis, the lip being often much swollen and everted.

Chancres of the tongue are most commonly seated at the tip of that organ or on its lateral borders: their surfaces are red and eroded, and the induration is sharply defined, while they are indolent in their course and development and are accompanied by submaxillary adenopathy.

Chancres of the finger occur most frequently in physicians, midwives, and nurses, and are contracted in the performance of their duties, both in the practice of midwifery and in digital examinations of syphilitic lesions and parts affected with such lesions, as well as in various operations upon syphilitic patients. The finger itself, not being inoculated, may convey the virus to some other part of the body, which thus become infected. In chancres of the finger the syphilitic virus usually gains entrance at the site of a cut, an accidental abrasion, or a hang-nail. The resulting lesion is usually very indolent in type, accompanied by much thickening and considerable induration, although this sclerosis is not so easily detected as where the tissues are more lax. They are not commonly ulcerated, although the surface may look raw and red, and they usually produce considerable deformity of the parts affected. An enlarged and indurated epitrochlear gland is nearly always present, together with an enlargement of the axillary glands, such enlargement sometimes going on to suppuration.

Lymphatic Adenopathy.—The primary adenopathy which takes place as an invariable accompaniment of the initial lesion involves a gland or glands in the chain of lymphatics in closest anatomical relation to the chancre itself. This induration appears usually in from six to ten days after the development of the chancre, and resembles in a marked degree the induration of the primary sore. Although the induration is of an inflammatory type, it is very indolent in character, and heat, pain, and redness are not present. Several glands are, as a rule, involved, which is in marked contrast to the monadenitis of the simple chancre. Each gland can be felt as a hard, shot-like mass, varying in size from a pea to a pigeon's egg, rounded and smooth, and freely movable beneath the skin. In chancres of the genitals the glands which take part in this enlargement are the superficial ones lying along the line of Poupart's ligament, two, three, or four such enlarged glands being, as a rule, distinctly discernible on palpation on the same side as the initial lesion. At first only one gland may be felt and on only one side, but later and in most cases several glands are involved on each side. Other deeper glands are doubtless involved, such as the crural and iliac, but owing to their being hidden in the deeper tissues they cannot be discovered by palpation. Very rarely do these glands suppurate, and then it is due either to irritation of the chancre or to a mixed infection. As in the case of genital chancres, so with extra-genital chancres, we get an adenopathy of the glands in nearest relation to such lesions, so that we may look for induration of the epitrochlear glands in chancres of the fingers or hand, of the submaxillary and submental glands in chancres of the lips and buccal cavity, and the preauricular in chancres of the forehead.

Diagnosis.—The diagnosis of the initial lesion of syphilis, while not difficult in typical cases, may, owing to many different and widely differing causes, become almost or even impossible to the most careful and experienced physician. This statement, of course, holds good only during the early stages of the chancre, for its complete development and a careful watch of accompanying symptoms and subsequent developments will rarely fail to solve all difficulties, even in the most doubtful cases. Hence an early diagnosis cannot always be made, and any opinion given soon after the development of a suspicious though doubtful source should only be expressed after a most careful consideration. As syphilis can be acquired only by direct or mediate contagion, a careful examination of the person from whom the disease is supposed to have been contracted is of the greatest importance when such examination can be made. Unfortunately, promiscuous intercourse, the unwillingness of the suspected person to submit to an examination, and the possibilities of mediate contagion render this procedure impracticable in many cases. Having failed in this, or if it is impossible to use this method of confrontation, we must then consider carefully the characteristics of the initial lesion itself, and consider how they agree or vary with other conditions liable to be mistaken for the true syphilitic sore. The condition most constantly present in the initial lesion, and the elements upon which the diagnosis chiefly depend, are its period of incubation, the induration of its base, and the adenopathy of the nearest chain of lymphatic glands. Of these three signs, the period of incubation is perhaps most to be relied upon, although the patient's statement in regard to the date of probable infection is often not to be relied upon, or, on the other hand, it may be misleading. The induration, too, may be inflammatory or caused by the injudicious use of caustics, or it may be completely masked or changed by the processes of inflammation or gangrene. Induration of the lymphatics may be caused by the inflammation of the sore, but in this case the enlarged glands would be painful on palpation, and while, in some rare cases, the syphilitic bubo may become inflamed and suppurate, such suppuration is in nearly all cases the result of a mixed infection. The initial lesion may be mistaken for a simple abrasion or any indifferent lesion of the genitals, mucous membranes, or cutaneous surface, but the persistence of the lesion, its indolent character, and induration of the nearest lymphatics will afford a clue to its true character. Simple abrasions with ulceration tend to rapid recovery with cleanliness, are found most commonly in persons of uncleanly habits, are irregular in shape, non-indurated, beginning as an abrasion, and remaining as a simple ulceration until recovery takes place. Herpes progeneralis may be mistaken for the true chancre. It is generally due to friction, mechanical or otherwise, to irritation by acrid discharges and secretions, and to cold or fever, or it may be a true neurosis. It begins as a group of a few or several vesicles, attended by smarting, burning, and itching. The vesicles rest upon a reddened base without induration. Their contents, clear at first, become cloudy and purulent, and if the vesicles are ruptured a scab quickly forms. A gland or glands in the groin may be enlarged, and are always painful on pressure, while involution takes place in a few days at most. In herpetiform chancre the lesions are not so distinctly grouped; the base becomes indurated, the borders thicken, and an indolent adenopathy of the inguinal glands always follows. Epithelioma of the genitals, mouth, and tongue may be mistaken for chancre, but the more rapid development of the chancre, the early adenopathy, and the subsequent developments will serve to differentiate it from epithelioma; while excision of a bit of the lesion with a microscopic examination of the excised portion will settle the diagnosis.

in doubtful cases. An ulcerating, gummy tumor of the genitals might be mistaken for the initial lesion if there was an uncertain or doubtful knowledge of a previous syphilitic infection, but in such a case we should have a history of an indolent tumor or mass which went slowly on to suppuration, a deep suppurating ulcer resulting. Its border would be soft and ragged, induration of the base would be absent or doughy and boggy if present, and, although a single inguinal gland might be enlarged, the true characteristic adenopathy of primary syphilis would be absent. The differential diagnosis between balanoposthitis and that rare form of the initial lesion known as infecting balanoposthitis may be very difficult, but the condition of the inguinal ganglia will afford the surest aid to a correct diagnosis. The initial lesion of syphilis, unlike the chancre, which is a local infection, is but the beginning of a pathological process which profoundly affects the whole human economy. It is therefore of the utmost importance that we should make a correct diagnosis in all cases of the initial lesion, and, while such a result is possible in typical cases, yet in the forms of the initial lesion where ulceration is present the diagnosis at the start will be most difficult. In order, therefore, to keep clearly in mind the most important points of differential distinction between the two lesions—chancres and chancreoid—let us consult the following table:

Frequency of Appearance.—Chancre occurs but once, as a rule, in the same individual, absolute immunity from a second attack being the rule with very rare exceptions, while the chancreoid may occur an indefinite number of times in the same person.

Nature of Ulcer.—The chancre is a local manifestation of a constitutional disease, while the chancreoid is a purely local infection.

Causation.—The chancre is due to either direct or mediate contagion by the inoculation of the secretions from the initial lesion or from most of the so-called secondary lesions, by the blood during early syphilis, and by physiological secretions contaminated with a syphilitic virus. Chancreoid is due to inoculation, nearly always direct, with the pus of the chancreoid lesion, virulent bubo, or lymphitis.

Period of Incubation.—The chancre has a well-marked period of incubation, lasting on an average twenty-one days, and varying in length from ten to forty days, while the ulcer of chancreoid develops immediately after infection, commonly making its appearance in from twenty-four to forty-eight hours.

Induration.—This is almost invariably present in chancre, is hard, firm, elastic, and sharply defined, and is usually persistent for some weeks. When present in a chancreoid it is due to inflammation by irritation or caustics; it is inelastic, easily compressible, and of temporary duration.

Adenopathy.—In chancre the enlarged inguinal glands are painless, multiple, and rarely suppurate unless injured or due to mixed infection. In chancreoid suppuration of the lymphatics is frequent, the bubo being painful, and monoglandular in contrast to the polyadenitis of the initial lesion.

Inoculability.—The secretion of the chancre is not inoculable upon the bearer, upon other syphilitic persons, or upon animals; while the secretion of a chancreoid is auto-inoculable and can be transmitted to other persons and to animals.

Method of Origin.—The chancre begins with a papule or an erosion, and remains an erosion or ulcerates slightly. Chancreoid begins as a pustule or an ulcer and remains an ulcer.

Pain.—Chancre is but slightly sensitive, while the chancreoid is nearly always painful.

Number of Lesions.—Chancre is usually solitary, or, if multiple, the lesions appear simultaneously. Chancroid is rarely solitary, especially in women, several lesions appearing at once or successive ulcers appearing through auto-inoculation.

Site of Lesions.—Chancre is not uncommonly extra-genital, while chancroid appears almost invariably on the genitals or the adjacent parts.

Shape of the Ulcer.—In the chancre the edges are smooth, often elevated, sloping, adherent, and not undermined; while in the chancroid they are clean cut, perpendicular, often everted, and undermined.

Floor of Ulcer.—The floor of the chancre is smooth, often concave, and shiny; while in the chancroid it is uneven, dug out, irregular, and dull in appearance.

Secretion.—This, in the chancre, is scanty and serous or sero-sanguinolent, unless the sore is irritated, when it becomes purulent. In the chancroid the secretion is copious, purulent, and irritating in the early stage, becoming laudable when the ulcer is healing.

Pathology of the Primary Lesion.—The following aims merely to give a brief account of the changes in the primary lesion, lack of space forbidding a full account of all the details. Opinions are divided as to whether a chancre is a purely local lesion or a general infection which first manifests itself at the point of inoculation. The latter view, as will be seen, is probably correct.

Most observers are now agreed that the first manifestation of syphilis is seen in and around the vessels and very soon after the infection. Even in a chancre which is excised as soon as it appears marked changes in the epithelium and vessels are already found. The epidermal cells proliferate—most at the edge of the tumor, less in the center. At the height of the process the epithelium in the center is thrown off, leaving a moist, red delta. At the edge of this the epithelium ceases abruptly in a knot-like swelling surrounding the chancre like a wall. The papillæ swell and increase in size and show marked infiltration, with small round cells which lie in a sort of reticulum. As the papillæ increase the interpapillary processes decrease in size and are pushed downward in long, thin bands. Often the ends of the bands become cut off by the growing connective tissue, and thus form isolated blocks of epithelium. Leukocytes are found in the border of the process in moderate numbers, but rarely in the center.

The cells of the vessel-walls swell and proliferate, this change affecting most the adventitia and media. Infiltrating the adventitia, and often the media and the connective tissue surrounding the vessels, are numerous round-cells. So much are the coats of the vessels increased in size that they may become two or three times their normal diameter. Sometimes a true syphilitic endarteritis obliterans is encountered. By these processes the lumen of the vessels is very much contracted, sometimes to complete obliteration, but this obliteration is less often caused by arteritis and phlebitis than by the infiltration of all layers by granulation-cells (Fenger). These changes in the vessels are found not only in the tumor itself, but extending a considerable distance from it. They also occur very early, before the primary lesion manifests itself to the examining finger. The vessels in the boundary zone are much convoluted, showing that they have increased in length as well as in breadth. From the vessels the process spreads rapidly and early to the perivascular lymph-spaces, causing proliferation of their cells, and spreading thence along the lymph-vessels to the glands. In view of these early changes and the rapid spread we can understand why excision of the chancre does not

cure syphilis. The connective-tissue cells also participate in the process and proliferate rapidly. By the rapid and enormous growth of some of the spindle-cells, giant-cells are formed. These are most numerous along the edge of the process.

One characteristic of the primary syphilitic lesion is its peculiar hardness. Unna says this hardness is not due to the round-cell infiltration nor to the increase of connective tissue, but upon the deposition of collagen in the connective-tissue bundles forming the reticulum of the infiltrate. That syphilis is due to a bacillus is probable, but not yet completely proven.

Second Period of Incubation.—Following the appearance of the initial lesion, we have another period of rest from manifestations of the disease, called the second period of incubation, lasting on an average about forty days. The duration of this second period of incubation is, however, of variable length, having lasted in some cases only twelve or fifteen days, while in others it has been prolonged for several months, Ricord having reported a case where the appearance of the first cutaneous manifestation was delayed until the seventh month. On the other hand, cases have been reported where the so-called secondary manifestations of the disease have never appeared, tertiary lesions following the chancre only after the lapse of several years. These rare cases are not to be confounded, however, with the not unusual ones where the secondary manifestations are so light as to have escaped the notice of the patient or perhaps even of the physician himself. Assuming, then, as previously stated, that the secondary period of incubation lasts, on an average, forty days, what may we expect to find suggestive of syphilis during those forty days which intervene between the appearance of the chancre and the first cutaneous eruptions? As a rule, the patient enjoys his usual state of health, and, so far as this may be a criterion, he has nothing to warn him of the slow pathological changes which are surely going on, and which will later be expressed by many and widely-varying symptoms. Some patients may thus pass over the time from the appearance of the initial lesion to the first cutaneous manifestations with no indications of constitutional affection, but in the majority of cases in from three to five weeks after the appearance of the chancre various objective and subjective symptoms become quite marked. The patient looks pale and anemic, complaining of lassitude, rheumatic pains in the bones and muscles, and headache more or less pronounced, which occurs toward evening and becomes most severe at night, this headache being entirely unrelieved by ordinary remedies and responding only to antisiphilitic treatment. As a less common disturbance may be mentioned occasional painful swelling in the frontal region, the parietal bones, or the clavicle. At times we may observe effusions in the joints, painful in character and resembling similar swelling due to the acute arthritis of rheumatism, although treatment based on such a diagnosis would be of no avail. Enlargement of the spleen has been observed at this time, although it is by no means frequent. The liver is at times slightly enlarged, and is sometimes accompanied with jaundice and clay-colored feces. By far the most common, however, of symptoms present at or about this time are chloro-anemia, the so-called syphilitic fever, and a generalized adenopathy of the lymphatic ganglia. A general ganglionic engorgement is by far the most common symptom of the secondary incubation period of syphilis, careful examination revealing one or more such swollen glands in nearly every case. In fact, this adenopathy is one of the most common symptoms at this stage of the disease, and is of very great importance as regards a correct diagnosis. This glandular swelling is entirely distinct from the primary adenopathy

which accompanies the initial lesion, although having its characteristics as regards size, induration, lack of pain, and indolence. It involves to a greater or less extent the entire superficial lymphatic ganglia, being noticeable in the inguinal glands when these have not already become indurated in connection with the primary lesion, the epitrochlear, the submental, submaxillary, post-auricular, occipital, anterior and posterior cervical, and axillary. One or more glands in one or several of these ganglia may be found enlarged on careful palpation, the enlargement varying from the size of a pea to a pigeon's egg, and being hard, indolent, and painless. If suppuration takes place, as sometimes happens, it is due to pyogenic infection and not to the syphilitic process. While the detection of an enlarged and indurated gland or glands is of great significance as regards a diagnosis, we must remember that enlarged glands in these situations are frequently found in persons free from syphilis, due to irritation and many non-specific diseases. Again, on the other hand, in persons covered with a dense layer of adipose tissue such glandular induration may be made out only with great difficulty or perhaps not at all. The glandular swelling which occurs in persons of a scrofulous diathesis has not the smooth, even surface of that occasioned by syphilis, and it is apt to become inflamed and undergo ulceration, while that occurring in prurigo has existed for a lengthy period, together with the easily diagnosed lesions of the same disease. In like manner, the deep visceral glands, as the retro-peritoneal, prevertebral, mediastinal, and bronchial, take part in this general lymphadenitis, and, although sometimes thus enlarged during the period of secondary incubation, they are most commonly coexistent with later stages of the disease, supposedly having the same relation to visceral syphilis that the superficial ganglia have to the syphilodermata.

Syphilitic Fever.—This symptom is present to a greater or less degree toward the end of the second incubation period in a large majority of cases of syphilis, provided there has been no specific treatment. It may be so slight as to pass unnoticed, while, on the other hand, it may be so severe as to attract the immediate attention of the patient and even lead to mistakes in diagnosis, being mistaken for the febrile disturbance of typhoid, malaria, or acute rheumatism. It is of more frequent occurrence in women than in men, and in the anemic and debilitated than in the strong and robust. It is uninfluenced by ordinary antipyretics, but responds readily to mercurial medication. It commonly appears a week or ten days prior to the first skin eruption, and is as a rule, about one degree higher at night than in the morning, averaging about 101° F. at night and rarely going higher than 104° . As the first cutaneous eruption appears the fever has usually reached its highest limit, and then gradually declines or even ceases abruptly. Fever may return again at any stage of the disease, although it becomes milder as the disease progresses. It is at times remittent in type, and in this form is generally the precursor of a new development of constitutional symptoms. A syphilitic fever rarely precedes or accompanies a papular syphiloderma, while it is very frequently present in the pustular form; which may probably be explained by the fact that the pyogenic influence is more marked in cachectic and broken-down patients who are most subject to the outbreak of pustular syphilides.

Chloro-anemia and Cachexia.—An examination of the blood during the second period of incubation of syphilis reveals the fact that changes gradually take place in a majority of cases both in the coloring matter and blood-corpuscles. A decrease in the amount of the oxyhemoglobin present is evident during the whole secondary period of incubation in about 75 per cent. of

cases. A diminution in the number of red corpuscles also takes place, and this diminution is in proportion to the loss of oxyhemoglobin, while at the same time there is an increase in the number of the white corpuscles. The amount of these alterations in the blood varies considerably in individual cases, and these changes are most marked during the existence of the syphilitic fever. It will thus be seen that we have a true chloro-anemia and leukocytosis, which may, owing to decided alteration in the blood and a resulting chain of symptoms, lead to a condition known as syphilitic cachexia. Fortunately, this state of affairs is seldom met with, owing to proper treatment, and when seen it occurs in broken-down and debilitated subjects, and is often the result of improper treatment or the excessive and ignorant use of mercury. Syphilitic cachexia is seen in its worst form during the later stages of the disease, particularly in long-protracted cases of syphilis characterized by repeated outbreaks of the pustular syphilides, and combined with visceral lesions and perhaps other constitutional diseases. The general symptoms of this so-called tertiary cachexia resemble the condition observed after any chronic wasting disease: the complexion becomes pale and waxy; the skin is shrunken, owing to loss of adipose tissue; the vitality is seriously impaired; there are loss of sleep and palpitation of the heart; and vertigo and headache are also complained of by the sufferer. This condition of affairs may become very alarming, but improvement is generally marked under careful tonic and hygienic treatment.

Women are the most frequent sufferers from syphilitic cachexia, and Fournier speaks of a form which he calls "asthenia." He regards it as differing from chloro-anemia, since the countenance of the patient thus affected is not anemic. There are present in these cases great weakness and prostration. The patient becomes apathetic and indisposed to all exertion, even gentle exercise inducing fainting. The pulse is weak, respiration slow; the appetite, digestion, and nutrition are greatly impaired; and there is much marked nervous depression.

THE SYPHILODERMATA AND THEIR CHARACTERISTICS.

Before studying the individual characteristics of the different forms of skin-lesions seen in syphilis let us glance briefly at the general features of these lesions taken as a whole.

Syphilis causes two distinct pathological conditions of the skin—one the hyperemia, and the other the cellular infiltration—and each tends to run a very protracted course. Skin-lesions may occur at any period of the disease, being among the earliest and also among the latest manifestations.

The hyperemic syphilides are found in the early stages of the disease, usually during the first two years of the diathesis. The infiltration process usually comes on in proportion to the time that has elapsed since the inoculation. However, it is not at all uncommon to find a certain amount of cell-infiltration during the early months, confined to the superficial layers of the skin, while later the process extends to the subcutaneous layers.

The syphilides occur in a great variety of forms, represented grossly by macules, papules, pustules, bullæ, and tubercles, together with changes of these different lesions resulting in pigmentation, scaling, crusting, ulceration, and cicatrization. These various lesions may occur at any period in the course of the disease, being at times scarcely noticeable and causing slight inconvenience, while, on the other hand, they may be so severe as to cause considerable discomfort and even disfigurement and deformity. The syp-

ilodermata, even in their characteristic forms, display the widest possible variation in type, and simulate in appearance almost every known variety of dermatoses. Taken as a whole, however, they convey to the careful observer, in a vast majority of cases, a distinctive type which marks them as syphilitic in their origin and nature. The different peculiarities of the skin-lesions in syphilis, which, taken together, serve as a guide to their true nature, consist in their evolution, mode of development, contour, grouping, color, etc.

General Symptoms.—These, as a rule, are absent. The syphilitic fever which ushers in or appears during the existence of the early roseola is perhaps the most common sign of constitutional disturbance. Slight fever, loss of appetite, pains in the muscles and bones, and headache confined to the lateral part of the head, sometimes immediately precede a widely distributed eruption of the skin; but, as a rule, the eruption appears without any marked constitutional symptoms, the patient being in his usual condition of apparent good health.

Concomitant Symptoms.—Careful inspection of our patient will usually reveal other unmistakable signs of syphilis. With early eruptions we should look for the initial lesion, the induration left after it has healed, or even the scar which may follow. Induration of the inguinal glands, adenopathy of the cervical and epitrochlear glands, together with alopecia, mucous patches of the anus, genitalia, and mouth, may also be present; and some of these symptoms will nearly always be found during the first few months of the disease. With the later eruptions—that is, those commonly occurring after the first year—pains in the bones, bone-lesions, permanent alopecia, cicatrices, or other symptoms pointing to syphilis exist in most cases.

Method of Evolution.—Compared with other inflammatory lesions of the skin, the eruptions of syphilis develop very slowly, and, if untreated, remain comparatively unchanged for long periods of time. New and entirely different lesions often appear before the involution of lesions already present, while the slow and gradual change of existing eruptions and the modifications which take place in their appearance generally mark them as distinctly syphilitic.

Polymorphism.—During the first year of the disease a multiplicity of lesions is the rule rather than the exception, while after the first year this condition is not so commonly present. Thus, during the early stages of the disease we may see a variety of lesions, macules, papules, pustules, crusts, and scabs being found on the same patient, either side by side or widely scattered.

Contour and Symmetry.—The single early lesions, while usually rounded in form, show a decided tendency to group together in circular patches or curved lines, this peculiar grouping being specially characteristic of the small papular syphilide. The large papular and tubercular syphilides are also very prone to a circular or crescentic arrangement, involution taking place in the center of a patch, while it spreads at the periphery. The earlier eruptions are usually symmetrical, while the converse is true of the later manifestations.

Color.—The color of the different syphilides varies according to the stage of their development, and is influenced by the complexion of the patient as well as by a condition of good health or cachexia. In the early eruptions, particularly when newly developed, the color is usually pinkish red, but is not so bright as is seen in the non-specific exanthemata. The color gradually fades and becomes a yellowish or reddish brown, or it may assume this appearance at the very outset. The different papular eruptions most commonly show the brownish-red color which has so often been compared to copper or

raw ham. In the lower extremities, owing to faulty circulation and blood-stasis, the color is often bluish or a dull, liver red. The color of the different lesions is brighter and redder in blondes than in brunettes, where brownish colors usually prevail, while in patients with marked cachexia the color is apt to be livid or bluish red. The pigmentation of the skin left after involution of the eruptions is found in different shades, varying from a light brown to almost black. The cicatrices of syphilis are at first pigmented, being brownish in color, but this pigmentation slowly disappears during the course of time, leaving a white, glistening scar-tissue.

Site of Lesions.—All parts of the integument are subject to the invasion of syphilis, and, while some few places usually escape the eruptive accidents of the disease, other places sooner or later commonly become the seat of specific lesions. The early eruptions are pretty generally distributed as a rule, while the later eruptions are more unevenly distributed and confined to particular localities, as will be pointed out later.

Absence of Sensation.—Pain and itching are not commonly present in the specific eruptions, this fact being often of much importance as an aid to diagnosis. In some of the syphilides marked by a rapid development, particularly the papular and pustular varieties of the scalp and mucous patches of the genitals, itching may be a marked symptom. So, too, lesions about the mouth and genitals, if exposed to constant friction and irritation, and ulcers of the leg, may at times be quite painful.

Amenability to Treatment.—The early eruptions of syphilis undergo marked improvement as a result of a proper and judicious use of mercury, and, while the later manifestations may be influenced by its use, it is here that we see the remarkable effects of the iodide, gummatous deposits, extensive ulcerations, and lesions of the bones often disappearing like magic as a result of its administration.

DIAGNOSIS OF THE SYPHILODERMATA.

The general characteristics of the syphilodermata and the peculiarities of the individual lesions serve, in the majority of cases, to distinguish them from all other cutaneous eruptions. In many cases, however, the cutaneous manifestations of syphilis are so similar to other dermatoses that the syphilitic type, as we may call it, is not sufficiently marked to enable us in all cases to make a correct diagnosis from the appearance of the cutaneous lesions alone. It becomes our duty, therefore, to investigate in the most careful and painstaking manner the history of our patients, and to make intelligent inquiry as to the evolution and development of existing skin-lesions. So, too, we should seek for evidences of a primary sclerosis, general adenopathy, alopecia transitory or permanent in character, miscarriages and abortions, and all other disorders affecting the bones, the viscera, and the mucous membranes. We should also seek for scars as evidences of the former ravages of the disease. We shall thus find in many cases that some fact of the existence of a previous lesion of syphilis will aid us greatly in establishing a correct diagnosis. We must remember, too, that syphilis interferes in no way with the development of other dermatoses, and we are often called upon to decide how much of a given eruption is due to syphilis and how much to some widely different disease or cause. Too much stress cannot be laid upon the importance of arriving at a correct diagnosis in all cases of syphilis, the happiness of a father, a mother, a child, or a lover often depending upon our decision. A perfect knowledge of the syphilodermata

and the widely varying types which they present, together with careful and intelligent observation, will alone enable us to arrive at such a conclusion.

The Macular Syphilide.—The macular syphilide is usually the earliest and most common lesion of the skin. It is seen about forty days after the occurrence of the initial lesion, but may not occur until a much later period. It is prone to recurrence, especially during the first year of the disease, but when it appears subsequently it has lost its early characteristics, occurs in larger spots, and is accompanied oftentimes by papules, pustules, and other syphilitic skin-lesions. The macular syphilide or roseola represents a hyperemic condition of the skin due to the specific poison. It consists of numerous rounded or oval, ill-defined spots, varying in size from a split pea to a ten-cent piece or even larger. These are rarely raised above the level of the surrounding skin. Their color at first is a light rose-red, and disappears on pressure, the color returning as the pressure is removed. Later they assume a violet-red or reddish-brown color, and slowly fade. At the end of a week or ten days brownish spots of pigmentation are left even after deep pressure. Desquamation seldom occurs. The spots vary greatly both in number and size, as well as in the amount of coloration present. Cold makes the eruption stand out much brighter. This fact is of diagnostic value, as all the other erythematous lesions of the skin are blanched by exposure to cold.

In some individuals the spots are widely scattered, in others they are almost confluent. The eruption appears most abundantly upon the chest and belly, upper extremities, and neck, and shows plainer upon the flexor than upon the extensor surfaces. The back of the hands and dorsal surfaces of the feet are spared. Sometimes, though rarely, it comes on the face, or, again, the eruption may be entirely confined to the trunk. It is not uncommon for the eruption to be ushered in with more or less febrile disturbance, and it usually reaches its height in a week or ten days, and then slowly fades, being readily influenced by mercurial treatment. Appearing, as it usually does, on the covered parts of the body, without itching, pain, or constitutional disturbances, and lasting but a relatively short time, one can easily see how readily it may be overlooked. It sometimes passes from the macular into the maculo-papular and papular type. As the macular eruption often appears during the existence of the primary lesion, all patients with suspicious sores should be stripped and the skin carefully examined, while at the same time, before making a positive diagnosis in recent cases, we should seek for other lesions, such as glandular enlargement, crusts and pustules of the scalp, falling of the hair and eyebrows, mucous patches on the tongue, lips, fauces, and around the anus, and inquire into the history of headache, pain in the bones and muscles, etc. The macular syphilide must be differentiated from the eruption accompanying measles and scarlatina, some of the drug-eruptions, urticaria, erythema, tinea versicolor, etc. In measles the eruption appears upon the face and neck first; there is a catarrhal condition of the mucous membranes present, fever and cough, and the macules become paler upon exposure to cold. In scarlatina there is a general hyperemic condition of the skin, punctate in character, appearing first on the neck and chest, and later on the extremities, high fever, and a characteristic condition of the tongue and fauces. Following the internal and external use of mercury, an eruption bright red in color, confined to certain spots rather than disseminated, may appear. It is accompanied by burning and itching and the presence of minute vesicles. The roseola which sometimes follows the internal administration of copaiba, cubeb, santal oil, etc. is made up of usually rounded or irregular bright spots separated by intervals of normal

skin. Burning and itching are present, and there may be a formation of wheals. Gastric disturbances often accompany the skin-manifestations. The outbreak usually occurs on the dorsum of the hands and feet and about the articulations. The eruption is bright red, and a feature common to all the drug-eruptions is that they disappear on discontinuing the exciting cause. Urticaria is accompanied by much itching and the formation of wheals, and may appear and disappear in a comparatively short time. In tinea versicolor the eruption spreads peripherally, is fawn-colored and scaly, and reveals its parasitic character when examined microscopically. The various forms of erythema are rarely diffuse in character; they change their form and shape; they are of a brighter color and give a history entirely unlike that of syphilis. Little difficulty will be met with in making the diagnosis of the macular syphilide if its general diffuse distribution over the chest, abdomen, and extremities, and the exemption of exposed parts, are kept in mind. At the same time, however, we should seek for all existing confirmatory evidence of syphilitic infection.

Pathology of the Syphilitic Macule.—According to Crocker, in the macule of syphilis the morbid process is limited almost entirely to the upper layers of the corium, chiefly the papillary layers, in a sharply-defined area. The epidermis is raised up as a whole, but the cells of the rete and horny layers, as a rule, are normal, excepting where they are stretched at the point where the effusion is greatest. There may be an elongation of some of the deeper cells, and these may obliterate the definite line between the epidermis and the papillary layer; and in this case the papillæ are more or less flattened out and the fibers of the corium are separated, so that the individual fibers may be made out. This is probably due to the effusion. The upper fibers of the corium, which stand out separately, form a striking contrast to the lower part of the corium, which is normal. Only a moderate degree of infiltration with leukocytes is present, and this chiefly around the vessels of the superficial plexus with their papillary branches. A moderate dilatation of the capillaries and small arteries is present. Both are filled and surrounded with cells. Prominent nuclei are found in the walls of the capillaries, and round spindle-cells in the adventitia of the larger vessels. There is a slight effusion around the sweat-ducts, hairs, and sebaceous follicles in the upper part of the corium, but the deeper part of this layer is unaffected by the process.

The Pigmentary Syphilide.—Pigmentation in varying degree is a common sequel to all syphilitic eruptions, but the true so-called pigmentary syphilide occurs at times as a distinct expression of syphilis. It is most commonly seen during the first year of the disease, but sometimes occurs during the second year and even later. It is not a common manifestation, and occurs oftener in women than in men, and, in fact, is very rarely seen in males. It may be the only manifestation of the disease, or it may coexist with other lesions of the skin or mucous membranes. Its usual site is the sides of the neck, less often the face or forehead, and exceptionally it extends to the trunk and thighs, in this latter case being usually seen in males. It occurs in irregularly rounded and poorly defined patches, while the borders may be sharply marked, even jagged or dentated. The color varies from a light-yellow to a dirty deep-brown shade. The size of the patches also varies from that of a split pea to a silver quarter, and they may be either discrete or confluent. The pigment may be unevenly distributed through the patches, being deeper at the margins in some cases. The intervening skin is unaffected, although the normal skin seems whiter than usual, due to

the contrast of the surrounding affected areas. The patches are not raised above the surrounding skin, and, owing to the lack of vascular changes, do not disappear on pressure. This pigmentation may remain for months or even years unchanged, and is not amenable to treatment. The lace or retiform variety of the eruption is more common than the one just mentioned. It comes on the sides of the neck more or less slowly, and may extend to the chest. The color is a light yellowish-brown to dirty gray, giving the skin a grimy appearance. At first the discoloration is uniform and there are no intermingling white spots. After the eruption has lasted for some time whitish spots appear, and the condition at this time might easily be mistaken for a leukoderma. As the disease advances there is a marked tendency on the part of the white spots to increase in size, and toward the end of the process the white spots leave only oval, rounded, or wavy, irregular lines of pigmentation, which present the appearance of a piece of lace with large uneven meshes. It is by the extension of the white area and a corresponding disappearance of the pigmentation that the skin gradually regains its normal appearance; and this may not entirely be brought about until many months or, in some cases, even years have elapsed. This eruption may at times resemble chloasma, vitiligo, leukoderma, and tinea versicolor. Chloasma is usually found on the face, which region is generally exempt from the pigmentary syphilide. Vitiligo and leukoderma are not symmetrical, as is usually the case with the specific eruptions. Tinea versicolor is usually scaly, and may be attended with mild itching. It occurs generally over large areas on the anterior aspect of the chest and belly, and its parasitic nature is easily demonstrated with the microscope.

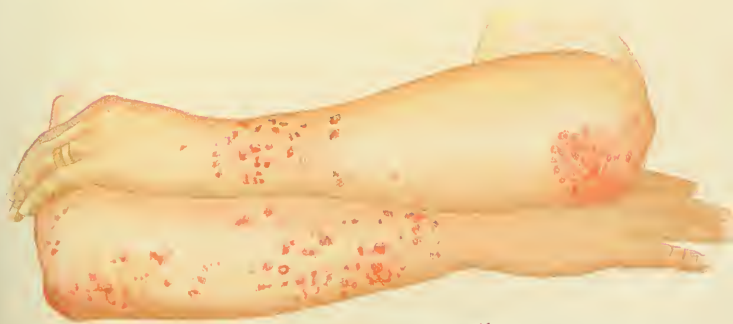
The Papular Syphilide.—In the papule we may recognize a type of nearly all the skin-lesions of syphilis. The other eruptions either develop from the papule or revert to it. The papule may be the earliest manifestation of syphilis or it may occur very late in the disease. Papules are of two kinds—acuminate and flat—and each may be subdivided into the small and large varieties.

The small acuminate papular syphilide commonly makes its appearance during the first six months after infection, and reaches its full development in about two weeks. The eruption appears as firm, reddish, circumscribed, round or globular elevations from a millet- to a hempseed in size, occurring in patches, each group containing from ten to thirty or even more papules. It begins as a reddish point, which rapidly develops into a true papule, and at times, particularly when seated near a hair-follicle, it may be capped with a small vesicle, pustule, or scale, which gives it a very characteristic appearance. The color is at first a light red, later a dark reddish-brown. This eruption is usually symmetrical, and appears principally on the face, neck, shoulders, arms, sternal region, buttocks, and calves of the leg. Its earlier eruptions are more symmetrical than its later manifestations. The eruption often appears first about the face, neck, forehead, wrists, etc., where it is exposed to irritation either from wearing apparel, hats, collars, cuffs, etc., or shaving of the face. It also occurs on the palms and soles. When the eruption occurs late it loses its disseminated distribution and becomes localized to certain parts of the body, and shows a strong tendency toward grouping and circular configuration. This is a very chronic eruption, and may last for years on the palms and soles in spite of active antisiphilitic treatment. In healing the lesions undergo a fatty degeneration and disappear by absorption, leaving behind pigmentation and a slight atrophy, with a minute punctate scar. When these papules occur at the angles of the mouth and

PLATE 7.



Papulo-squamous syphilide.



Papular and papulo-squamous syphilide.



interdigital folds they are very apt to crack and give rise to deep fissures, which are exceedingly painful and slow to heal. The small papular syphilide is usually easily recognized, but may be confounded with scabies, lichen planus, lichen pilaris, lichen scrofulosum, and punctate psoriasis. Scabies may be recognized by the intense itching which accompanies it, as well as by the marks made by scratching, its history, contagion, and the presence of burrows. In lichen planus the papules are larger, umbilicated, more deeply pigmented, and itch intensely. In lichen pilaris the papules are pale in color, not grouped; they have a greater tendency to scale and are situated over a hair-follicle. Lichen scrofulosum occurs principally in children and is a very rare disease. The papules are pale yellow in color, and on disappearing do not leave marked pigmentation. The eruption is nearly always limited exclusively to the trunk. Punctate psoriasis is much more scaly than the papular syphilide. Slight bleeding points are present if the scales are scratched off, and the patches spread from the periphery. Psoriasis frequently occurs on the scalp and over the knees and elbows; the spots are larger, while the scales are silvery white, dense, and imbricated.

Large Acuminate Papular Syphilide.—Where the parts are not in contact and the lesions have an opportunity to push forward, they may attain the size of peas or coffee-beans. This process is seen best on the back, gluteal region, calves of the legs, and extensor surfaces of the arm. This eruption is apt to be mixed in with pustules, and the area of polymorphous lesions thus formed may be transformed into a superficial ulcerating patch, showing in a rough way a tendency toward a figure-of-8 or S-shaped arrangement. Treatment modifies the evolution of the process to a marked degree.

The Small Flat Papular Syphilide.—This eruption differs from the one just described chiefly in not being acuminate. These lesions are of a roundish or oval shape and distinctly flattened at the apex. There may be a tendency for the top of the papule to scale slightly. It occurs on the flexor surfaces of the arms and legs, on the anterior and posterior surfaces of the body, and on the face, especially near the nose and mouth at the juncture of the skin and mucous membrane. The palms and soles are often affected, but the lesions have not the hard, shotty feel of the acuminate variety. The spots vary in color from a light, almost imperceptible pink to a deep, lurid, reddish brown. The color of the papules often changes rapidly in the same individual, due to increased congestion; this is well shown by anything that causes a congestion of the capillaries, such as sneezing, coughing, etc. Their size is usually under one-fourth of an inch in diameter. It is not a profuse eruption, due undoubtedly to the fact that it occurs at a time when the patient is already under specific treatment. Like other syphilitic papules, these disappear by an absorption of the cellular elements. This process is greatly facilitated by the use of mercurials. Without treatment they slowly flatten down, and are replaced by pigmented areas which are apt to persist for a long time. Although the lesions are quite amenable to treatment, we are almost powerless against the resulting pigmentation.

The Large Flat Papular Syphilide.—Like the small variety, the spots are either rounded or oval, often irregular in shape, and varying in size from a split pea to a ten-cent piece, and sometimes are even as large as a silver quarter. The borders are sharply defined and the lesion elevated above the surrounding skin, firm in consistency, with a flat, scaly, or smooth shining surface. In color they are pale or bright red, becoming darker as the process goes on. The raw-ham or coppery color supposed to be so characteristic of syphilis is more often seen in this than in any of the other skin-manifesta-

tions. These papules begin as small red spots which rapidly increase in size. No itching or pain accompanies this breaking out. The number of papules present varies, as a rule, with the time that has elapsed since the primary infection—the longer the time the fewer the lesions, and the greater will be the tendency toward grouping in patches and a confinement of the lesions to certain regions. In rare cases this is the first eruption to appear, in which case it resembles the small papular eruption in its course and manner of appearance. These lesions usually occur in the middle and late periods of the secondary stage, and show no tendency toward a circular arrangement. Their distribution, particularly in the early stages of the disease, is very extensive. Most often it affects the forehead, back of neck and shoulders, flexor surfaces of the extremities, the scrotum and region about the anus, upon the surfaces that are in coaptation or are kept moist; for example, under or between the breasts in stout women, about the navel, between the toes, and on the perineum. In the latter place they are apt to undergo superficial ulceration or excoriation, and are likely to become transformed into the condylomata lata. When seated on or about the genitals their secretions give rise to a foul, disagreeable odor. The presence of the papules along the forehead at the margin of the scalp constitutes a distinctive feature, classically known as the "corona veneris." The papular syphilide undergoes an absorption in the center, leaving a raised ring which may be scaly or smooth, and which, in its turn, undergoes absorption. The same appearance may be produced by the confluence of several small papules arranged in a circle. The papular syphilide, owing to certain changes and modifications, may become either the so-called moist papule or the papulo-squamous syphilide. The moist papule is peculiar to syphilis. It develops ordinarily from a dry papule. The metamorphosis consists in a loss of the epithelial covering, due partly to friction, contact of two surfaces of skin, the presence of perspiration, or irritating secretions. A moist secreting surface is left. This lesion is of special clinical importance on account of its frequency, its diagnostic significance, and the fact that the secretion is highly contagious, furnishing a common means of syphilitic infection. The change from the dry to the moist papule is brought about largely by local conditions. Warmth, friction, delicate skin with moist contiguous surfaces, as in the natural folds of the skin, help in their production, and they may be found also at the junction of the skin and mucous membrane about the natural orifices, as the mouth, anus, and vulva. They are also found beneath the pendulous breasts of stout women, between the toes, and about the navel, and are commonly seen in the buccal cavity and throat. In size they vary from a pin's head to a ten-cent piece or larger. It is not at all uncommon for two or more lesions to coalesce. The patches have a soft, moist surface, with a grayish opaline appearance due to a desquamation of the epithelial covering. These lesions are much more common in women than in men, especially about the genitals; in fact, in the former it may be the only manifestation of syphilis. In the mouth they run a very protracted course, being aggravated in many cases by the use of tobacco, the presence of bad teeth, and a general lack of cleanliness. Usually they represent a surface-change of a dry papule, but they may develop from a erythematous or a simple inflammatory erosion; and even the primary lesion itself may become a mucous patch. Owing to a hypertrophic condition they may become warty or papillomatous, forming the so-called vegetating syphilide. About the scrotum, vulva, and anus they exhibit their most marked degree of development. Heat, friction, and moisture may cause them to become enormously developed. The papules do not usually remain

PLATE 8.



Papulo-crustaceous syphilide.

discrete, but run together, forming irregular-shaped masses or enormous growths whose surfaces present the appearance of a cauliflower. It is generally considered that in order to produce these vegetating growths the presence of irritating discharges is necessary in addition to the underlying syphilis. The objective appearances of moist papules vary according to their location and the integument involved. Under the mammæ in stout women they occur as large, round, or concentric, flat, slightly-raised spots, the surface being eroded or covered with a thin yellowish crust. Not infrequently they are grouped about the nipple, and play an important rôle in the syphilis of nursing infants. Owing to the highly infectious nature of their secretions these lesions constitute the most common source of contagion in the acquired syphilis of infants. They have a strong tendency to coalesce and form large eroded areas in the axillæ, while about the navel they occur as small, usually discrete, moist lesions, with a slight tendency toward crusting. Between the fingers they rarely occur. Between the toes, due to pressure and perspiration, they are not simply erosions, but often become papillomatous, with deep ulcerations and fissures. In these cases walking is much interfered with on account of severe pain. Like all ulcerated papules, their secretion is most disagreeable. Mucous patches of the mouth are more irregular in shape, and they either ulcerate or vegetate. At the angle of the lips they are often deeply fissured and very painful. On the involved skin a dry, brownish crust is often found, while on the affected mucous membrane the appearance is clearly that of the opaline patch. They appear most characteristic about the scrotum in men, the vulva in women, and the anus in both sexes. On the scrotum they appear reddish or grayish, rounded, generally discrete and moist. About the anus they are arranged on either side, and may be accompanied by a persistent burning and itching, and where fissures are present defecation may be exceedingly painful. In the female there is often an accompanying dermatitis, edema of the labia, and persistent induration, due to infiltration and hyperplasia of the tissues. Moist papules are usually limited to the secondary stage, but may persist almost indefinitely if not subjected to treatment. However, they do not show the same tendency to resorption as do the other manifestations of syphilis. On the contrary, they show a great tendency to relapse and are often refractory to medication. Cases have been reported of relapses ten, twenty, and even thirty years after the occurrence of the initial lesion.

Nummular Syphilide.—It is customary to describe under this name a variety of the large papular eruptions, where the lesions to a certain extent retain their papular appearance, but are of large size—sometimes the size of a silver dollar or even larger. The surface of the lesion is smooth, with a firm, sharply-defined border. In some cases the border of a papule is elevated, giving to the center a depressed, and in small papules an umbilicated, appearance. As the process advances desquamation takes place in the center, giving the edge a fringed appearance. It is common to see a decided tendency toward repeated desquamation. In the course of the retrograde metamorphosis the nummular papular syphilide often passes into the annular variety. The center of the lesion first assumes a normal appearance, while the elevated edge still remains firm and hard, and the umbilicated appearance is even more marked than earlier in the process. This same appearance may be brought about by the confluence of small papules. In this way the circinate forms are made up. In some cases, instead of grouping themselves in circinate forms, they assume irregular serpentine rolls or chains, or one large papule may be surrounded by several small ones in a star-shaped arrangement, the

small papules being distributed with a good deal of regularity as regards their distance from each other and from the center, the small papules oftentimes coalescing so as to form a ring around the central papule. Usually this form of syphilide is discrete, areas of sound skin separating the diseased spots. This eruption commonly occurs near the end of the secondary stage of the disease, at a time when the lesions generally become larger in character and more localized. It is exceptional for it to occur early. It is seen more often about the face, back of neck, on the palms and soles, and about the genitals. When occurring about the genitals these lesions are usually moist, have a tendency to become fissured, and they may ulcerate superficially. Like all moist lesions, they secrete a characteristic fluid of a sero-purulent nature.

The Papulo-squamous Syphilide.—Both the large and the small papular eruptions may undergo desquamative changes during their course of evolution and development. In the true papulo-squamous type, however, the desquamation is so marked as to become a distinctive feature of the lesion. These scales are found commonly at the apex of the papules, are ashy gray in color, rather adherent, and not prone to exfoliation. Beneath the scales the firm reddish-brown color of the papule is seen. If the scales are at the base of the papules, the edges of the papules have an irregular, ragged circle of frayed-out epidermis. The scales are usually thick, dry, and of a dirty gray color. Less often they are hard, firm, of a horny nature, and closely adherent. It has been noticed that the later lesions show the greatest tendency toward scaling. Location also plays an important part: on the face, along the chin, among the eyebrows, and along the naso-labial folds these lesions are often met with. In these situations they are often complicated by a seborrheic process. Perhaps the most marked type of the papulo-squamous syphilide is seen on the palms and soles, and is often, although incorrectly, called palmar and plantar syphilitic psoriasis. In certain individuals there seems to be a marked tendency toward scaling of all papular lesions, irrespective of location or age. This condition has been so marked that some observers have thought given cases to be syphilis in a person with a psoriatic diathesis. However, it seems most probable that in those cases we have to do with an idiosyncrasy, for many of the syphilitics who show this marked tendency toward scaling never have had psoriasis. Late in the disease, when the lesions are large and deep-seated, by a fusion of the annular patches festoons and branching figures are formed. When these areas are covered with dry, thick, more or less friable scales, adhering closely, a very striking likeness to psoriasis figurata is presented. At this stage of the disease a correct diagnosis may be very difficult. However, by careful examination of the scales, the seat of the lesion, and the distribution of the morbid processes their true character will be determined. In psoriasis the lesions are more symmetrical: there is a predilection for certain regions of the body; for instance, along the hairy margin of the scalp, on the knees and elbows and extensor surfaces. In syphilis the face, neck, and flexor surfaces are more apt to be attacked. The scales of psoriasis are whiter, firmer, thinner, more adherent, and distinctly imbricated. When the scales are removed mechanically in psoriasis small bleeding points are seen. In syphilis, on the other hand, the scales are thick, small, much less abundant, and do not so completely cover the lesion. These scales are of a dirty gray color, and when removed have an infiltrated dry base with raised edges, and instead of bleeding points we see a smooth, shiny, reddish-brown, or coppery-colored spot. In psoriasis we shall usually find small recent lesions in connection with the older ones. An inquiry into the history of the case will likely reveal the fact of previous attacks. Psoriasis

PLATE 9.



Pustulo-crustaceous syphilide.

usually comes on before puberty—acquired syphilis, however, not till some years later.

Palmar and Plantar Syphilides.—Owing to the thickness of the stratum corneum the papule is not elevated above the surface, as in other parts of the body, but occurs in the form of thickened, discolored, irregular patches, or we may find macules dull red in color, covered wholly or in part by scales or shreds of epithelium. In size they vary from a split pea to a ten-cent piece. They usually appear in the center of the palms or soles, and spread peripherally or by concentric rings in a serpiginous course, and may traverse the entire palmar or plantar surfaces. They rarely appear upon the dorsum of the hand or wrist. Gradually the epidermal coverings are broken and raised, leaving dirty, grayish epidermic scales adherent at the edges. The center appears as a dull red, shining spot surrounded by ragged, undermined skin. There is a marked tendency for the papules to run together instead of remaining discrete, thus forming circular and crescentic edges, with the process of healing going on in the center. Often deep cracks develop in the natural lines and furrows and extend well down into the true skin, causing much pain and soreness. Unless these fissures are present no pain is experienced. The location of the lesion in places so much exposed to friction, pressure, and all sorts of irritation no doubt explains the chronicity of the affection. It stubbornly resists all internal medication, and improves very slowly even under vigorous local treatment. Lesions on the soles are less common, though they often exist with affections of the palms. When present, however, they are not usually so persistent, due probably to the fact that they are less exposed. When fissures occur on the soles, owing to the thickness of the epidermis they are usually deep and exceedingly painful. They may even ulcerate very extensively, and are very difficult to cure. In point of time the occurrence of this syphilide is indefinite, though it usually appears from the third to the twelfth month after infection, and may persist in one form or another to the tenth year or even later. In the early affection the lesions are usually symmetrical, but later only one palm or sole may be affected. There is little difficulty in recognizing the syphilitic disease of the palms and soles. It is so very rare that psoriasis occurs in this location that it need hardly be considered; but if found here it is nearly always present upon other parts of the body, particularly the elbows, knees, and scalp. On the contrary, we know that the palms and soles are the favorite seats of the papulo-squamous syphilide, and this may be the only skin-manifestation of the disease for years. The palmar syphilide is most often confounded with eczema. In eczema there has been at some time a history of burning and itching and discharge, which is never the case in syphilis. The patches of eczema do not ulcerate, and are more deeply infiltrated than in syphilis. Then, too, the spot of eczema usually begins on the wrist, at the back of the thumb or finger, or may begin on the dorsum of the hand, where syphilis is rarely found. Eczema is very commonly asymmetrical, which is rarely the case in the early syphilides. Syphilis begins on the center of the palms, spreads centrifugally, does not invade the dorsum, and does not burn or itch. In old cases, however, the distinctive characteristics are absent, and it is often impossible to make a correct diagnosis, even the therapeutic test being of little value, as the specific affections of the palms and soles are very obstinate in yielding to treatment.

Pathological Anatomy of the Papule.—According to Cornil, microscopic examination of thin sections of the skin reveals very clearly and distinctly the evidences in the papule of syphilis. The inflammation may

extend beyond the superficial epidermic layers. The surface of these papules is somewhat elevated, at times more or less thickened, and desquamation may have removed the most superficial layers. The connective tissue of the papillary layer is normal. There may be considerable extravasated lymph in the connective tissues around the vessels. About all the vessels of the deeper layers there is an extravasation of lymph-cells. The migration of white cells is limited, and only seen along the course of the vessels. The connective tissue of the skin is not affected, and the swelling is due simply to the effusion along the course of the blood-vessels. Hence it can be readily seen that while pressure with the fingers on one of these papules in forcing part of the blood out of the vessels causes the redness and swelling to disappear to a certain degree for the time being, as soon as the pressure is removed both conditions return. The redness does not entirely disappear under pressure. There is a faint yellow or purplish color that pressure does not affect. This is the staining due to the fact that with the escaping white blood-corpuscles red corpuscles also have escaped, and their coloring matter is deposited in the tissues. This pigment lodges in the papillary layer, and it is due to this fact that the syphilides have a yellow or bronze color. Later on this color is taken up by the cells of the rete mucosum, carried to the surface, and thrown off. The histological structure of the small acuminate papule has not been carefully studied, and can only be judged by comparing the other syphilides of papular form—namely, the mucous patch or moist papule, the large lenticular, and the one just noted. The small variety should be the same in general as the ones just described, excepting that the papillary layer is thicker. This thickening is due to a more intense inflammation of the connective tissue of the papule. These small papules probably vary in no way histologically from the papules of the roseola already described.

Large Syphilitic Papules.—Cornil removed some of the large squamous and non-squamous syphilitic papules at autopsies, and found that the elevation of the papules formed the arc of a large circle. There is a thickening of all the layers of the skin—epidermis, rete mucosum, papillary layer, and derm. The thickening begins at the borders in all layers—that is, next to the normal skin. The thickness is greater at the center of the papule. The corneous layer of the epidermis is four or five times thicker than normal. This superficial horny layer may be easily separated from the deeper layers, to which it is always attached by prolongations down into the rete mucosum at points where the hair-follicles and sudorific and sebaceous glands are located. In this way the arches which hold the corneous layer to the rete mucosum are formed. The cells between the epidermic and the dermic layer are thickened to three or four times their normal size. There are prolongations of the rete mucosum into the capillary layer, and the papillæ themselves are elongated and hypertrophied. In this case there is an infiltration of cellular elements instead of lymph along the vessels. Here the cells have permeated everywhere into the papillæ between the fibers of connective tissue. The vessels of the papillæ are dilated and filled with blood. In the larger, older papules there is not only an inflammation of the papillæ and the superficial corium, but the entire derm, and with it the subcutaneous cellular tissue, shows the effect of the inflammation. In most of the preparations of cutaneous papules there are seen a few papillæ that show a tendency to separate from the rete mucosum. There is then left a space between the papillæ and the rete. These spaces are not empty during life, but are filled with blood-plasma and numerous red and a few white blood-corpuscles. It is

important to recognize this effusion of blood in the syphilitic eruptions, as these bloody effusions show the alteration in the blood of syphilitics, the diminution of the corpuscles, and the dilatation of the vessels. The vessel-walls are changed, so that the blood-cells pass through the walls more easily. This effusion of blood gives the peculiar copper color and the various shades of ecchymoses to the syphilitic eruption due to the extravasated blood-pigment.

The Vesicular Syphilide.—This is the rarest of all forms of the syphilides, and we may well doubt its actual occurrence except among the early forms of severe inherited syphilis. It occurs in connection with bullous and pustular syphilides closely and irregularly arranged in groups. It is never found alone. Its predilection seems to be for the face, chin, about the mouth, on the forearms, buttocks, and thighs. Relapses are very infrequent. The vesicles vary in size from a pin's head to a millet-seed; they contain clear serum, and rest on an infiltrated base, which is of a brownish-red color. Unlike the vesicles of eczema, they show little tendency to run together, but rather involve the deeper layers of the skin. When larger than a millet-seed they are filled with sero-purulent fluid and are seated upon papules. This eruption is readily amenable to internal treatment. Some writers have described a similar eruption occurring during the six or eight months after inoculation and having the same general arrangement and grouping as eczema. When we bear in mind the fact that syphilitics are subject to eczema and all the skin affections the same as non-syphilitics, and that the iodides are commonly employed, and so often produce vesicular lesions, we can plainly see that supposed cases of vesicular eruptions in acquired syphilis are, to say the least, of rather uncertain value.

The Pustular Syphilide.—The pustular syphilides occur both as an early and as a late manifestation of syphilis, and present many and varied characteristics. The lesions vary in size from a pin's head to a finger-nail. They may be flat, acuminate, hemispherical, or irregular in shape. They may occur sharply localized to certain parts of the body, and show a decided tendency toward symmetrical grouping, or, again, they may be very widely disseminated. The majority of the lesions develop from a papular infiltration, but may arise from vesicles or start as minute vesico-pustules. They are usually surrounded by a dull red, copper-colored area of inflammation varying in size. This process shows a marked tendency to develop in regions where hair and sebaceous follicles are abundant.

When the pustular syphilides invade the skin early, their extension is rapid and the number of lesions numerous. Later the eruption appears slowly and in smaller numbers, but with greater tendency toward localization. The crusts are formed by the breaking down of the center of the lesion, some lesions becoming incrustated much quicker than others. As a rule, the secretion from the larger lesions dries quicker than from the small. In color the crusts vary from a reddish to a blackish brown, may be acuminate or flat, soft and friable, or thick and laminated in character; the later ones are of a greenish-black color, similar to an oyster-shell. Their consistency is firm and they are sometimes adherent. There is little, if any, ulceration under the small crusts, and their removal shows the typical papule. There is usually an ulceration under the larger ones, and thick brownish pus is abundant. Where the eruption is papulo-pustular, there is usually no destruction of tissue, though the spots may remain pigmented for some time; this more often occurs in the earlier eruptions. Cicatrices always follow these lesions, varying, of course, according to the depth and extent of the ulceration.

Marked pigmentation frequently occurs, which lasts for a long time usually, and then fades away, leaving a characteristic white shiny scar. The pustular syphilide commonly occurs in weak and debilitated persons and those whose surroundings and mode of life are of the poorest. The strumous and cachectic and those weakened by alcoholism and debauchery are particularly liable to eruptions of the pustular syphilide. It may be of short duration and mild in type, or, conversely, it may be very rebellious to treatment and of great significance. Its early appearance in a severe form presages a bad type of syphilis. The pustular syphilides, for convenience in description and diagnosis, are best divided into four forms, known as the small and large acuminate and small and large, flat pustular syphilides. The small acuminate or aeneiform syphilide is usually widely diffused and situated around the hair-follicles and sebaceous glands. It consists of conical or partially rounded pustules, varying in size from a pin's head to a millet-seed. Sometimes these lesions constitute the whole eruption, or they may occur with acuminate papules or macular syphilides. When they occur in the early secondary stages as a general eruption, they may be accompanied by a marked febrile disturbance; in fact, the highest noticed in syphilis. Pyogenic organisms undoubtedly play an important rôle in this eruption, a condition which is favored by lack of personal cleanliness. The eruption begins as a papule, but, owing to the intensity of the inflammation, may rapidly become vesicular and pustular, the process reaching its height and the lesions becoming fully developed in from twenty-four to forty-eight hours. In this case the pustules are generally widely scattered. Where they are more slowly developed they begin as papules, and for several days may appear simply as small papules with minute vesicles at the apex, which become purulent. This purulent secretion soon dries, forming a scab of a reddish or yellowish-brown color. The crust on falling leaves a small, punched-out, pigmented cicatrix. Both of these conditions eventually disappear. The appearance of this form of eruption is also attended with fever, the temperature rising gradually and in some cases remaining elevated for some time. In the first variety the rise in temperature is sudden. In cases not treated and in badly-nourished individuals the pustules may become small ulcers. This eruption usually begins about the face, neck, and scalp, and then spreads to the trunk and extremities. It is most abundant on the outer aspect of the thighs, about the shoulders, and over the sternum and buttock. The earliest eruption is usually the most abundant. The later attacks show a greater tendency toward grouping and circular distribution. This eruption occurs as one of the early lesions, but may appear later. When it recurs, however, it does not come in its original form, but the lesions are deeper and tubercular in character. On the scalp the hair usually falls from the affected follicles, but is generally restored. Rarely this is not the case, and a small cicatrix is formed.

The Large Acuminate Pustular Syphilide.—The large acuminate pustular syphilide has the same seat as the form just described, but the lesions are from two to five times as large, and seated on a reddish or copper-colored, very slightly thickened base. The pus may form slowly or rapidly, and dries to a reddish or brownish scab, beneath which there is slight ulceration. These syphilides usually arise from a macular or small pustular lesion, rarely from a true papule, and are generally few in number, being either disseminated or grouped. They are found upon the scalp, face, shoulders, and chest, and other syphilitic lesions are usually present. As a rule, there is no febrile disturbance connected with their appearance. The crusts fall,

PLATE 10.

Tubercular syphilide.



leaving pigmented spots. Sometimes one crop of pustules follows another, so that this eruption may last several months. Its course is generally modified by treatment, subsequent outbreaks being prevented. This eruption in weakly individuals or when untreated often ulcerates deeply and reduces the person to a state of profound cachexia. This eruption runs a slow course, usually with considerable febrile disturbance, and is often encountered when treatment has been insufficient or discontinued too soon. Chronologically, this syphilide seldom appears earlier than the fourth or fifth month, and it may be seen as late as the second year of the disease.

The Small Flat Pustular Syphilide.—This manifestation of syphilis is seen quite frequently, and is usually found upon the face, scalp, trunk, and the flexor surfaces of the extremities and grouped about the mucous orifices of the body, where it shows a decided tendency toward a characteristic circular arrangement. It consists of small flat pustules springing from macular lesions, which tend to dry in irregular, flattened, adherent crusts. These crusts often spread beyond the diseased or ulcerated area or show a border of inflamed, brownish-red, dull-looking skin. The pustules may be situated so near each other as to become confluent. There is usually an ulcerated and often indurated base beneath the crusts of this syphilide, especially in weakened and debilitated individuals, or it may spread out superficially, forming serpiginous lesions. A favorite seat for this variety is the face, about the alæ of the nose, along the chin, in the beard, the anterior surfaces at the flexors of the wrist and elbows. The lesions are pustulo-crustaceous, and develop from either macules or papules. This manifestation of the disease usually yields fairly readily to judicious treatment. In neglected cases it may spread peripherally, attacking the sound skin and forming cicatrices in the center, or the outbreak may be so slight that almost no change results in the skin of the affected area. This affection occurs not before the latter part of the first year of the disease. It resembles at times pustular eczema, but the ulceration, the manner of formation of the lesions, and the history of the case will distinguish the two diseases. Besides the superficial, serpiginous lesions already mentioned, there is another condition which attacks the tissues more deeply, with loss of substance and the formation of cicatrices. This is commonly known as the tubercular, serpiginous syphilide. This is apt to run over large areas superficially; however, it does attack the deeper structures. Where this takes place there is a narrow, sharply-defined areola of redness; the crusts are uneven and piled up. Beneath the crusts the process extends, and, instead of the superficial grayish ulceration, there is a deep, clean-cut, uneven ulcer, bathed in secretions and of a dark-red color. If the crusts are removed, they rapidly form again, and often remain adherent until the healing process is completed. There seems to be a greater destruction of tissues about the face than elsewhere, the best examples in neglected cases being seen on the hairy scalp and about the alæ of the nose. In favorable cases healing takes place beneath the crusts, leaving a dark-red, scaling, pigmented cicatrix. This form of the eruption runs a very slow, prolonged course. In certain cases there is a tendency for the pustules to become confluent. When this condition takes place the lesion attains considerable size by the formation of new pustules about the outer edge of the affected area. This occurs in the shape of an elevation about the margin of the original crusts. The purulent ring is soon crusted over. In this way the central nucleus of the diseased area is enlarged. It may go on extending in all directions or only one or two; that is, it may advance in one direction in the manner just described, and be followed by

the healing process. In this way a reniform or serpiginous appearance results. This condition may extend over large areas, sometimes invading one-half the face or large sections of the scalp.

Large Pustular Syphilide.—The general appearances of these lesions are like the foregoing, variations taking place in the size and depth of the ulceration. The superficial, large, pustular eruption is one of the late secondary manifestations. This eruption shows a decided preference for the lower extremities, but may occur on the buttocks, sometimes on the neck, and very rarely on the trunk. The deep variety is also generally a late manifestation, excepting when it occurs in so-called malignant syphilis, when it appears early. It is the most formidable of the pustular syphilides. This also is usually found upon the lower extremities, but may appear on the shoulders, arms, and trunk. The pustules in the superficial variety develop on a reddened base, with an area of infiltration surrounding it. The pustules contain a puriform exudation, turbid and often mixed with blood. The covering of the pustule is very thin and soon breaks in the center, and then the contents dry and a brownish-black crust forms, under which the ulceration goes on. This process involves only the superficial layers of the skin. If the crust becomes detached and eroded, papular elevation remains. This may take place several times before the diseased spot is healed. Pigmentation usually exists for a long time. In the deep variety there is a more decided infiltration of the base, the destructive process is deeper and more extensive, and the crusts are more of the oyster-shell, piled-up variety, while the zone about the region is of a much brighter red. After the infiltrated area has undergone retrograde change and the lesion is completely healed, a permanent scar remains. The ulceration goes on under the crust as in the former variety, the ulcer having a distinct, punched-out appearance, the cavity secreting a purulent, blood-mixed fluid, which rapidly dries, forming thick, heaped-up crusts. Sometimes the ulceration extends beyond the margin of the crust, which soon becomes surrounded by a zone of pus. In this form of syphilide repair takes place slowly. The secretion thins, the edges of the ulcer become worn away, the floor of the ulcer becomes covered with healthy granulations, and the lesion clears up, although the crusting may persist until the ulcer has completely healed. These lesions always leave scars, which are at first reddish, surrounded by a copper-colored ring. Later, the cicatrices become a shiny white and are very persistent. These characteristic scars show clearly the nature and extent of the destructive process. When the ulcers are discrete they generally have a rounded contour. When they have coalesced or extensive areas have been involved, the ulcerative process is usually of an uneven depth, and hence a partial or complete destruction of the skin results, giving it a peculiar and characteristic appearance. In point of time this is not an early manifestation of syphilis. While this eruption may be most malignant in character, it is usually amenable to treatment, although in weak or debilitated individuals it often runs a very severe course.

Pathology of the Pustule.—According to Kaposi, the area of infiltration is sharply defined, very dense, and extending through the entire capillary area, with varying depth, into the corium, and occasionally going as far as the subcutaneous connective tissue. It is made up of formed elements, which, according to their age, progress either toward absorption or supuration. In the pustular syphilide the two modes are combined in such a way that the external appearance of the lesion is pustular. Only in the superficial layer of the syphilitic papule is the pus produced which elevates the epidermis in

the form of a pustule. The process of suppuration does not extend deeper into the tissue even where it spreads beyond its original boundaries. As in the papulo-squamous forms, the greater part of the infiltration is absorbed. There is only a slight histological difference between the structure of the large and small pustular eruptions and the rupial syphilide. In the first two the lesion includes a hair-follicle. If pus is produced, it is formed in the most superficial layers and in the rete mucosum, and the pustule will appear not only around, but within, the hair-follicle. In going from the papular to the pustular syphilide various transitional stages of the process will be met. In the large form of pustular eruption which precedes the formation of the rupia the histological change is very simple. Although the process extends over a greater area, it rarely extends deeper than the middle layers of the corium. The most essential feature is the occurrence of distinctly outlined, very granular, opaque, nucleated pus-cells and free nuclei in the uppermost layer of the corium, rete, and papillary layer, enclosed in an edematous, large-meshed tissue. Over this the epidermis bulges, thus forming the covering of the pustule. This condition corresponds to the acme of the process for every single patch in the diseased area, varying according to the age of the local disease.

The Bullous Syphilide.—The bullous syphilide described by many authors hardly deserves to be called a special type, since the bullæ undergo purulent transformation and are followed by crusts, beneath which an ulcer forms as in the large, flat, pustular syphiloderm. The lesions usually have a characteristic dull-red halo about them, and are discrete, rarely scattered over the body. The steps in their development are almost identical with the large, flat, pustular eruption. The seat of predilection seems to be the lower extremities. It is most commonly seen in the eruptions of the inherited disease or late in the acquired. The lesions vary in size from a split pea to a pigeon's egg. The underlying ulcer is usually superficial. In some cases no change in the skin is produced. In cachectic individuals and those without treatment the ulceration extends in depth and area, and the crusts developed may strongly resemble rupia. It is said that these bullæ only occur late in syphilis, and those cases even only in individuals who have had visceral lesions and repeated severe relapses of the disease. It is impossible to distinguish the bullous syphilides from pemphigus by the lesions alone. This point can only be determined by the previous history, the presence of other syphilitic lesions, etc.

The Rupial Syphilide.—Of the syphilitic skin lesions, this is one of the most characteristic, and may even be called pathognomonic. The beginning of the lesion may be a bulla containing blood-stained serum or it may be a flat pustule. A bright zone of inflammation surrounds the lesion. In either case the covering is soon ruptured, and the contents dry into a greenish-brown scale or crust. Ulceration goes on under this crust, gradually advancing toward the periphery, and the crust is pushed slowly up by the new formation beneath. This gives it the characteristic stratified appearance, each new stratum being larger in area than its predecessor. The size of the original ulceration is shown by the size of the uppermost layer of the crust. This syphilide, like the superficial papular, may extend more rapidly in one direction, thus giving it an irregular or crescentic, or perhaps horseshoe, shape. The piled-up crusts are of a grayish or greenish-brown color. It is not uncommon for the ulceration to advance slowly in a serpiginous manner, and for the crusts to be knocked off or removed by mechanical violence. In this case an indolent-looking ulcer, with clean-cut, undermined edges, secreting a

thin, serous pus more or less mixed with blood, is relieved. When the process of repair has begun the crusts fall, the floor of the ulcer assumes a more healthy appearance, and scar-tissue begins to form. The scars left by the rupial eruption are smooth, white, and shiny. Rupia runs a chronic course, successive crops of ulcerations sufficing in some cases to carry it over a period of several months. It usually occurs as a late secondary manifestation of the disease, but in weak and debilitated individuals it may occur quite early, in which case it is ordinarily attended by fever. Occasionally rupia is seen as a general eruption, though it rarely occurs on the face, neck, and extremities. The lesions are not very deep, and the larger the lesions the smaller their number. When once seen the characteristic appearance of the crusts will never be forgotten. The so-called late, secondary, rupial, or small and large pustular eruptions all have the same general characteristics; that is, they affect the deep layers of the skin and undergo the same general retrograde change, resulting in scar-tissue formation. Their distinctive feature is ulceration, which is common to them all, though they differ very materially in the way in which they begin. They all indicate a severe form of the disease.

The Gummatous and Tuberculous Syphilide.—Tubercles and gummata of the skin are the latest and deepest cutaneous manifestations of syphilis. Tubercles and gummata have striking resemblances, since they come at the same time and represent the same pathological changes and have the same clinical significance. Their chief points of distinction lie in the fact that the tubercles are not so deep as the gummata in their involvement of the subcutaneous tissue, while they show very much less marked cellular infiltration. The tubercular syphilide has been spoken of as being intermediate, pathologically, between the papule and gumma. It first appears as a small flat papule, with the entire skin indurated—that is, from the superficial to the deeper layers. They commonly appear in groups, isolated and few in number, or in some cases they may be diffuse and scattered over the whole body. They occur in two varieties, the dry and the ulcerated. The former are usually raw ham-colored, and are arranged in rings or segments of rings. Their usual seat is on the face about the nose and mouth, near the ears, on the forehead and back of neck and the lower extremities. There is usually no ulceration present, though the lesion is covered thickly with scales amounting almost to crusts. They undergo resolution, with a resulting cicatrix, which may either be white or pigmented. This process is slow, and a long time is required to bring about repair. Infiltration of round-cells and their transformation into cicatricial tissue takes place the same, though more slowly, as in any form of granulation.

The Ulcerative Tubercular Syphilide.—This is a much more serious lesion, on account of the extensive suppuration caused by it. Like the former, it may occur in groups or isolated, oftentimes extending over considerable areas of the skin. About the face the tubercles are often prominent, bright red, and cause much swelling. These lesions differ from the ones just mentioned chiefly in the manner in which they disappear—the former by interstitial absorption under an intact or simply inflamed skin, the latter by a central softening: the skin covering this part thins, breaks down, and an ulcer results, which discharges a thick, yellow matter. This dries into grayish- or greenish-black crusts. The edges of these ulcerations are clean cut, hypertrophied, and inflamed, and the process extends deep into the tissue. In depth and size of affected area the ulcerations differ considerably. Perforation, phagedena, or a serpiginous condition may be present. Upon the location of the lesion and the extent of the inflammatory complication the gravity

PLATE II.



Tubercular syphilide with new and old scar-tissue.



of the tuberculo-ulcerous syphilide depends. As has already been said, it is by far the most common on the face and about the alæ of the nose; also over the scapulæ, the neck, and extremities; about the bend of the elbows, on the dorsum of the hands, about the knees, and on the extremities it shows itself by preference. The process advances, both by the enlargement of the ulceration and the development of new lesions, which coalesce and tend to group themselves in a circular form. On the nose perforation of the alæ not infrequently occurs, while destruction of the septum and bony framework of the nose may take place, often causing considerable deformity. Should the inflammation take on a phagedenic or necrotic form, the destruction is rapid and may be very extensive; for example, the whole nose, lips, and part of the cheek may be destroyed in a very short time. Extension commonly takes place by serpiginous ulceration. This is seen more often about the face, but may occur at any part of the body. The morbid process begins with one or more isolated tubercles grouped about a large tubercle, usually in a circular form. Ulceration takes place, crusts are formed, and healing commences in the center, while extension proceeds at the periphery by the development of new tubercles. In this way the morbid process strikingly resembles lupus, and has sometimes been incorrectly called syphilitic lupus. As the process of repair goes on the crusts fall and a more or less reddish scar is revealed. The color of the scar finally changes to a silvery white; it becomes shiny, and more or less depression exists according to the depth of the destructive process. In regard to the time at which this form of syphilis may develop there is a wide range. It rarely occurs before the third year, but may appear as late as the fifteenth year or even later.

Differential Diagnosis of the Tubercular Syphilide.—The tubercular syphilide may be mistaken for the large papular eruption of syphilis, but the distinction is made by the earlier appearance and more rapid course of the papular lesion. The manner of retrogression is also different. The papule flattens, shows a tendency to scale, or may, in fact, have repeated attacks of desquamation. The tubercle, however, rarely loses its globular shape, does not become eroded, and undergoes resolution, leaving pigmentation. Of the non-specific affections likely to be mistaken for syphilis, the greatest difficulty is found in lesions of the hands and face. Palmar psoriasis is mentioned as being one of the likely lesions on the hand to be confounded with the tubercular syphilide. True psoriasis, however, is so extremely rare on the palms that it need not be considered, and when found on the palms is present on some other part of the body. Palmar eczema is of more importance. However, this is attended with more scaling, fissuring, burning and itching, and a serous exudation. The edges of the diseased area are not so sharply defined, and the process tends to extend beyond the palm. On the face lupus vulgaris is perhaps the most likely to cause confusion, especially when the syphilide is localized in places known to be favorite seats for lupus. Not only do they resemble each other in location and analogous morbid processes, but in the manner of retrograde changes. Both may undergo an interstitial atrophy and pass away and never openly ulcerate. Both also may extend peripherally by the development of new tubercles and taking on a serpiginous course. Lupus is much slower in its development, however, as it usually appears before puberty. There is a difference in the color of the lesion. The tubercles of lupus are more of a pink color and less defined in outline, with an area of inflammation about them which shades off gradually into healthy skin. The ulcers of lupus are more indolent, painless, and bleed easily, while the secretions are less, and hence the crusts are less abundant.

The healing process is slower in lupus, and the scars left are puckered, thick, and hard, unlike the smooth, shining, and often depressed scars of syphilis. However, with these differences it is often very difficult to make an absolute diagnosis, as, for instance, when the nose is the seat of the morbid process. Both cause loss of tissue and deformity. Lupus, however, begins on the outside and extends in, and may destroy the cartilaginous septum, but does not destroy the bone. Syphilis, on the contrary, not infrequently begins in the bone, and then attacks the soft parts, and the entire organ may be thus destroyed. The offensive condition known as specific ozena is generally present. Acne rosacea tuberosa may be confounded with the tubercular syphilide. The syphilitic lesions are smooth, glassy, firm, and clearly marked in outline. In acne the nodules are less clearly defined, and are situated in an area of thickened and reddened epidermis among dilated capillaries. In acne the destructive degenerative changes of syphilis are never present.

Epithelioma and leprosy must also be borne in mind. When epithelial disease is situated on the face and nose, the lesion is usually single, the edges of the diseased spot being hard and everted. The base is often granulating and of a fungous character. This disease occurs in the aged, accompanied by local glandular enlargement and more or less grave cachexia. Leprosy, when of the tubercular variety and situated about the forehead, face, and ears, resembles syphilis. The syphilitic nodules are never so large, are harder, and less protuberant. In leprosy anesthesia is present in the center of the tubercle and over a small area around it.

Pathology of the Ulcerative Tubercular Syphilide.—Kaposi describes this lesion as differing histologically from the papule only in the depth and extent of the area of the cellular infiltration. Otherwise, the same perishable elements go to make up the infiltration, and show in the older (central) portion the same dusky, granular opacity, while those cells at the periphery still show a nucleus, and are capable of being stained with carmine, and have a normal granular protoplasm. The papillæ and the peripheral portion of the tubercle are well preserved and are distinctly marked from the mucous layer. In the older, atrophic portions the demarcation between the rete and the papillæ becomes indistinct. The infiltration extends from the papillæ into the rete mucosum. The latter then becomes narrower, and is finally altogether wanting when the cell-infiltrated corium is laid bare by the beginning ulceration. Up to this point the appearance does not differ from that of an initial sclerosis or a superficial exulcerated papule. As the ulcerative process advances there is a loss of substance, varying in depth, but which, under the microscope, has the same general appearance as it has to the naked eye. The depth and extent of the process is determined by the cellular infiltration. In case the tubercle is gummatous the process will extend deeply into the subcutaneous tissue, and may closely surround the included structures, glands, and follicles, extending in between the fat-globules, and may follow along the course of the vessels beyond the infiltrated area, though it is usually pretty sharply defined. Back of this wall the cellular infiltration of the gummy node is to be recognized. This layer is evidence of the advancing necrosis of the specific infiltrated tissue, and gives the surface of the ulcer the well-known unclean, lardaceous appearance.

The Gummatous Syphilide.—The term "gummatous" was formerly restricted entirely to specific disease. Now it is sometimes applied to some forms of scrofuloderma.

A gumma is a collection of cellular infiltration in the subcutaneous tissue, due to syphilis. It is practically a solid nodular tumor, more or less sharply

defined, situated deep down in the connective tissue, and may even involve the deeper structures, such as the muscles, bones, etc. These tumors are painless, not tender to the touch, and grow slowly. The skin glides freely over them at first, but later it becomes involved by a secondary ulceration. Occasionally, when treated, it undergoes absorption, suppuration in this case not taking place. Ulceration is the more common outcome, in which case it begins by a central softening, and then the process involves the overlying skin. This becomes of a reddish or purplish hue, with an area of hyperemia about it. Finally, the skin gets thinner and thinner, and then gives way in one or more spots, and a thick, sanious, gummy discharge takes place. In cases where there has been active inflammation the secretion may be partly or wholly purulent. When this condition takes place, not only the contents of the tumor, but the tissues of the periphery, take part in the suppurative process, so that the entire new growth is completely destroyed. Then we have an ulceration, the size and shape being dependent upon the extent of the gummy infiltration and the manner in which it is broken down, so that we may have an oval, round, branching, or irregular-shaped ulcer, remaining with sharply-defined, clean-cut edges as though punched out. There is usually considerable round-cell infiltration in the edges of the ulcer, and surrounding this an area of hyperemic skin. Inasmuch as all the gummatous new growth undergoes the breaking-down process, the depth of the ulcer depends upon the depth of the cell-infiltration. These lesions run a variable course, depending largely upon the treatment they receive, though surgical interference is rarely necessary. Sometimes they run together, and in this way very extensive areas may become involved, and a profound cachexia results; or they remain in an indolent condition for a long time, discharging foul secretion and showing very little tendency toward repair. The tissue of a gumma during its early stage feels moderately firm, is of a reddish color, and quite vascular. Later, as it gets firmer and denser, it loses its color and takes on a dry appearance. This change is due largely to diminution and obliteration of its blood-supply.

In order for repair to take place in the gummatous syphilide it is necessary completely to remove the new-growth tissue. To bring this about as speedily as possible, active local and constitutional treatment must be instituted. This process of repair is very slow in some cases, especially when the tissues overlying the muscles have been destroyed. When proper treatment is carried out the discharge becomes less foul, the floor of the ulcer cleans up, healthy granulations appear, and the process of cicatrization begins. In certain cases the granulations become exuberant, the same as in any other area of granulation-tissue. After healing has taken place the areola of pigmentation and the purpling or bronzing of the skin remain: these may not disappear for several years. Gummatous ulcers leave scars which vary according to the depth of the ulceration. If the ulcer was superficial, a slightly sunken, thin, parchment-like cicatrix, of a perfectly white color, remains. The scars from the deep ulcerations may be very much depressed, being bound down by fibrous bands. When the lesion is seated over a bone and the periosteum has been involved in the ulceration, the scar may become very firmly adherent to the bony structure. In other cases, where there has been extensive erosion of the bony structure, there is no formation of scar-tissue, the space of the eroded tissue being filled in and about with fibrous tissue-bands. The locations attacked by the gummatous syphilide are the scalp, face, especially about the nose and mouth, and also on the neck. The lesions are seen oftener on the back of the trunk and extremities than on the front.

The syphilide shows a preference for localities where there is abundant loose connective tissue ; hence it is rarely seen on the palms and soles. It is more apt to be found about the joints on the extremities, and is seldom found on the lower part of the belly. The lesions of this syphilide undergo certain modifications according to the part of the body affected. About the scalp they lose their freely-movable and sharply-defined characteristics, involve the whole thickness of the integument, and may quite early adhere to the bones beneath. The ulcers may also lose their characteristic appearance by developing phagedenic and serpiginous changes. It is not uncommon for the ulcers on the scalp to become infected with the streptococci of erysipelas, and in this way a serious complication arises. Gummatous lesions of the upper extremities show little out of the ordinary course. When situated over nerve-trunks severe neuralgic pain may be caused. These lesions occur on the hands and fingers near the joints, but do not involve the articulations. The lesions may resemble dactylitis in the swelling and deformity they produce. Gummata rarely develop before the third or fourth year after infection, and may occur at any time after that, even as late as thirty or forty years. Roughly speaking, individual lesions run a course of from thirty to fifty days, and, as a rule, are amenable to treatment. When seated upon the legs the question of diagnosis is the chief interest. When they occur upon the leg they are usually upon the upper and middle third, while simple ulcers are more apt to occur upon the lower portions of the leg and over the bony surfaces. When gummata occur on the thighs, they are apt to be very large. They are to be distinguished from lipomata, fibromata, and sarcomatous tumors. It should not be difficult to establish their correct nature by the rapidity of their growth, location, and the presence of scars of previous eruptions, together with the syphilitic history.

Pathology of the Gumma.—The structure of the gumma has been studied by all pathologists as the most characteristic production of syphilis, whether found in the skin or viscera. According to Cornil, when a section of skin covering a gumma is examined with a low power it is seen to be slightly elevated by the accumulation beneath, but the structure above, consisting of the epidermis and capillary layers, is intact. The new growth begins in the adipose globules of the derm, and then invades all the deep portions, as well as the loose subcutaneous cellulo-adipose tissue. At this stage the growth is sharply limited, although it gradually merges into sound skin. At the margin of a gumma the connective-tissue fibers are separated by rows of round cells, and the ducts of the glands are also surrounded in a similar way. The pre-existing cellulo-vascular tissue is thus infiltrated, and the enormous number of cells present strangle the normal tissue and impair the circulation. There is a collection of round-cells and detached endothelium within the capillaries and venules. Their lumen also often shows granular coagulation of fibrine. These coagula are caused in all severe inflammations by a modification of the vascular wall. This allows the escape of the corpuscles ; the cells of the endothelium swell, the circulation is interfered with, the lymph-cells are arrested, and then the coagulum forms. During the period of softening the cellular elements become granulo-fatty, the tumor becomes less dense, the superficial layers of the skin become infiltrated with the same cellular elements, and become actually inflamed and are finally perforated. Perforations of the upper layers having taken place, the fluid and solid portions of the gumma are slowly discharged. This process goes on very slowly, and may last a month or even two months after the skin is broken.

SYPHILIS OF THE BONES, JOINTS, BURSÆ, TENDONS, AND MUSCLES.

BY LEWIS C. BOSHER, M. D.

OSSEOUS lesions due to syphilis may be regarded as the most common, important, and frequently the gravest effects of the late stage of this disease. Though syphilitic osseous affections occur oftener, and the changes are more pronounced and characteristic in the tertiary stage, yet they may be met with in any period of the malady. Mauriac has reported cases of large cranial nodes and periostoses due to specific inflammation of the bones and periosteum, occurring shortly after the appearance of the initial lesion, even before the first cutaneous eruptions were noted. Pains in the bones of a rheumatoid or neuralgic character often precede or usher in the first symptoms of secondary syphilis. In the early stages of the disease the osseous lesions are exhibited in the form of inflammation of the periosteum or periosteal nodes, which are observed most frequently in the cranial bones and the tibiæ. These swellings readily disappear under appropriate treatment without leaving any trace. Later in the disease gummatous infiltrations and circumscribed deposits may occur, either in the periosteum, between it and the osseous tissue, in the bone-substance, or in the medulla.

The determining cause of bone affections in adults, in both the early and the late stages of syphilis, is generally some form of traumatism, and the frequency of these lesions occurring in bones, such as the tibia, clavicle, and those of the cranium, which are exposed to contusions and injuries, has been noted.

Again, any disease that lowers the vitality of the patient may serve to precipitate the tertiary lesions.

The pathological changes of the osseous structures due to syphilis have been described by Cornil as (1) simple osteo-periostitis; (2) rarefying osteitis; (3) intense rarefying osteo-mylitis or gummatous osteo-periostitis. From these different states result formative osteitis or eburnation, the exostoses, the necroses, and the sequestra.

Simple Osteo-periostitis.—This form attacks the superficial layers of bone and the periosteum, and, aside from causation, does not differ materially from ordinary osteo-periostitis. Any portion of the skeleton may be affected, but the tibia, ulna, clavicle, sternum, and cranial bones are more frequently involved. This lesion is usually observed at the end of the secondary or in the tertiary stage of the disease. There is an increased vascularity of the parts, and beneath the periosteum, between it and the underlying bone, numerous round-cells similar to those of embryonal marrow collect, producing oval swellings which shade off into the surrounding tissues. These tumors vary in size from a pea to an egg, and are designated syphilitic nodes. Beneath the periosteum the superficial bone presents the enlarged Haversian canals filled with marrow. There is usually some inflammatory edema of the surrounding connective tissue of the periosteum. Nodes are attached to the

bone, but not to the integument—are usually smooth, fairly well defined, somewhat elastic to the touch, sensitive to pressure, and, at times, exceedingly painful, the pain being invariably increased at night. The pain is of an aching, boring, or crushing character. The nocturnal exacerbations of the pain of osseous lesions in syphilis have been attributed by Ricord to the warmth of the bed-clothing increasing the circulation of the blood through the capillaries of the surface. In some cases the pains are as severe during the day as at night. The shafts of the long bones, especially the superficial ones, as the tibia, clavicle, and ulna, are the seat of these pains, although the cranial bones are also sometimes affected. During the existence of the nodes the affected bones are generally markedly sensitive, and the slightest pressure or manipulation will produce exquisite suffering. The nodes can be readily felt as irregularities or flattened elevations by passing the fingers over the diseased bone.

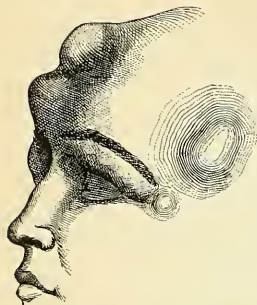


FIG. 208.—Syphilitic nodes of the skull (after Jullien).

Five cases of nodes of the hyoid bone in the course of syphilis have been recorded by Elliot. The chief symptoms described by the patients were severe



FIG. 209.—Syphilitic exostoses of the vault of the skull.

pain in swallowing or speaking or from certain movements of the neck and head.

Epilepsy or paralysis may occur as the result of the pressure of a node

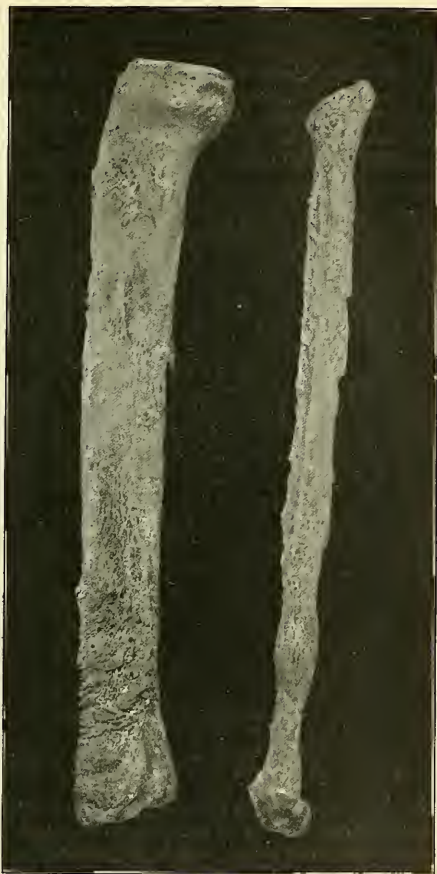


FIG. 210.—Syphilitic thickening of the tibia and fibula, with abundance of exostotic growths.

upon the inner table of the skull, or paraplegia when the node appears in the spinal canal. Nodes are well shown in Fig. 208.

Under prompt specific treatment nodes generally disappear, but if neglected the skin becomes reddened, thinned, and adherent to the growth, which, breaking down at the center, leaves a typical syphilitic ulcer with necrosed bone at

the base. The diseased bone comes away and an adherent cicatrix is the result.

Rarefying Osteitis.—In this process the inflammation increases in intensity, and there is a formation in the subperiosteal tissue, marrow-spaces, and Haversian canals of small round-cells and transuded blood-corpuscles, which resemble granulation or young marrow-tissue. With an increase of this cell-exudation the osseous trabeculae become thinned and eventually absorbed. Following the absorption of the osseous tissue there is an enlargement of the Haversian canals, and, when marked destruction of the osseous trabeculae occurs, a communication from one Haversian canal to another may be made, inflamed marrow taking the place of the osseous tissue. In response to treatment, or in the natural course of the disease, there is a tendency to repair, a

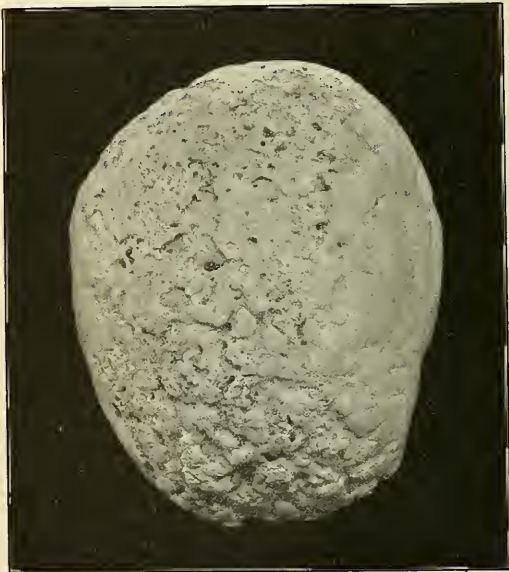


FIG. 211.—Syphilitic thickening, exostoses, and perforation of skull.

formative osteitis occurring in which new osseous tissue is developed, resembling normal bone-formation. In a more advanced stage the formative osteitis may involve the bone proper and cause a sclerotic hardening, the induration being as dense as that of ivory. This process is termed eburnation or condensing osteitis. The new bone-formation may take place beneath the periosteum, between it and the bone, in the bone proper, or within the medullary cavity. Small elevations of the surface without any considerable thickening of the bone are named osteophytes; more defined growths are exostoses; a general enlargement of a whole bone is termed a hyperostosis. Well-marked cases of exostoses and hyperostoses are shown in Figs. 210 and 211, which, by courtesy of Dr. D. L. Huntington, Deputy Surgeon-General

U. S. A., were photographed from specimens in the Army Medical Museum at Washington. Fig. 209 shows a syphilitic exostosis of left side of vault of skull. In Fig. 210 the right tibia and fibula present irregularity and general thickening of compact tissue, with abundance of exostotic growths. Sometimes the growth projects and appears to be superadded to the bone, as the epiphysis of a long bone, and, being movable upon the bone beneath, is known as an epiphysary exostosis. Occasionally the syphilitic exostosis is the result of an osteitis that terminates in hypertrophy of the normal bone,



FIG. 212.—Syphilitic caries and perforation of frontal bone.

forming what is known as a parenchymatous exostosis. Exostoses springing from the inner table of the skull or occurring in the spinal canal may, by pressure upon the brain, cord, or nerves, give rise to various forms of paralyses, convulsions, and neuralgicæ.

Gummatous Osteo-myelitis and Gummatous Osteo-periostitis.

—In these conditions we have a rarefying osteitis in which the very abundant subperiosteal embryonal tissue or the medullary tissue assumes the arrangement observed in the gummata. The lesions are seen in the form of tumors, varying in size and having a tendency to become caseous during some period of their evolution (Cornil). The gummatous deposit may take place in the

medullary canal, in the substance of the bone, or under the periosteum. The medulla being first attacked, the condition known as osteo-myelitis results. A gumma of bone is a localized intense osteo-periostitis, the osseous lamellæ being destroyed by a rarefying osteitis. It is a very much more serious trouble than osteo-periostitis. The cranial bones, especially the frontal or the parietal, may be attacked, the gummatous deposit occupying the diploë. The two tables of the skull are thus separated and caries or necrosis results, with frequently a perforation either externally or internally. In this manner one or more of the cranial bones may be riddled with holes or marked with pit-like depressions. A syphilitic periostitis or a syphilitic pachymeningitis, with an accompanying loss of the cranial bones between the two, due to a rarefying osteitis, is a quite common condition in the late stages of the disease. When many distinct foci of disease coalesce great destruction of tissue may occur, resulting sometimes in the almost entire loss of one or more cranial bones, thus exposing the dura mater. Figs. 211 and 212, photographed from specimens in the Army Medical Museum, exhibit thickening, exostoses, ulceration and perforation of the skull, and syphilitic caries and perforation



FIG. 213.—Destruction of facial bones due to syphilis.

of frontal bone. These lesions are chiefly limited to the cranial and facial bones, though the long bones may be similarly affected. Cases have been recorded in which almost every piece of the skeleton was involved, either simultaneously or successively, with either nodes, caries, necroses, or exostoses. When the bones of the face are attacked by gummatous osteo-periostitis, the periosteum becomes stripped from the bone and a necrosis and exfoliation of bone result. If the nasal and palate bones become involved, the nasal and oral cavities are frequently thrown into one. Necrosis nearly

always follows syphilitic involvement of the nasal bones, producing the peculiar deformity of the flattened nose, due to a prominence of the lower soft parts and a sinking in of the upper portion of the nose. Destruction of the bones of the face is well shown in Fig. 213. An involvement of the superior maxillary by gummata is sometimes followed by an almost entire destruction of the bone. Occasionally the disease may attack the bones of the base of the skull, causing delirium, coma, and death.

Diagnosis.—Bone-syphilis in the acquired form of the disease is ordinarily readily recognized. The location and form of the lesion, the nocturnal pains, demonstration of previous or existing syphilitic history, and the therapeutic test will aid in establishing the diagnosis. The differential diagnosis between syphilitic osteitis and tuberculous osteitis is well shown in the following table, arranged by Simes and White :

SYPHILITIC OSTEITIS.

TUBERCULOUS OSTEITIS.

Syphilitic osteitis occurs in persons in varying physical conditions.
 Begins most frequently in the periosteum.
 Tends to the formation of new bone or to necrosis.
 Is often unaccompanied with suppuration.
 Does not involve neighboring articulations.
 Frequent in bones of the cranium.
 Histologically, consists of a relatively large mass of granulation-tissue.
 In the majority of cases can be cured, or at least arrested, if taken in time, by judicious specific treatment.

Osteitis of tuberculosis in persons who have other symptoms of this disease.
 Begins in the medulla.
 Tends to disintegration of the parts.
 Generally terminates in the formation of pus.
 Apt to do so.
 Almost never found in this situation.
 Made up of a varying number of tubercle-granulations and surrounded by isolated granules.
 We know of nothing which materially affects the course of this disease.

OSSEOUS LESIONS OF HEREDITARY SYPHILIS.

Lesions of the bones frequently occur in hereditary syphilis, and constitute one of the most important, constant, and characteristic symptoms of the disease. Syphilitic affections of the bones have been thoroughly investigated by Wegner, Waldeyer, Köbner, Parrot, Cornil, and Taylor. The bones are found to be more frequently affected in the inherited than in the acquired form of the disease. Out of 212 cases of late hereditary syphilis, Fournier reported the bony lesions as occurring 82 times. The pathological changes in young infants are usually concentrated at the diaphyso-epiphyseal junction of the long bones, forming an osteo-chondritis, while in well-grown children and young adults they are exhibited as a periostitis or an osteo-periostitis.

Osteo-chondritis.—In the growing infant the epiphyses of the long bones are united to the shafts by a narrow layer of cartilage, and here the growth in the length of the bones takes place. This cartilaginous layer, the zone of proliferation, is the seat of the most frequent syphilitic changes. The bones most notably affected are those of the forearm, the leg, the arm, and the thigh, though the clavicle, sternum, metacarpal, and metatarsal bones may also be involved. This inflammatory process is caused only by syphilis, and is a constant manifestation of the inherited form of the disease. It may occur as early as the first months of the disease or as late as the twelfth year. In the living subject this lesion is seen as a swelling at the junction of the diaphysis and the epiphysis, more frequently at the distal than the proximal extremity of the long bones. The tumors are smooth and globular, and form

in some cases a ring or collar which usually extends completely around at the diaphyso-epiphyseal junction. Occasionally the whole epiphysis is enlarged with or without the ring-formation at its junction with the shaft. These swellings, appearing soon after birth, are attended with little pain, and their development may be completed slowly in some cases and rapidly in others. Articular effusion into the joints contiguous to the lesion, especially into the elbow- and knee-joints, may also occur. Under appropriate treatment this pathological process may disappear, or it may degenerate by ulceration as in gummata, the epiphysis being separated from the shaft, epiphysis and cartilage both being destroyed. No deformity occurs should the morbid process be arrested before the cartilages and epiphyses are destroyed, but following the destruction of the cartilages, the growth of the bone at that point ceases and a more or less shortened and useless limb results. When, as a sequence of this diseased condition, the epiphysis becomes separated from the diaphysis of one of the long bones, while the integument remains healthy, we have a disease designated by Parrot *pseudo-syphilitic infantile paralysis*. The patient has no power of movement, the limb appearing to be paralyzed. If this condition is unrelieved for some time, atrophy of the muscles may result.

Wegner distinguishes three prominent stages of alteration of the long bones :

In the first stage there is seen between the cartilage and the new-formed spongy bone a white or reddish-white zone about the twelfth of an inch in breadth, with very irregular borders, consisting of calcified cartilage. In this zone the microscope shows an excessive proliferation of cartilage-cells.

In the second stage the calcified zone is increased to about twice the breadth of that in the first, and it is more irregular and is not so sharply outlined against the ossification zone. The calcified cartilage sends papillary-like projections into the hyaline cartilage above, and is encroached upon by the irregularly ossifying margin below. In the midst of the cartilage, blood-vessels are seen surrounded by a large amount of fibrous connective tissue.

In the third stage the periosteum and perichondrium at the extremities of the long bones and at the junction of the ribs with the costal cartilages become thickened. The whitish calcified zone is hard and brittle. Above this zone the cartilage is swollen and blue, and between it and the new-formed bone there is a soft and irregular zone of a grayish-red or yellow appearance, which resembles granulation-tissue or pus. This soft zone consists of a very vascular granulation-tissue and of round- and spindle-shaped cells. The cartilage-cells of the calcified zone are now no longer well formed, but are degenerated and distorted.

Periostitis.—This is one of the late bone-symptoms of inherited syphilis, occurring, according to Taylor, sometimes as early as the second or as late as the nineteenth year, but is unusual before the fourth or fifth year. The long bones are especially liable to be attacked, notably the tibia, femur, ulna, radius, and humerus, but the cranial as well as the other bones are sometimes the seat of periosteal nodes. Very often more than one bone in a subject is affected, and the bones may then be attacked symmetrically. The lesion commences as a thickening of the periosteum, which is attended with the production of osteophytic growths, described by Parrot as osteoid and spongioid. The cranial as well as the shafts of the long bones may become tumefied and hypertrophied, presenting inequalities or nodes. Hyperostoses, resulting from hereditary syphilis, may so distort the tibia as to produce the condition called

by the French authors the "sabre-blade deformity," the osteophytic growth, which is painful and tender, forming a curve with an anterior or lateral convexity (see Fig. 214).

After the long bones, those of the cranium are most frequently affected. The nodes and exostoses of the frontal and parietal bones are regarded by Parrot as entirely characteristic of infantile syphilis, and he has described four of these osteophytic growths as appearing upon the frontal and parietal bones about the bregma and separated by a crucial depression as typical of inherited syphilis. Osteophytic growths may, at times, induce premature closure of the fontanelles, resulting ultimately in idiocy.

The chief points in the differential diagnosis between syphilis of the bones and rickets may be briefly stated as follows: Epiphyseal swellings occurring under six months are nearly always syphilitic. In syphilis the epiphyseal swelling may be unilateral, while in rickets it is always symmetrical. Enlargement at the costo-chondral articulation is almost invariably present in rickets and absent in syphilis. In rickets the bones are thinned and not enlarged, as in syphilis, and the characteristic nodes are absent. The fontanelles are open in rickets, and are apt to be closed by osteophytic growths in syphilis. In syphilis other syphilitic symptoms are usually present, and the benefit of specific medicine is at once apparent. Specific treatment has no beneficial effect upon rickets.



FIG. 214.—Sabre-blade deformity of the tibiae in hereditary syphilis (after Hyde-Montgomery).

SYPHILITIC DACTYLITIS.

To Dr. R. W. Taylor is due the credit of having thoroughly investigated this subject, and to him we are indebted for the greater part of our present knowledge of this interesting disease. This affection, peculiar to the fingers and toes, is an evidence of late syphilis, and occurs both in the acquired and the hereditary forms of the disease, but more frequently in the latter. Two varieties are usually recognized. In the first form of dactylitis there is a gummatous infiltration into the subcutaneous connective tissue and fibrous structure of the joint. The disease advances slowly, and the affected member is increased in size, becoming firmer and harder. The integument of the finger or toe is inflamed and bluish-red in color, and the swelling, which is more pronounced upon the dorsal surface as a rule, terminates abruptly at the metacarpophalangeal joint. Pain may or may not accompany the formation of the swelling. One phalanx, more frequently the proximal one, is usually involved, though the whole finger may be included. Occasionally the metacarpal bones and the distal phalanges are attacked. Several fingers or toes may be involved at the same time or successively. The toes are usually affected in their entire length. Not long after the development of this affection, symptoms of joint-involvement appear, and flexion becomes impaired by the swelling. This condition, left untreated, is followed by an abnormal mobility of the joint.

The process runs a chronic course, and in the early stage responds to treatment, but, if neglected, effusion into the joint, destruction of the cartilages and other joint-structures, with permanent loss of motion, may result.

The second variety commences as a specific osteitis or osteo-myelitis, with accompanying inflammation of the periosteum, and may pursue either an



FIG. 215.—Syphilitic dactylitis (after Chapin).

acute or a chronic course, as a rule progressing rapidly if occurring early after infection. Like the first variety, it may affect one or several phalanges of a single digit, usually the proximal one, and more frequently those of the fingers than of the toes. The metacarpal or metatarsal bones, especially those of the index finger and thumb, may be involved at the same time.

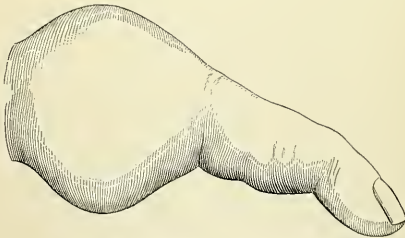


FIG. 216.—Syphilitic dactylitis (after Bergh).

According to the portion of the finger attacked, the swelling may be acorn-shaped, fusiform, or cylindrical. The integument is but little affected unless the swelling is marked, when it becomes stretched and tense, and as a result of pressure may be very sensitive. Occasionally suppuration occurs, and the pus and the gummy detritus escape through an opening in the integument,

usually on the side of the finger. A limited necrosis may occur, but more frequently absorption of the gummatous deposit results. Effusion into the joint has been occasionally observed, but it is usually speedily absorbed. As a result of the absorption of the gummatous deposits, atrophy and shortening of the shafts of the bones, or the formation of false joints, or in rare cases ankylosis, may ensue.

This affection is a late manifestation, being observed from the fifth to the fifteenth years, though Taylor records a case occurring as early as eighteen months after infection.

Syphilitic dactylitis of inherited syphilis is characterized by the same pathological lesions noted in the acquired form. It may occur in the early months of the disease or even as late as the twentieth year.

Diagnosis.—Paronychia, whitlow, and gout may be distinguished from syphilitic dactylitis by absence of pain and acute inflammatory symptoms in the latter. Rheumatoid arthritis begins in the joints, is quite painful, and is associated with other symptoms. The sheaths of the tendons too are involved, and deformity of the fingers commences early in the disease. Enchondroma may be differentiated from dactylitis by the fact that it forms a hard and well-defined tumor, which involves only a limited portion of the bone and is usually attached to the palmar surface of the finger. The history of the case, with the therapeutic test, will aid in diagnosing it from tubercular dactylitis.

The **prognosis** is good if the disease is recognized early and prompt and appropriate treatment is used.

SYPHILIS OF THE JOINTS.

The joints may be involved in both the secondary and the tertiary stages of syphilis.

Arthralgia.—Pains sometimes occur in the joint with the first appearance of secondary manifestations, even before the cutaneous eruption has been observed. One or more joints may be attacked, but usually the larger ones, especially the knee-joint, are first affected. The skin over the joints exhibits no redness, and there is no subcutaneous inflammation nor any effusion in the joint. The chief symptom is often only the pain, which is markedly increased at night. There is also some stiffness of the articulation and an inability to move the joint. This affection has been regarded as a low grade of specific inflammation of the synovial membrane and fibrous tissues, though there is no change in the joint appreciable on examination. Occasionally the cartilages are involved, when crepitation becomes a marked symptom. These painful sensations in the joints may continue for a longer or shorter period of time, sometimes disappearing without any apparent cause, and always being readily influenced by antisyphilitic treatment.

Synovitis.—The two varieties of synovitis occurring in the early and late stages of syphilis are characterized, the one by a chronic effusion into the joint without observable changes, and the other by an effusion into the joint with thickening of the synovial membranes. In the first variety, like syphilitic arthralgia, there is no involvement of the integument. The affection, coming on slowly and painlessly, is soon marked by effusion with stiffness in the joint. The effusion varies in quantity and is intermittent in character, being in some cases gradually absorbed, and in others remaining chronic and persistent. Dull pain may be felt toward night, and slight pain may be produced as a result of firm pressure on the

joint. In this form of synovitis suppuration and destruction of the joint do not occur.

The second variety of synovitis is observed late in the secondary and during the tertiary stage of syphilis. This form of synovitis is characterized by appreciable lesions of the joint structures. The joint involved is painful, enlarged, and marked by impairment of motion. The effusion comes on slowly and is accompanied by a thickening of the synovial membrane. Richet regarded the synovitis of the late stage of syphilis as due to gummatous infiltration into the subsynovial connective tissue. Aside from the infiltration into the synovial membrane, there are well-marked tufts springing from its surface. The ligaments, capsules of the joints, cartilages, and subchondroid tissues may also become involved, followed by a thickening and degeneration, with the formation of abscesses and sinuses connected with the joints.

The autopsies reported by Lancereaux have confirmed the view held by Richet. This affection usually involves a single joint, the knee and the sterno-clavicular joints being most frequently affected, though the elbow, wrist, and ankle are often attacked in a similar manner. The symptoms of synovitis and arthritis resulting from syphilis are not sufficiently characteristic to be distinguished from the same symptoms in the subjects of other diseases, and therefore the diagnosis cannot be made positively without consulting the history of the patient and other existing evidences of the disease. The history of the case, other existing evidences of the disease, absence of pain to any great extent—and, when present, occurring chiefly at night—and the favorable effects of antisyphilitic treatment are important points for establishing the diagnosis of syphilitic joint-affections.

In the early forms of this affection the **prognosis** is much more favorable, usually responding promptly to treatment, but in the later forms it is a more serious disease, as permanent thickening occurs, with more or less interference of motion.

SYPHILIS OF THE BURSAE.

Syphilitic affections of the bursæ have been observed in both the early and late stages of the disease.

In secondary syphilis irritative bursitis, with serous effusion into the bursa, attended by redness, pain, sensation of heat, and tumefaction, may sometimes occur. This is, however, a rare affection. Fluctuation can be obtained by palpation. Under antisyphilitic treatment this form of bursitis ordinarily disappears. Bursitis in tertiary syphilis is more common. The bursa is attacked by gummatous infiltration with a formation of connective tissue. The bursa may be primarily involved, or it may become implicated by an extension of gummatous infiltration from adjacent parts.

The prepatellar bursa is most frequently attacked, both knees being affected or only one. Next in frequency are the bursæ over the inner side of the knee and behind the olecranon. Keyes has reported a number of cases of tertiary disease of the bursæ. Gummatous bursitis may occur at any time from one and a half to eight years after infection. This affection is, as a rule, painless, forming a firm, hard, or elastic movable tumor beneath the skin.

Syphilitic bursitis pursues a very chronic **course**, terminating usually by softening, the pain becoming more noticeable, and later, by discharging, leaving a gummatous ulcer which cicatrizes rather slowly.

SYPHILIS OF THE TENDINOUS SHEATHS, THE TENDONS, AND THE APONEUROSES.

Both Fournier and Verneuil have reported numerous cases of syphilitic affections of these structures.

Verneuil described in the sheaths of the extensor tendons of the fingers an acute and painful hygroma not extending above the dorsal ligament. The swelling is of a triangular shape, with the base toward the fingers. The tendons of the ankle and foot may be attacked in a similar manner. The lesion consists of a hyperemic condition of the sheath with serous effusion. Fournier has frequently noted these hygromata, having observed them in the tendo Achillis, biceps flexor cubiti, and the supinator longus. Little or no pain accompanies these hygromata unless they reach an unusual size, when the skin may become tense, inflamed, and painful. The pains around the knees, and especially the elbow, often felt in secondary syphilis, have been attributed to syphilitic involvement of the tendons of the deep-seated muscles. Both tendons and aponeuroses may be the seat of gummatous infiltration. Gummy tumors occurring in the tendons are not usually painful. They may remain indolent for a long time or may soften, the overlying skin becoming reddened, breaking down, and leaving a gummy ulcer.

Bouisson has reported a case in which a nodule appeared in each tendo Achillis close to the heel in a syphilitic patient, and promptly disappeared under specific treatment.

Syphilitic tumors of the aponeuroses are not so pronounced, are less circumscribed, and are not so liable to degenerate, as those of the tendons. The aponeuroses may be involved by an extension of the gummatous infiltration from adjacent tissues. The dense fasciæ of the extremities, especially the fascia lata, are more apt to be attacked.

SYPHILIS OF THE MUSCLES.

Three forms of myositis are usually met with in syphilitic subjects: the irritative or congestive, the diffusè interstitial, and the gummatous.

Irritative or Congestive Form.—This variety is commonly seen with the early manifestations of syphilis and closely resembles muscular rheumatism, inasmuch as the pain is increased by pressure and contraction of the muscles. This form of myositis may last for years if untreated, but will yield promptly to antisiphilitic treatment, leaving no permanent structural change.

Diffuse Interstitial Myositis.—In this form of myositis there is a development of connective tissue in the interspaces between the muscular fasciculi. The new connective-tissue formation hardens, and, after having caused an atrophy of the primitive muscular fibrillæ, eventually destroys them. Any muscle of the body may be affected by this process, but ordinarily by preference the flexor muscles of the upper extremity are invaded, especially the biceps. The contraction of the muscles comes on gradually, being attended by little or no pain. There is also some lack of proper function of the muscle, and an inability on the part of the patient to extend the limb. Virchow regards these contractions as due to calcareous degeneration of the muscular tissue, and as similar to that produced by traumatic or rheumatic inflammation. Zeissl reports a case where the knee was flexed to a right angle by a retracted biceps, and which readily responded to mixed treatment after the failure of relief by other measures. Mauriac notes this

affection as occurring about the tenth month after infection as the average date of appearance, but has often observed it at an earlier or later period.

The course of diffuse myositis is chronic, lasting for months or even years.

Gummatous Myositis.—In gummata of muscles we have a condition differing from the diffuse form only in being circumscribed and with a tendency to soften and discharge externally. These tumors grow slowly and, as a rule, without pain, are usually of a globular shape, and may vary in size from that of a pea to an orange. They are ordinarily an evidence of late syphilis, though Mendel recently reported a very interesting case in Fournier's clinic of a man who presented four nodules in the muscles on the back of the leg, elongated, and all situated in the long axis of the limb, occurring between two and three months after infection. The initial lesion had not yet cicatrized. A few days later there appeared just opposite, on the anterior surface of the tibia, an oval tumor, elongated in the axis of the bone, hard, painful, and movable during contraction of the tibialis anticus. This case was diagnosed as gummata of the muscle-sheaths and as very unusually precocious. Gummy tumors occur most frequently in the large muscles, as the gluteus maximus, trapezius, sterno-cleido-mastoid, and pectoralis major, and are found oftener near the tendon than in the center of the muscle. Cardiac gummata have been reported by Ricord, Lebert, Virchow, and Lancereaux. Autopsies have revealed gummata both in the diffuse and circumscribed form, generally of a yellow color, dry and caseous, seated either in the walls of the heart or in the septa. A very unique case of gumma of the diaphragm has been recorded by Murchison. Bouisson describes the gummy tumors of muscles as forming first a local and circumscribed swelling, due to plastic effusion. This is followed by a moderate softening and inflammation of the neighboring muscular fasciuli. The deposit is finally organized into fibrous tissue or even into cartilaginous or osseous material. Osseous masses are sometimes seen in the muscles of old syphilitic patients.

Muscular gummata are rarely single, but may occur in numbers in a single muscle or in a group of muscles. The tumor appearing in a muscle is not always attended with pain, but when present it is usually worse at night and aggravated by contraction of the muscle.

According to Nélaton, the tumor is ordinarily fixed when felt during contraction of the muscle containing it, and movable when relaxed. Muscular gummata are frequently accompanied by other evidences of a syphilitic nature, which assist in the diagnosis.

Left untreated, muscular gummata grow slowly larger, but under active antisymphilitic treatment commonly disappear.

SYPHILIS OF THE RESPIRATORY, CIRCULATORY, LYMPHATIC, AND ALIMENTARY SYSTEMS.

BY JO H. LINSLEY, M. D.

SYPHILIS OF THE NOSE.

Primary.—But few cases of chancre of the nose have been reported. When present the most common seat of the lesion is just within and around the orifices of the nares. The finger is the usual medium through which infection occurs.

Secondary.—Secondary affections of the nose are undoubtedly often unrecognized. They occur from three weeks to eight or nine months after the initial sore, and consist of a coryza or mucous patch, or both. There is nothing in the character of the coryza, *per se*, to indicate its specific nature, and even the mucous patch may cause no well-defined symptoms.

Tertiary.—The later manifestations of syphilis may involve any portion of the nasal cavity, although the septum is most often implicated, and both the cartilaginous and bony structures are apt to suffer. Tertiary syphilis of the nose is undoubtedly more rapidly developed in those persons suffering from chronic rhinitis or other non-specific affection of the nasal passages. This form of the disease may not be detected for years after infection; again, the most severe tertiary manifestations may develop in from six months to one year after inoculation. If the floor of the nose or the turbinated bones are the seat of the lesion (a rare occurrence), the gummata are usually unilateral, while, if situated on the septum, and particularly if on the cartilaginous portion, they are generally found to be bilateral. The gummy syphilide is the one which is productive of the greatest destruction, and the one which often requires the greatest care in recognition and management. This usually affects the end of the nose, either on one side or the other, and presents itself as an indefinite enlargement or infiltration of the tissues, with more or less heat and redness, and often with very considerable pain. At times one side of the nose only will be infiltrated, or the entire free end of the organ may be involved in a mass of new tissue, which will tend to ulcerate in one place or another and have formed upon it crusts of varying sizes (Burnett). Great deformity of the nose may occur if this condition is not properly attended to. Again, erysipelas may be present as a complication of an ulcerated gumma.

As a rule, syphilitic ulcers of the nose are confined to the nasal cavities—*i. e.* they do not extend to the skin beyond the nostril nor do they pass into the pharynx.

Individuals with a tuberculous predisposition are more apt to develop nasal syphilitic lesions than those not similarly affected.

Hereditary.—Hereditary syphilis usually occurs in infants at birth or within a short time thereafter. The affection is manifested by the occurrence of “snuffles” or a severe coryza or catarrh. Its tendency is to progress gradually unless promptly and carefully treated. The margin of the nostrils and the integument of the upper lip may be exceedingly irritated by the acrid discharge from the nose. This discharge, thin at first, afterward

assumes a muco-purulent character. A flattened nose, causing a lifelong deformity, may result if caries of the bones and cartilages occurs.

Pathology.—The first change in the mucous membrane of a part which is the seat of a syphilitic infection is an infiltration of small round-cells or leukocytes. These cells invade all the layers of the mucosa, and may extend to the deeper structures, even to the cartilage and bone. The lesion is not sharply circumscribed, but the infiltration gradually becomes less and less from the margin of the area of greatest cellular activity. The early gumma is not, histologically, different from granulation-tissue or a recent tubercle, and much resembles a lymph-nodule. The development of the gumma may be slow or rapid. This depends, apparently, upon either the amount or degree of activity of the inoculating virus, or upon the amount of resistance the organism exhibits through the agency of its phagocytes or the germicidal tissue-juices, either or both. The cellular infiltration appears to be superficial or deep according to the conditions just enumerated. The presence of these small round-cells or colorless corpuscles causes more or less swelling of the tissues at the seat of the lesion, the size of the tumefaction depending, of course, on the amount of cellular invasion. The cells invade all the immediate structures of the part affected, even the walls of the nutrient arteries: a thickening of the intima (which may ultimately occlude the lumen of the vessel) first occurs, closely followed by a hyperplasia of the elements of the adventitia. Different views have been held regarding the etiology of this change in the vascular walls, but, without further consideration of them, the writer states his belief that the cause for the proliferating endarteritis is a toxin, which latter is the product of a micro-organism which is undoubtedly the cause of this disease. The identity of this bacterium is not yet definitely determined, although few practitioners to-day doubt its existence. Together with the round-cell infiltration, the endothelial cells lining the vessels proliferate, and a few delicate fibers of new connective tissue can be seen. This process is progressive until the endarteritis has become obliterating, and the further passage of blood in the affected vessel of course prevented. The result of this is to cut off the blood-supply at the distal ends of the small arteries. This corresponds to the center of the gumma, which becomes more or less necrotic or "*cheesy*" because of impoverished nutrition. Its appearance under the microscope is that of a more or less circumscribed granular, nearly amorphous area (see Fig. 221, *e*). The cutting off of the blood-supply to the gumma results, eventually, in a necrosis or breaking-down of its center and the formation of an ulcer.

A peculiar change noted in the adventitia of the vessels—more particularly in the cerebral vessels—as well as in the connective-tissue stroma of many glands, in the later stages of syphilis is the hyaline thickening, the nature of which is not well understood.¹

Symptomatology.—The symptoms of nasal syphilis vary according to the stage and violence of the affection. The initial lesion may be half an inch or more in diameter, is commonly quite firm, of an inflammatory nature, and has a well-defined margin which is raised above the surrounding surface. The glands about the ear may be swollen. In the secondary period redness of the mucous membrane, with an obstinate catarrh, may be the only symptom. Mucous patches may be sometimes found at the external angle of the nostril, on the septum anteriorly, the inferior turbinated bodies, and on the margins of the posterior nares. Often, however, in the absence of other

¹The histology of a gumma above given applies, with few exceptions, to gummata wherever located.

lesions of syphilis, the character of the nasal affections may be suspected only because of their persistence. There may be difficulty in breathing and more or less stoppage of the lachrymal ducts and Eustachian tubes in syphilitic erythema of the nose. These troubles are mechanical, and are caused by the swollen folds of mucous membrane.

On account of the superficial character of the primary gummatous infiltration, and the few symptoms produced thereby, the presence of a fully-developed syphilitic ulcer of the nose is the first thing which calls our attention to the involvement of this organ by the disease. The seat of the ulcer is usually the septum. A gummatous septum may be confounded with two conditions—namely, deflected septum and sarcoma. In the former the tumefaction is harder and dense to the touch, and there will be a corresponding concavity on the opposite side of the septum. In sarcoma the microscope must be employed where possible. Usually, however, a sarcoma is softer, more pedunculated, somewhat movable, bleeds readily, and is attached higher up in the cavity. The borders of the ulcer are fairly well defined and the surrounding mucosa normal. The edges are not sharply cut and the center of its surface is slightly depressed. On the latter is found thick, grayish-yellow, viscid muco-pus, in which are mingled extraneous matters from the inspired air. It is not apt to extend, bleeds readily, and is not very sensitive. If the gumma is on one of the turbinated bodies, the pain is greater, especially at night, but disappears after the gumma has broken down and an ulcer formed.

Plugs or casts of inspissated mucus, mixed with blood and pus, are now and then discharged. These are of a very disagreeable appearance, and possess an almost intolerable odor, especially if necrosis of the bone has occurred. In the latter case the stench is most penetrating, clinging always to the patient, and oftentimes to the practitioner after he has treated a case locally.

There is but little sense of smell, which is probably due to the failure of the odorous particles to reach the olfactory tract, owing to the obstruction by crusts, etc. Should the disease involve the vomer extensively, a characteristic flattening of the nose may be produced by the falling in of the bridge (see Fig. 217). The entire nose may be destroyed, leaving two gaping orifices to represent the original situation of the organ. In many cases of bony necrosis spicula of dead bone are discharged in greater or less number. In others the seat of the necrosis may be effectually concealed by dark-colored crusts and greenish-yellow masses.

The earliest ordinary manifestations of hereditary syphilis in infants has already been described as a coryza. This is usually accompanied by some form of cutaneous eruption. Occasionally we may have affections of the special senses, as deafness, iritis, or obscure brain-symptoms. In young children suffering with hereditary syphilis of the nose the progress of the disease is rapid; the coryza is soon followed by ulceration, which



FIG. 217.—Flattening of the nose from destruction of the cartilaginous septum by syphilitic disease (McKenzie).

may result in denuding the bone of its periostum, causing necrosis. It is

possible for hereditary syphilis to manifest itself as late as between the fourth year of life and puberty. This exhibition of the disease corresponds to the tertiary stage of immediate inoculation, and the lesions exhibited in the latter are exemplified in the former, except that more rapid and extensive destruction of tissues is seen in the later manifestations of hereditary syphilis than in the tertiary forms of acquired, undoubtedly owing to the less resistance offered to the virus by the younger organism.

Diagnosis.—There should be little difficulty in recognizing syphilis of the nose at almost any stage, particularly the later manifestations of the trouble, as the tendency to involve the nasal cartilages is peculiar to this disease. Dry catarrh, with attendant ozena, may be mistaken for syphilitic caries, but to the experienced the difference in stench is peculiar, the former being eradicated by syringing, while the latter is positively non-removable. A perforated septum may result from tubercular ulceration, blood-cyst, and septal abscess, as well as from tertiary syphilis. To avoid an error in diagnosis the history of every suspected case should be reviewed, the skin examined for coppery patches and cicatrices, and hardenings searched for in the tongue, pharynx, and larynx, and the tibiae looked over for periosteal nodes. After a gumma commences to ulcerate the tissue is destroyed very quickly, until the result is a deep ulcer which is so typical as to render diagnosis easy.

A typical myxoma, though of small size, occasionally develops in the ragged edges of the ulcer. Polypoid masses may also occur, even to the extent of more or less obscuring the diagnosis. They are easily removed, when the diseased condition of the deeper structures is apparent. A rather characteristic feature of the tertiary ulcer in the nose is the massing of mucus which has undergone cheesy degeneration in the narrow portion of the nasal cavity, because of the obstruction to its egress. It is a peculiar clear white substance, much resembling potted cheese in appearance. Upon cleaning the ulcer these masses come away in large flakes. When the hair of the head comes off soon after birth hereditary syphilis should be suspected.

The bridge of the nose in these cases is usually broader and flatter than normal, the face is pinched, the features have the expression of an old man, and the skin is more or less dry and rough.

The differentiation between syphilis and lupus is as follows: Lupus usually spreads from the face to the nasal mucous membrane, while syphilis attacks the latter primarily. The progress of lupus is slow, without deformity, while the syphilitic process is rapid and very destructive. Lupus is not apt to attack bony structures, while syphilis is prone to invade osseous tissue. The hard palate is rarely attacked by lupus, but frequently by syphilis. The effect of antisiphilitic treatment will materially aid in clearing up the diagnosis, as lupus would be aggravated and syphilis improved by it.

Prognosis.—In secondary syphilis and in mild tertiary disease where there has been little destruction, with a minimum loss of vitality on the part of the patient, a course of proper antisiphilitic treatment is very sure to result in recovery. The prognosis is more unfavorable if caries is actively occurring. The latter occurs whether the gummatous deposit is primarily in the bone or only involves the mucous membrane or the periosteum.

The vomer may be implicated partially or entirely, in which latter case a certain part of the hard palate becomes involved, perforation results, and the disease appears in the roof of the mouth. It may extend to the superior maxilla, may destroy the walls of the lachrymal canal, or certain portions of the ethmoid and sphenoid bones may be gradually eaten away, and even the

basilar process of the occipital bone may be wholly destroyed by the same gradual process, or considerable portions of these bones may be exfoliated by rapid necrosis. The cranial cavity has been exposed, and in such cases there usually succeeds a fatal cerebritis or meningitis. The liability to external deformity depends largely upon the extent of the original lesion. If the gummatous infiltration of the septum is followed by ulceration, destruction of the periosteum, and necrosis, it will be impossible to avoid an external deformity. The only time it is possible to prevent such deformity is at the period of the gummatous deposit or in the commencement of ulceration.

In hereditary syphilis of the nose, where the disease is in evidence at birth, the prognosis is unfavorable, one of the difficulties being that the nasal trouble interferes with proper nursing, the result of which is a greater or lesser degree of malnutrition.

If the hereditary symptoms appear later, the prognosis is more favorable, as the child has had an opportunity to grow and enhance its resistance to the microbic invasion. In brief, the age of the child when the disease appears, together with the amount of its resisting power, the amount and virulence of the syphilitic virus, and the stage of the disease when first submitted to treatment, are all important factors when determining the prognosis.

SYPHILIS OF THE PHARYNX.

Primary.—Syphilis of the pharynx is usually a local exhibition of constitutional syphilis. When situated in the pharynx the chancre is nearly always found on one of the tonsils, the open mouths of the crypts presenting a favorable lodgement for the virus. The initial lesion is not common, and is found oftener in females than in males. The manner of contraction of the primary sore is, many times, by an outrageous and disgusting practice. Kissing, use of pipes, drinking vessels, etc. are mentioned (Bosworth) as other sources of contagion. Sometimes a diagnosis of chancre of the pharynx is impossible until secondary symptoms are manifest elsewhere.

Secondary.—A diffuse redness and thickening of the pharyngeal walls, together with swelling of the tonsils, is often seen accompanying the secondary manifestations of the disease. The pharyngeal redness is usually persistent, especially in smokers, and is aggravated by the use of mercury internally. The throat is the most common seat for the manifestations of secondary and tertiary syphilitic phenomena. Mucous patches in the adult are usually seen on the pillars of the fauces and veil of the palate. The usual period for their first occurrence is from six weeks to three months after the primary sore, although there seems to be no period during the course of syphilis which is free from their development.

At first these patches are very slightly elevated, are of a circular or elliptic form, and nearly always symmetrically situated on each side of the throat. At a later stage they become the seat of shallow ulcerations; their surface changes to a grayish-white color and their edges become uneven. In six or eight weeks they generally disappear spontaneously, their former position being marked by a slightly deeper shade of the mucosa: while they last they cause considerable soreness of the throat, especially on deglutition.

The skin-manifestations associated with condylomata are usually of the nature of syphilitic papulæ, though some of the other early syphilides may be present (McKenzie). The posterior wall of the pharynx is not usually invaded by syphilitic erythema, although a certain amount of discoloration may be present.

The early mucous patch is believed to be the most contagious of all the secondary manifestations of syphilis, equally so with the primary chancre, and the poisonous virus may be conveyed by means of the saliva. Mucous patches which occur a long period after the primary sore are not considered contagious. The majority of true ulcers of the tonsil are syphilitic.

Tertiary.—The destruction of the back of the palate by tertiary syphilitic ulceration is not an infrequent result of heredity. The ulceration now and then breaks out anew, and the age of the patients varies from three or four years to fifteen or sixteen. Later in life it is not possible to determine invariably between the acquired and hereditary disease. When gummy tumors occur in the pharynx, they are usually situated beneath the mucosa of the posterior wall, but may occur in the soft palate. They grow slowly, as a rule, and after a longer or shorter existence their centers soften from lack of nutrition, and a perforation of the mucous membrane results. If the gumma be in the soft palate, a destruction of the tissues on both sides occurs, resulting in a fistula communicating with the mouth and the posterior part of the nasal cavity.

The edges of such fistulae or ulcerations are sharply defined and heal slowly. In such cases there is a peculiar nasal pitch to the voice, and fluids are apt to pass up into the nose during the act of swallowing. It is a rule that in cases where there is a gummatus infiltration beneath the mucosa disintegration takes place so quickly that ulceration has occurred when these patients present themselves for treatment. It must not be forgotten that all gummata may be absorbed under the influence of intelligent specific treatment. The length of time a gummy tumor may exist prior to ulceration cannot be accurately determined, depending largely upon its location and the amount of irritation to which it is subjected.

Pathology.—The pathology of syphilitic infiltration, the succeeding gummata, cheesy degeneration, and ulceration has already been discussed in the article on Syphilis of the Nose, and the description of these processes there given will apply to the histology of syphilitic neoplastic growth in any of the mucous membranes.

The opalescent appearance so often seen on the surface of a mucous patch or ulcer is caused by degenerated cell-protoplasm and serum containing large numbers of small round-cells.

Symptomatology.—The peculiarities of the hard chancre are not always present in the initial lesion found in the pharynx. The local appearance resembles that of an ulcer, the mucous membrane surrounding which is somewhat edematous and elevated. The hard base can be felt, and enlargement of the glands about the angle of the jaw and in the cervical region usually occurs. In the case of the latter the bubo is usually larger and more sensitive than that of the inguinal lesion. Except in unusually severe cases the chancre produces few symptoms, either locally or generally, and may even run its course and heal without attracting much attention on the part of the patient.

A common secondary manifestation of pharyngeal syphilis is erythema. This occurs from six weeks to four months after the primary lesion. The first symptoms are dryness of the throat, more or less pain on deglutition, and a slight rise in temperature—in fact, simply those met with in an ordinary sore throat. The redness is due to venous congestion of the mucosa, and the color is a more or less deep shade of purplish red. The outlines of this eruption are well defined and abrupt. It does not shade off

into the surrounding healthy mucous membrane, and this fact is one of great clinical importance.

Mucous patches are found in the majority of cases of secondary syphilis, although they may be met with at any stage of the disease. In these earlier stages of syphilis they are probably as contagious as the chancre. When occurring in young infants they are found on the fauces and upper part of the pharynx. In later life the pillars of the fauces and veil of the palate are their favorite locations. They are somewhat elevated at first, are circular or elliptical, and are usually situated symmetrically on each side of the throat. Later on their edges may become uneven, and ulceration occur which is superficial in character. After their disappearance—six to eight weeks—a deeper shade of red marks their former location in the mucous membrane.

As in the manifestations of tertiary syphilis elsewhere, the deep ulcer is the result of the breaking down or necrosis of a pre-existing gumma. Its usual location in the pharynx is beneath the mucosa of the posterior wall; less frequently it occurs in the soft palate and pillars of the fauces, and occasionally in the tonsils. The secretions of the parts are increased, and deglutition becomes more difficult and painful.

If the posterior nasal passage be cut off or occluded, the sensation in the nose may be painful; the victim cannot clear his throat, has no sense of smell or taste, and has a feeling of dryness and stiffness constantly. Dyspnea and difficult swallowing occur when the passage to the lower part of the pharynx is contracted.

Diagnosis.—Chancre of the pharynx is diagnosed with difficulty, and only with certainty after the development of constitutional symptoms of syphilis or a history of specific infection is obtained.

If an ulcer or sore of the pharynx prove intractable to the ordinary (non-specific) treatment for such affections, the possible specific nature of the lesion must be taken into account in making a diagnosis. The appearance of erythematous patches of the skin simultaneously with the throat-patches, together with symmetrical arrangement of the latter, is the most valuable aid to the diagnosis of secondary syphilis of the pharynx. A mucous patch of the pharynx much resembles an area of the mucous membrane soon after having been touched with solid nitrate of silver. The patches become more opaque the longer they exist. If the exudation become of a fibrinous character, producing a false membrane, the lesion may much resemble a diphtheritic patch. If these conditions are absent, the history of the case must be accurately investigated, as well as cicatrices of the initial lesion looked for.

A syphilitic ulcer may be mistaken for a cancerous growth in the pharynx, but the history, as well as the subsequent development, of the case will clear the diagnosis. In the case of cancer the affected area has a brighter color, the process is a less destructive one, and there is more thickening than in syphilitic ulceration. The sharp-cut and well-defined edges, the well-marked areola, the depressed surface of the ulcer, and the presence of a more or less excessive secretion of pus will usually be sufficient to stamp the lesion as syphilitic. Again, it is necessary to differentiate between pharyngeal syphilis and acute tuberculosis of the pharynx. In the latter affection there is much pain and the outlines of the superficial ulcer are ill defined.

It is more difficult to distinguish tertiary affections of the pharynx from tubercular ulceration. The latter may be deep and involve much tissue, but it spreads slowly and is usually painless.

In syphilis the ulceration, as a rule, extends rapidly and often causes much pain. The border of the tubercular ulcer is sharp, but the induration is

not so great as in the syphilitic affection. In cases of very deep tubercular ulceration much caution is necessary in making a diagnosis, and every means of investigation should be employed. Consequently, it is always best to have some of the discharge of the ulcer carefully examined by a competent microscopist. The tubercle bacillus, when found in such material, is presumptive evidence of the tubercular character of the difficulty. But if a negative result be obtained, it should not be accepted as final until many (fifteen or twenty at least) collections from the surface of the ulcer have been made and carefully examined. The best time to collect this material is early in the morning, as soon as the patient arises.

Prognosis.—The nature of the prognosis will depend upon the age and character of the affection. In the early stages of syphilis, in the majority of cases, a favorable prognosis can be made as regards life, but in the later troubles it must be more or less serious. Secondary manifestations are not serious, and may subside without receiving attention. Edema of the glottis is not caused by erythema, even though the latter extend to the larynx.

In the tertiary form of syphilis death may be caused by hemorrhage produced by the destruction of the walls of a large vessel by the ulcerative process. Serious deformities often result from the ulceration, and caries of the bones at the base of the skull, and the cervical vertebræ may be affected, producing cerebral and spinal symptoms. When partial or complete destruction of the soft palate, uvula, or pharyngeal wall has occurred, the healing process results in the formation of more or less extensive rigid bands of cicatricial tissue, the contraction of which tends to increase the already existing deformities. The result in such cases is the narrowing of the passages, with the consequent interference with respiration, deglutition, and phonation. If the palate is destroyed, the voice has a characteristic nasal twang, the patient talks with difficulty, and experiences inconvenience in swallowing because of the regurgitation of food into the nasal cavities.

Even with a minimum amount of ulceration some cicatricial tissue is produced in the process of healing. This syphilitic cicatricial tissue is peculiar in that it consists of a central thicker mass, from which connective-tissue fibers radiate into the surrounding tissues. A deformity frequently seen in these cases is the adhesion between the wall of the pharynx and a posterior pillar of the fauces. An impairment of hearing, caused by closure of the Eustachian tube, is one of the results of this lesion.

SYPHILIS OF THE LARYNX.

Primary.—One case of laryngeal chancre has been reported, the lesion being on the free border of the epiglottis on the left side.

Secondary.—The lesions of secondary syphilis of the larynx are not always early developed, and, *per contra*, tertiary lesions may be very early developed. Hence it is not always possible to differentiate clearly between the manifestations of these two stages in the larynx. The specific laryngeal phenomena observed in general syphilis may be hastened by the existence of an ordinary catarrhal laryngitis, such as is produced by any irritant, as excessive use of alcohol, cigarette-smoking, and inordinate use of tobacco, or change of climate or temperature. The winter months are more favorable to the development of laryngeal lesions than the summer-time, and more laryngeal cases are seen during the former than during the latter season. Because of their greater exposure to the weather and poisonous atmospheres men are more often affected than women. Again, young adult life seems to be the favorite age for the development of secondary manifestations.

The time at which these conditions appear after the development of the chancre varies from a few weeks to sixteen or seventeen months. A condition of chronic laryngitis frequently occurs in this stage, and may persist for a long time, often resulting in a permanent thickening of the mucosa. This condition is not to be mistaken for erythematous edema, which causes a puffy appearance of the mucous membrane. Chronic ulcers usually accompany this state, and are often found on the vocal cords. They have ragged and thickened edges, and vegetations or condylomata may arise from them, particularly at the insertion of the inferior vocal cords. As a result of this the voice is partially or entirely lost. They usually occur from two to seven years after the chancre.

The mucous patch is nearly always found in the secondary stage, its most frequent locations being, in order, the upper surface of the vocal cords, arytenoids, and the ventricular bands. It may occur within six weeks after the initial lesion, or may not appear for twelve months or longer.

Tertiary.—The lesions seen in tertiary syphilis of the larynx are ulceration, gummata, perichondritis, cicatricial stenosis, and caries.

Deep ulcerations, which are the characteristic lesions of tertiary laryngeal syphilis, may be formed by an extension of the disease from the pharynx or from the breaking down of a gumma. This process may entirely destroy the epiglottis. Ulcers usually occur from three to four years after inoculation, but may be delayed from twenty to fifty years after the time of infection, and without the occurrence of intermediate symptoms. The upper surface of the epiglottis is the most frequent seat of these ulcerations, and it results in a thickening of the valve, with ulceration of the center and free border. The gummata of the larynx are softer than those found in other places, are very vascular, and tend to deep ulceration. They may be single and large or multiple and small, and usually occur on the anterior surface of the posterior wall. Gummata of the larynx are very prone to rapid degeneration, undoubtedly due to the vascularity and constant functional activity of this organ.

An extension of the disease from the mucosa and submucosa usually results in a perichondritis which may involve the cartilage itself.

The parts are sensitive to pressure from the outside, and considerable pain usually accompanies the lesion. The epiglottis and the arytenoids are most often affected, rarely the cricoid. They may suffer complete destruction. The cicatricial formation following syphilitic ulceration is of a most extensive character.

After organization of the new tissue sharp contraction occurs, producing various contortions of the larynx, all of which result in a greater or less degree of stenosis. Necrosis is a common result of the involvement of the perichondrium by inflammation or gummatous ulceration where ossification of the cartilage has occurred. It takes place late in the disease, and often produces structural and irremediable laryngeal changes.

Hereditary.—In hereditary syphilis evidences of the disease may be present at birth and continue for many years. It is uncommon to find such symptoms before the age of seven. When present the infant has a metallic cry which is peculiar. In young children laryngismus is often present. The free borders of the epiglottis are usually found ulcerated and the underlying cartilage exposed. Acute stenosis of the larynx usually occurs in the infant.

Pathology.—Laryngeal syphilis is productive of a great variety of pathological manifestations, from a simple erythematous redness of the mucosa to hypertrophy of the tissues, condylomata, destructive ulceration,

perichondritis, and cartilaginous necrosis. The principal lesion in syphilitic erythema of the larynx is similar to that found in the same affection of the mucosa elsewhere—*i. e.* a more or less extensive infiltration of the mucosa with lymphoid or small round-cells. The result of this, especially in the condition under consideration, is a more or less considerable swelling of the laryngeal mucous membrane. The cell-invasion may be diffuse, causing a rosy-red appearance, or be unevenly distributed in circumscribed areas, causing a mottled condition. If the pressure in the deeper layers of the mucosa be sufficient to deprive the surface epithelia of nutrition, ulceration will follow, the extent and depth of which will depend upon the amount of cell-infiltration. Disintegration of mucous patches or papules may cause erosions and ulcerations of a similar character.

They are multiple, as a rule, frequently recur, and accompany the production of mucous patches on mucous membranes elsewhere, and usually occur at periods varying from twenty-one days to four months after the appearance of the chancre. Tubercular subjects are more susceptible to them than those not so tainted.

Condylomata may be formed here which, histologically, are identical with the papillomata. They consist of enlarged or hypertrophied papillæ having a delicate connective-tissue stroma, with a great hyperplasia of epithelial cells, with more or less round-cell infiltration, and occasionally a little mucous tissue. They cannot occur below the vocal cords, as papillæ are absent below this point. Ulceration of these condylomata does not usually occur unless it be of a very superficial nature. They generally disappear—undoubtedly by absorption.

In tertiary syphilis rapidly-formed ulcers may occur as a result of an inflammatory action, probably of a microbic nature, which produces rapid dissolution of the tissue. This same ulcerative process may result in union between the vocal cords, more or less complete according to the extent of opposing surfaces involved, and may affect their entire length, leaving only a very slight opening for the purposes of respiration. The crico-arytenoid articulation may become ankylosed; in fact, syphilis is the most frequent cause of this lesion. The production of gummata, although very rare in this locality, is attended by the same pathological phenomena which occur in the formation of gummata elsewhere.

Symptomatology.—The symptoms of syphilis of the larynx are subject to variation in different individuals and in different stages of the disease, from the mildest to the most severe. The patient may have the sensation of slight irritation, with the desire to clear the throat, or he may have such severe dyspnea as to require an intubation or tracheotomy. It cannot be truthfully stated that any of the symptoms of secondary syphilitic laryngitis are pathognomonic. Although usually absent late in the disease, cough is often present during the early stages of laryngeal syphilis.

Phonation may be interfered with, the degree ranging from slight hoarseness to complete aphonia. Odynphagia may be slight or even absent early, but later, swallowing may be accomplished only with the greatest difficulty. There is little pain when the patient is not swallowing, and McKenzie considers this symptom as very characteristic. There is usually, if not always, more or less edema present in all cases of syphilis of the larynx.

In children the victims of hereditary syphilis this condition is liable to sudden exacerbations, even though there are no other active manifestations of the disease. Cough and pain are, generally speaking, not as frequent as in other inflammatory conditions, and cases are often seen which do not

exhibit any of the ordinary laryngitic phenomena, such as tickling, dryness, cough, pain, dyspnea, and dysphagia. A greater or less impairment of function is often the only symptom observed in syphilitic erythema of the larynx. The superficial ulcer is productive of no characteristic symptoms and destroys little tissue.

The voice is affected according to the extent of ulceration.

A bloody muco-purulent secretion is generally found. These ulcers may leave but little cicatricial tissue after healing.

This condition, although not the most frequent, when occurring is the *earliest* manifestation of tertiary syphilis of the larynx. A marked hyperemia of the mucosa is generally present at the same time. Ulceration, gummata, and more or less cicatricial stenosis are the prominent symptoms met with in tertiary syphilitic laryngitis. Characteristic white, shining, stellate, and retractile cicatrices, as though the parts had been seared, are the result of deep ulceration of the larynx. Ulcers may develop from three to four years after the primary lesion, but have been known to occur twenty, and even fifty, years after inoculation, without the development of any intercurrent symptoms. The epiglottis is the most frequent seat of tertiary lesions, although no portion of the larynx is exempt from invasion. The upper surface of the epiglottis is more frequently involved than the under. Although ulceration may destroy the greater part of the epiglottis, still, after the parts have healed, swallowing can usually be accomplished. The difficulty in performing this function is greatly enhanced, or altogether prevented, if the ulcerated edges of the epiglottis unite with similar ulcers of the pharyngeal wall during the reparative process, thus causing one of the most serious forms of dysphagia, as well as distressing dyspnea.

The posterior wall of the larynx is the most common seat of gummata, and the latter are often multiple.

Myopathic paralysis, usually on the left side, may occur in the later stages of laryngeal syphilis. It is generally unilateral.

Pain is rare before tertiary ulceration occurs, but when the latter process appears it is intense, and, if the pharyngo-epiglottic fold or the lower lateral edge of the epiglottis is involved, will be referred to the ears as "streaking pains."

The character of the sputum varies with the different stages. Of a purely mucous or catarrhal quality in the early stages, it becomes muco-purulent, purulent, sanguineo-purulent, and very granular, fetid, with a greater or less number of necrosed fragments, or contains cartilaginous particles, according as erythema, the various stages of ulceration, or gangrene are taking place.

Diagnosis.—The general outlines of the case, or the laryngeal pictures as seen by the laryngoscope, are usually sufficient to establish the diagnosis in these cases. The erythema, as it first appears, may require a guarded diagnosis, unless accompanied by other symptoms indicative of general syphilis, and it is often necessary to depend on these latter manifestations before making a diagnosis of early superficial syphilitic ulceration.

It is necessary to distinguish between the ulcers of tertiary syphilis and tubercular laryngitis, carcinoma, and sarcoma.

Syphilitic ulcers develop rapidly and are accompanied by an irregular inflammatory swelling and edema. As before stated, when the epiglottis is involved the upper surface is most often implicated. Again, there is usually only one ulcer, and this is unilateral everywhere except when on the epiglottis, where it is in the center. There are rarely more than two ulcers. They are usually ovoid, somewhat deep, and their size generally limited to a diameter of one-half to one inch.

Tubercular ulcers develop slowly, are pale, and a uniform swelling of the mucosa resembling an infiltration precedes their formation. The symptoms of laryngeal irritation are usually present for some months prior to the appearance of the ulcer.

If the epiglottis is involved, the lesions are bilateral and occur on both sides; the single ulcers are much smaller than syphilitic ones (being under 3 mm. in diameter unless several tubercles coalesce), and are round. Even when several tubercles adjoin, the diameter of the combined ulcer is not over 3 or 4 mm. When tubercular subjects are the victims of syphilis, the recognition of a laryngeal invasion by the latter disease may be very difficult.

The cancerous ulcer is developed during a few weeks: as a rule, midway between the time occupied by syphilis and tuberculosis a tumefaction is found before the ulcer, and the latter is usually the seat of nodular formations which may extend beyond the immediate seat of the ulcer. The mucosa surrounding the ulcer is generally considerably inflamed. The diameter of the ulcers may reach from 2 to 3 cm. The irregular shape, as well as the solitary arrangement, distinguishes the cancerous from the syphilitic ulcers. A distinct tumefaction is felt in case of a sarcoma, and possibly a denuded surface, but there is no distinct ulcer with a purulent discharge.

Many cases will arise in which the diagnosis is so uncertain that not only must the practitioner await the appearance of other manifestations of this disease, but he will be compelled to take cognizance of the result of specific treatment before making a conclusive diagnosis of his case. The writer personally knows of a case in which a carcinomatous infiltration of the lower pharynx and larynx was unrecognized for some time (several weeks) after the removal of some enlarged cervical glands which were declared to be carcinomatous by a competent pathologist.

Prognosis.—In secondary syphilis a favorable prognosis is the rule.

The lesions met with in this stage of the disease rarely leave permanent changes. If, however, considerable ulceration of the vocal cords has occurred, there may be more or less voice-impairment as a result of permanent injury to these organs. Edema may give rise to dangerous symptoms, particularly when occurring in children, on account of the smaller size of the laryngeal structures.

Even in tertiary syphilis the prognosis as regards life is rarely unfavorable. The deepest and most extensive ulceration will usually yield to treatment, although greater or less deformity, with loss of tissue, frequently results.

As above stated, if the vocal cords and cartilages suffer much ulceration, impairment, and even permanent loss, of the voice may result. The prognosis is more unfavorable the nearer the disease approaches the trachea. Deep ulcerations have caused death by involving the wall of a blood-vessel and producing fatal hemorrhage. In laryngeal stenosis either from edema or cicatricial contraction, but especially in the former, intubation and tracheotomy usually change the prognosis from grave to favorable to a marked degree.

SYPHILIS OF THE TRACHEA AND BRONCHI.

Syphilis of the trachea and bronchi is uncommon, and when present the disease is usually in the later stages. The trachea alone may be affected, or the trachea and bronchi.

Cancerous affections of these parts may be mistaken for syphilis, and *vice versa*, and a positive diagnosis only made post-mortem.

Pathology.—The gummatous infiltration, with subsequent softening from impaired or deprived nutrition and ulcer-formation, does not differ from the manifestations of later syphilis in any mucous membranes. Healing of the ulcers is attended with the growth of much cicatricial tissue, the presence of which diminishes more or less the lumen of the trachea. The walls of the latter may be dilated above and below the cicatricial bands. This constriction may reduce the tracheal caliber to one-eighth inch (McKenzie).

The size of the ulcers varies according to the area previously involved in gummatous infiltration. The trachea may, rarely, suffer a reduction in length as a result of cicatricial contractions. The lower part of the tube is more commonly involved in syphilis.

Symptomatology.—Dreschfeld¹ describes the most prominent symptoms of tracheal stenosis as follows:

1. Dyspnea, most marked during inspiration, and especially so on any exertion of the patient. This, though a most prominent symptom, may occasionally be absent, though the obstruction to the entrance of air into the lungs may be very great.
2. A hoarse, weak, or croupy voice, even if the larynx be free from disease, due to the weak air-current.
3. Swelling of the jugulars with every expiration, due to the abnormally increased pressure in the large veins within the thorax during expiration.
4. Slight downward movement of the larynx with every inspiration. This movement is much more considerable in stenosis of the larynx.
5. The patient breathes easier with his chin depressed, as this causes relaxation and dilatation of the trachea. In laryngeal stenosis, on the other hand, the head is thrown back to facilitate the breathing.
6. Retraction of the lower part of the chest with every inspiration.
7. Loud inspiratory stridor, heard best over the sternum, occasionally accompanied by a thrill to be distinctly felt over the place of constriction. Auscultation of the lungs reveals weak breathing and loud rhonchi, unless there be some lung-complication. It often happens that the stricture is at the bifurcation of the trachea, and extends to one bronchus rather than to both. In such cases we have the characteristic symptoms of stricture of a bronchus (diminished fremitus, diminished breathing, and more marked inspiratory retraction of the ribs) on that side.
8. The laryngoscopic examination may enable us to see the affected part, especially if the stricture is high up in the trachea or if the ulceration is extensive; and the introduction of a sound through the larynx, recommended first by Demme, may in doubtful cases assist us in our diagnosis. In spite of these definite symptoms, the diagnosis between syphilitic stricture of, and pressure on, the trachea is sometimes a matter of great difficulty. The principal symptoms of syphilis of the bronchi are those peculiar to stenosis.

Diagnosis.—The history of the case and laryngoscopic revelations are the principal means to be relied upon in making a diagnosis. The exclusion of other diseases which might produce stenosis must, of course, be kept in view.

Prognosis.—The prognosis in all cases of syphilitic involvement of the trachea and bronchi is grave. In the secondary stages, even though but slight tracheal symptoms are present, the susceptibility of this tube is proven, and the intimation is that the late stage will be accompanied by the most serious syphilitic lesions with which we have to deal.

¹ *Medical Chronicle*, Dec., 1885.

SYPHILIS OF THE LUNGS.

Tertiary syphilis is the only form of the disease with which we have to deal, the affection is not common, and when present is very apt to be mistaken for other lesions.

Pathology.—A new growth of connective tissue or a localized cirrhosis is the manner in which pulmonary syphilis manifests itself. Gummata, which are, histologically, identical with gummata elsewhere, are developed, which are attended with localized connective-tissue hyperplasia, and which may undergo caseation.

They are usually multiple, and are surrounded by the cirrhotic tissue. The pleura is generally thickened in the region of the gummata, and the two layers may be partly adherent.

Instead of a circumscribed area of gummatous and cirrhotic metamorphosis, a general fibrosis or an interstitial pneumonia may develop (Fig. 218).

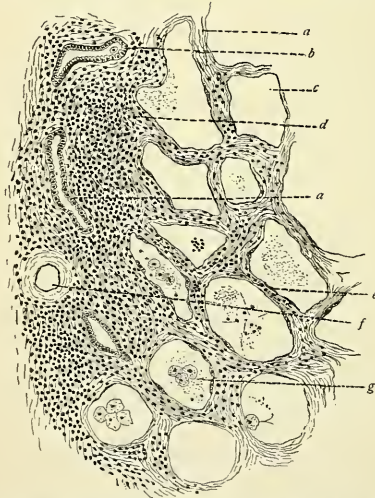


FIG. 218.—Syphilis of lungs: *a*, thickened alveolar walls or stroma; *b*, partly longitudinal section of bronchus; *c*, uninfiltreated alveoli; *d*, new connective tissue infiltrated with small round-cells; *e*, cells lining alveoli; *f*, artery showing thickened walls; *g*, desquamated lining cells.

Then, again, there may be a diffuse hepatization, being either lobar or lobular in character, and may be either grayish or white or red. In such cases the pulmonary alveoli are filled with epithelial cells, and the parietes show a round-cell infiltration. White infarcts may be produced by an obliterating endarteritis of the terminal branches of the bronchial artery.

Symptomatology.—The main symptoms are cough, with or without muco-purulent or bloody sputum and dyspnea. The amount of the latter will depend upon the amount of lung-tissue involved, unless the walls of one or more large bronchi are the seat of extensive cicatrices. The symptoms may closely resemble those of pulmonary tuberculosis, although there is more

wasting in the latter affection unless the liver and spleen be involved in the syphilitic process.

Diagnosis.—In the absence of expectoration the differential diagnosis between pulmonary syphilis and tuberculosis is very difficult, and must depend on the general history of the case.

Tuberculosis most frequently attacks the apices; syphilis usually involves the middle or lower, although, rarely, it may affect the upper lobe or lobes. If there be any expectoration, the detection of the presence of tubercle bacilli will be of great value. If the first examination of the sputum is negative, a number of subsequent examinations should be made before excluding tuberculosis. It is possible for both of these affections to be present simultaneously. A person whose vitality is reduced by the ravages of syphilis may prove a very susceptible subject for invasion by Koch's bacillus. In syphilis, in the majority of cases, there will be symptoms referable to the larynx and other portions of the respiratory tract. If symptoms referable to the middle or lower parts of the lungs occur and progress unattended with increased temperature, a strong suspicion of syphilis should be entertained.

Prognosis.—Unless a diagnosis can be made before extensive connective-tissue hyperplasia has occurred, a favorable prognosis can hardly be given. True, as regards life, the patient may be kept under treatment and by careful surveillance allowed to exist, but, as heretofore stated, the condition being, at best, a devitalized one, the victim is more liable to tuberculous disease. This is especially true in cases where a tubercular tendency, not heredity, exists. If the character of the malady is recognized early, and other important organs are not implicated, and intelligent treatment is faithfully carried out, the disease may be held in abeyance for years.

SYPHILIS OF THE CIRCULATORY SYSTEM.

Syphilis of the Heart.—In the later stages of this disease the heart may be affected by the development of syphilitic inflammation in the pericardium, myocardium, or endocardium. The result in either case is the more or less extensive growth of new connective tissue.

Pathology.—The heart-valves are not as often attacked as the muscular walls. In syphilitic endocarditis the apex in the left ventricle or the base of the heart near the aortic opening is the most frequent location of the disease. Syphilitic endocarditis develops either as circumscribed gummata or in the form of diffuse fibroid thickening. The former seldom occurs before the second year after infection. Syphilitic pericarditis generally follows myocarditis, and is almost never primary. The disease may involve the entire pericardium or only a portion of it.

Symptomatology.—The symptoms of cardiac syphilis are various and uncertain. As a rule, they are general debility, vertigo, headache, dyspnea, palpitation, sore throat, and more or less feverishness.

Neuralgic pains and symptoms of angina pectoris may be present.

The arteries are hard and tortuous, and resemble the vessels of old age, especially the temporal arteries.

Diagnosis.—The diagnosis of this difficulty is extremely difficult, and must rest principally upon the general symptoms of syphilis.

Prognosis.—If the patient is early brought under the influence of specific treatment, the prognosis is favorable, even though mitral and aortic insufficiency have been developed. Where the latter condition cannot be con-

trolled by treatment, unfavorable symptoms may develop, such as albuminuria, marasmus, and hemoptysis, and the prognosis must be grave.

Syphilis of the Blood-vessels.—The disease may exist as a periarteritis or as an obliterating endarteritis. In the former gummatous round or oval nodules may develop in the adventitia. The cerebral arteries seem to be the favorite seat of this lesion. There may be only an infiltration of small round-cells into the adventitia, the perivascular lymph-spaces, or both, or there may be a gummatous development, the softening of which so far destroys the integrity of the vessel-wall that cerebral hemorrhage frequently occurs as a result of the giving away of the latter. The severity of the symptoms in these cases depends upon the location of the hemorrhage. It may be so small and circumscribed, yet in so vulnerable a part of the brain, as to cause immediate death, its location not being ascertained until after weeks of laborious microscopical research. Obliterating endarteritis is a frequent accompaniment of syphilis, and is the cause of the formation of the more or less deep ulcerations following gummatous formations, the *modus operandi* of which has already been given. Although not generally referred to by authors, the writer has observed a peculiar hyaline thickening of the media of the arteries in the great majority (if not in all) the cases of syphilis in which the vessels have been subjected to microscopical investigation. Amyloid infiltration may account for this condition. Phlebitis affects the veins in syphilis, with, apparently, the same pathological or amyloid infiltration as in syphilitic endarteritis. When the veins are involved, the hyaline or amyloid infiltration before referred to is observed in the media and adventitia. This same peculiar hyaline appearance has also been noted as occurring in the connective-tissue stroma of such organs as the liver, spleen, and kidney in cases of general syphilis.

SYPHILIS OF THE LYMPHATIC SYSTEM.

Syphilis of the Spleen.—The spleen may be much enlarged in cachectic and anemic cases during the secondary stage of syphilis. The condition is usually transient and disappears under antisymphilitic treatment.

Pathology.—It is claimed by some investigators that splenic enlargement is the usual accompaniment of syphilis, and appears soon after the primary lesion. Indeed, the determination of splenic hypertrophy has been suggested as a valuable aid in diagnosis where there is doubt as to the nature of the chancre.

Where abdominal syphilis exists the spleen is usually implicated by the surrounding adhesions. This organ may be the seat of gummata, a general fibrous hyperplasia, with the accompanying amyloid appearance already referred to, or both (Fig. 219). In either case the organ is somewhat enlarged, rounded, and gives a fairly dense but resisting sensation to the touch.

The condition known as "sago spleen," or amyloid degeneration of the spleen, in the majority of cases is undoubtedly caused by syphilis. In late syphilitic interstitial splenitis the organ may be much atrophied.

Symptomatology and Diagnosis.—But little is known concerning the symptoms of syphilitic splenitis *per se*, and the diagnosis must rest largely upon specific manifestations of the disease in other parts of the body. As pointed out above, the presence of an enlarged spleen in doubtful cases may be of much diagnostic value.

Prognosis.—If the structural changes in the organ be not too great, the

prognosis is favorable in splenic syphilis. This statement must be liberally construed, as the effects produced by slight and more severe tissue-changes vary exceedingly in different individuals, and even in the same person at different times, depending not upon the physique or physical development, but apparently upon the state of general nutrition and upon the individual's amount of inherent immunity to microbial invasion.

Syphilis of the Lymphatics.—The route taken by the syphilis virus after leaving the primary sore or chancre is through the perivascular lymph-spaces in the region of the lesion. The common seat of syphilitic adenitis, or "*bubo*," is the groin. In this location it may follow a chancre on the penis or external female genitals, perineum, anus, buttocks, cervix uteri,

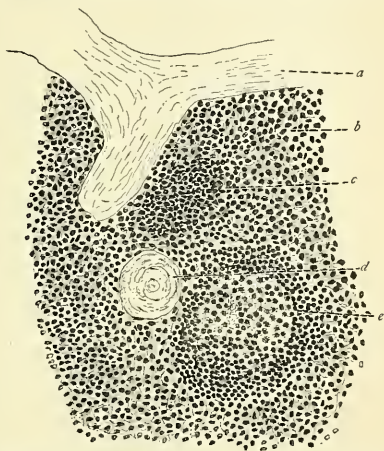


FIG. 219.—Syphilitic spleen: *a*, thickened and more or less translucent capsule and trabeculae; *b*, splenic pulp; *c*, Malpighian corpuscle; *d*, splenic artery, the seat of an obliterating endarteritis; *e*, gumma commencing cheesy degeneration.

surface of the urethra in both sexes, or, in fact, almost any part of the lower extremities (Taylor).

As a rule, those lymphatics which are in closest anatomical relation with the seat of the chancre are most often involved. The location of indurated lymphatics may be of value in determining the original seat of the chancre even after the disappearance of the latter.

Pathology.—The lesions of the lymphatics vary according to the stage of the disease. In the primary stage there is a round-cell hyperplasia of the lymphatics in the immediate region of the chancre, and the microscopical appearance of the involved structures is not different from that of ordinary acute inflammation.

In the secondary stage the glands of the neck, inguinal region, axilla, elbow, etc. are often swollen and indurated. There is, usually, a connective-tissue hyperplasia of the glands, as well as an accumulation of polyhedral and round-cells in the lymph-follicles and sinuses.

In the tertiary stage the glands may be the seat of gummata, the coales-

cence of several of which by neoplastic fibrous bands forms firm, nodular masses of considerable size. The histological appearances of such gummata do not differ from those of similar lesions elsewhere.

Symptomatology.—The inguinal glands of either one or both sides may be involved. If only those of one side are indurated, they will generally be on the same side as the chancre.

Taylor¹ says: "Whenever, as in the groin, a number of ganglia (glands) form a group, most of them, at least, are usually involved, but to an unequal extent. A 'pleiad,' as it has been called, or a rosary-like arrangement of small olive-shaped or globular tumors, is felt, cartilaginous in hardness, freely movable upon each other and the surrounding tissues, and without attachment to the overlying integument. One is commonly developed more than the rest, and attains about the size of an almond; the others, as large as a bean or cherry, surround it like satellites.

"There are no symptoms of acute inflammation. The change has taken place insidiously, and often without the patient knowing it. The skin is not altered either in color or temperature. Firm pressure sometimes reveals slight tenderness, but rarely excites severe pain, and motion is not usually impeded.

"Indolence is one of the chief characteristics of the wrongly-called syphilitic bubo."

Sometimes a single tumor, varying in size and shape from that of a plum to an oblong mass the size of a finger, is all that can be felt in the groin.

One or two weeks is the time usually required to produce the maximum hardness in the glands. Absence of inflammation, hardness, and persistence are important symptoms of syphilitic lymphatic enlargement.

The lymphatic vessel involved has the feeling of a tense cord extending from the chancre toward, but not to, the nearest lymphatic glands. This condition most frequently occurs on the penis.

Diagnosis.—If the chancre is present, the diagnosis of syphilitic adenitis of the lymphatics in the neighborhood is comparatively easy. Otherwise, it is not always a simple matter to arrive at a decision.

Many other conditions, such as gonorrhea, the effect of any irritant upon the glans penis, etc., may be provocative of buboes.

The inguinal glands may become enlarged and indurated in inflammatory diseases of the skin, such as eczema, psoriasis, and from injuries, such as cuts, abrasions, etc. In cases of doubt the nature of the difficulty may be established after one or two weeks.

The difficulty of diagnosis is naturally increased in fat subjects and in cases where there has been a connective-tissue hyperplasia of the abdominal fasciæ.

In the first stages of acquired syphilis a general subacute adenitis is usually, if not always, present. It is *not* present in hereditary syphilis. This is an important point, and should be borne in mind in cases of doubtful diagnosis. At times this condition can be distinguished from tuberculosis only by the presence of some other specific symptoms and the history of the case.

Prognosis.—Unless pyogenic bacteria invade the chancre, suppuration of the neighboring indurated lymphatics is not the rule. When, however, the micro-organisms producing pus, more especially the staphylococcus pyogenes aureus, find entrance to the affected gland, usually by means of the lymph-space surrounding the blood-vessels, suppuration naturally follows.

¹ *Veneral Diseases*, p. 573.

The formation of pus is more frequent in cases of phimosis. The suppurative adenitis may be acute or chronic, and, clinically, similar to chancreoidal adenitis.

Although suppuration of the lymphatics may occur more readily in individuals with broken-down constitutions, yet this debilitated condition itself must not be considered as the sole cause for syphilitic adenitis.

SYPHILIS OF THE ALIMENTARY SYSTEM.

Syphilis of the Mouth.—The neighborhood of the fauces is the favorite seat of syphilitic erythema of the buccal cavity. The differential diagnosis as between a common cold and syphilis is often difficult, and may only be determined by the history of the case. There is usually more edema in syphilis than in other affections of the mouth. Mucous patches are the most frequent evidences of syphilis of the month. The tonsils, uvula, veil of the palate and its pillars, the sides of the tongue, and mucosa of the lips are its most frequent seats. Another common location is the inner surface of the cheek near the last molar tooth.

Syphilis of the Lips.—The lips are frequently the seat of chancres. Generally they are on the vermilion border. They commence as small oval or round sores, raw surfaces, or fissures, and their specific nature is unrecognized until they are pretty well developed. They may resemble the chancre found on the penis or they may be more diffuse. More or less induration exists, the degree of hardness varying in different cases. They may discharge a thick secretion, and are the source of much annoyance. The lymphatics and salivary glands in the neighborhood are apt to become swollen and more or less tender.

The later manifestations of syphilis do not specially affect the lips.

Syphilis of the Tongue.—*Primary.*—Chancres of the tongue occur as fairly well-circumscribed areas on the sides or the tip of the organ, and have no particularly distinguishing characteristics.

Secondary.—An erythema of the tongue may accompany this condition when present in the mucous membrane of the mouth or pharynx. The whole surface of the organ may be involved, or it may occur in circumscribed round or oval areas. These patches may become denuded of epithelium, but such lesions are not the peculiar effect of syphilitic interference alone.

Mucous patches on the tip or sides of the tongue are not uncommon—are somewhat troublesome, especially when occurring in smokers. Fissures may result from both the foregoing secondary phenomena, and may be followed by a greater or less proliferation of epithelial cells.

Tertiary.—Sclerosis and gummata are the lesions peculiar to tertiary syphilis of the tongue, the former being usually developed at the fifth year of infection. The upper surface of the tongue—and that portion near the median line—is the part affected in syphilitic glossal sclerosis, which may be superficial or deep. The former may be circumscribed or diffuse, and is not prone to ulcerate, except from injury. In deep sclerosis the muscular tissue is involved, as well as the mucous, and we usually see two stages in its development. There is first a hypertrophic, and later an atrophic, condition. In the first the tongue may be much enlarged, and in the second contraction of the bands of new fibrous connective tissue occurs, and the tongue becomes smaller than normal.

The gummata may also be superficially or deeply situated. Both pro-

cesses are liable to develop into ulcers from the same causes which produce this condition elsewhere (see p. 666).

Naturally, the ulcers resulting from the deep gummata will usually be larger than those following the superficial infiltration.

Pathology.—There is nothing peculiar as regards the pathology of syphilis of the tongue other than above given.

Symptomatology.—The location of gummata at the tip and sides of the tongue, their insidious growth and chronic course, and the absence of pain are characteristic symptoms of this lesion.

Carcinoma of the tongue occurs late in life, as a rule, and gives rise to very sharp pain, radiating toward the ear.

Diagnosis.—Syphilis of the tongue may be mistaken for cancer and tuberculosis of this organ. A gummatous nodule breaks down; epithelioma is hard, warty, or like exuberant granulations, and, late in its course, may be subject to ulceration. Carcinoma may invade the lower surface of the tongue, and is commonly single, while syphilitic ulcerations are generally multiple, located on the upper surface of the organ, and are bilateral. The induration at the base of an epithelioma extends as the neoplasm develops; gummatous tumor breaks down in its entirety. Cancer interferes with the functions of the tongue much more than does a gumma.

Glandular enlargement is much more frequent in cancer than in syphilis, except with the initial lesion of the latter.

Antisyphilitic treatment, while benefiting cases which are specific, is very apt to aggravate those of cancer. The microscopic examination of sections from the tumor may aid in the diagnosis, although much care must be exercised in arriving at a conclusion by this method in affections of these parts.

Tuberculosis and syphilis of the tongue may coexist, in which case the effect of specific treatment will be of less value in determining the diagnosis. In tuberculosis the lungs are generally primarily affected, the tongue being rarely involved during the early stages of the disease.

Prognosis.—The prognosis is good in the earlier manifestations of syphilis. In the later stages, as regards life, it is also favorable, but if deep gummatous infiltration have occurred, very considerable deformities may result.

Syphilis of the Teeth.—According to Hutchinson, the second set of teeth may exhibit a characteristic deformity in hereditary syphilis. This is especially true of the upper central incisors. When they first appear these teeth are thin, narrow from side to side at their edges, and generally short. Later, a crescentic portion breaks away from their edges, and leaves a broad, shallow, vertical notch, which remains for some years, but finally becomes obliterated after the twentieth year by the premature wearing away of the teeth.

The two teeth may be considerably separated, but frequently point toward each other.

Syphilis of the Gums and Hard and Soft Palate.—*Primary.*—Chancres of the gums and hard palate are very rare affections, and when present cause little annoyance, but little pain, and, unless developing near the margin of the gums, do not tend to ulcerate.

Secondary.—The mucous membrane of the gums and hard palate is subject to syphilitic erythema, mucous patches, their manner of development being similar to that of the same lesions in other mucosæ.

Tertiary.—Gummatous infiltration, with subsequent ulceration, may involve the gums and hard and soft palate. In the latter case, however, the

invasion is exceedingly insidious, and the result may be very serious damage to this structure unless the condition is recognized early and properly treated.

Pathology.—The gummatous deposit may be circumscribed or diffuse.

The pathological sequelæ do not differ, practically, from those occurring elsewhere.

Symptomatology.—The most important symptoms accompanying syphilis of the parts under consideration are those developed during gummatous infiltration of the soft palate. Early in the affection these are either absent or of little account. There may be some difficulty in deglutition, and a tickling or uneasy sensation in the fauces. Later, without any premonition, the powers of speech and deglutition are suddenly lost, and regurgitation of food, especially fluids, through the nose occurs. These phenomena are caused by ulceration, perforation, and more or less complete destruction of the velum, uvula, and faucial pillars. There may also be some difficulty in hearing.

Diagnosis.—The differentiation between syphilis and tuberculosis will be the only difficulty usually met with. If the trouble occur in an adult who has been in good health up to the time of the present difficulty, the presumption of syphilis is strong. The effect of specific treatment is always of value in obscure cases.

Prognosis.—As regards life the prognosis is good. Considerable deformity may result from extensive ulceration, but the reparative process often effects wonderful salutary changes, and cicatricial contractions, instead of widening the space already produced, more or less completely close up the gap.

Syphilis of the Salivary Glands.—Both the sublingual and parotid glands may be affected in the secondary and tertiary stages of syphilis, but the condition is rare, and only occurs when the disease has made itself manifest elsewhere.

When implicated, both glands become swollen, more or less indurated, and the adjacent mucous membrane is apt to be infiltrated.

Syphilis of the Esophagus.—The esophagus is only occasionally the seat of the later phenomena of constitutional syphilis.

Pathology.—There may be ulceration of the mucosa or gummatous infiltration, which processes do not differ from these conditions when occurring in the pharynx or larynx. After cicatricial development and subsequent contraction the esophagus is generally found dilated above the stricture.

Symptomatology.—The ultimate result of syphilitic esophagitis, unless early and vigorously treated, is stricture. The symptoms produced by this condition are the same as those from a stricture produced by other causes, such as cancer or caustics, polypoid tumors, and external pressure by aneurysms, enlarged lymphatic glands, and pericardial effusions.

Diagnosis.—If traumatism can be excluded, the diagnosis can usually be limited to syphilis and cancer. Although this apparently simplifies matters, a positive diagnosis of syphilitic disease of the esophagus is one of the greatest difficulty. The history of the case and the effect of antisiphilitic treatment will both aid in elucidating the diagnosis.

Prognosis.—This is unfavorable, as permanent stricture is apt to be ultimately produced by cicatricial contraction, even though the first symptoms of this difficulty have been relieved by specific treatment. Epitheliomata may develop subsequent to the syphilitic inflammation, or gummata, being caused by the irritation produced by the latter.

Syphilis of the Stomach and Intestines.—The recognition of syphilis of the stomach and intestinal tract is only possible by a microscopic

examination of the suspected tissues post-mortem. It is a rare affection, and gives rise to no symptoms characteristic of its nature.

Syphilis of the Rectum.—Syphilitic affections of the rectum may occur as ulcerations of the mucous membrane, indurated or gummatous infiltrations, and a productive inflammation which is attended by more or less new connective-tissue growth. The result of any of these syphilitic manifestations is very apt to be rectal stricture.

This process is more common in females than in males, and is undoubtedly due to failure to receive prompt treatment.

The **prognosis** depends upon the time which has elapsed between the infection and the inauguration of treatment, being more favorable if the case comes under treatment soon after the disease appears than if at a later period.

Syphilis of the Anus.—Chaneres occur about the anal ring and within the latter for a distance of an inch or more. When gummata develop above the internal sphincter, a narrowing or stenosis of the rectum at the seat of the lesion usually follows. The condition is made apparent by digital examination.

When occurring on the outside, gummata are usually irregular, oval, or



FIG. 220.—Condylomata of the anus (Taylor).

round, possibly fissured or creased, of a more or less pronounced red color, and generally covered with a slimy secretion.

An enlargement of the inguinal glands accompanies the development of chancres in this location.

The fissures mentioned are not as painful as those produced by non-specific causes.

Condylomata may occur, and are produced in the same manner as when developed at other points (Fig. 220).

SYPHILIS OF THE LIVER.

Syphilis attacks the liver probably more often than any of the other abdominal organs, and affects men oftener than women.

Secondary.—That the liver is implicated in many cases of early syphilis is evidenced by the appearance of jaundice, usually of a mild type. The yellow discoloration of the skin may be slight, or there may be a deep

brownish-yellow appearance. The above symptom is probably due to an irritation of the common bile-duct, rather than to any structural change.

Tertiary.—The later manifestations of hepatic syphilis are divided by Osler into three forms, as follows:

(1) *Diffuse Syphilitic Hepatitis.*—This occurs most frequently in hereditary cases. The liver maintains its form, is large, hard, and resistant. Sometimes it has a yellow look, compared by Trousseau to sole leather or an appearance resembling the amyloid liver.

Close inspection shows grayish or whitish spots and lines, corresponding to the intertubular connective-tissue growth.

Under the microscope localized areas of small round-cell infiltration are seen, as well as connective-tissue hyperplasia.

These nodules may be microscopic, forming firm miliary gummata, which produce more or less deformity in cicatrization. There may also be larger gummata.

(2) *Gummata.*—In hereditary syphilis these may occur in childhood or in adult life. In acquired syphilis they rarely appear before the second year after the primary lesion. In the early stage there are pale grayish nodules, varying in size from a pea to a walnut. The larger, which are generally limited toward the liver-tissue, present yellowish centers at first. Later, the center becomes cheesy, with an irregular outline, and is surrounded by a more or less well-developed fibrous zone (Fig. 221). If these gummata be



FIG. 221.—Syphilitic liver: *a*, recent gummata formation; *b*, thickened connective-tissue stroma; *c*, liver-cells practically normal; *d*, gumma, showing peripheral area of round-cell infiltration; *e*, cheesy center; *f*, liver-cells more or less infiltrated with small round-cells.

numerous and extensive, the cicatricial tissue developed during their healing will produce great deformity of the liver. Rarely the gummata break down, soften, and liquefy, and may form fluctuating tumors.

(3) *Glisson's capsule* or sheath may be the principal seat of syphilitic invasion, resulting in a thickening of the capsule, as well as in the connective

tissue between the lobules and in the portal canals. This is really an interstitial hepatitis or cirrhosis.

Pathology.—The pathology of tertiary hepatic syphilis has been referred to at some length in the preceding paragraph. As a matter of fact, interstitial hepatitis caused by syphilis cannot be conclusively differentiated from the same lesion due to other causes. Although this is the dictum of many competent pathologists at the present time, yet the writer believes that in the majority of cases of syphilitic fibrosis the new tissue produced, as well as the original connective-tissue framework of the organ involved, will present a more or less pronounced hyaline, colloid, or amyloid appearance, which differs distinctly from the normal connective tissue as seen through the microscope.

The hepatic gummata in adults are usually larger than those occurring in children. Like non-specific interstitial hepatitis, syphilitic inflammation of the connective tissue of the liver may be accompanied by fatty and amyloid degeneration, and there may be atrophy of the liver-cells from pressure.

The surface of the organ is more or less deeply indented by furrows, caused by the contraction of dense, whitish bands of connective tissue. The latter may even produce a lobulated condition, the bulgings being soft and smooth to the touch. The enveloping capsule is thickened, and presents either various-sized localized opaque patches or a general thickening.

Symptomatology.—In hereditary syphilis jaundice may be present, indicating hepatic irritation. Otherwise, the symptoms of hereditary syphilis are variable and cannot be relied upon.

In the adult the symptoms referable to the liver may be of so slight a character that the individual's attention is not attracted thereby. Indeed, a liver may be found post-mortem to be studded with gummata, with more or less interstitial hyperplasia, and yet no symptoms indicative of liver involvement were complained of before death. As a rule, pain, either localized or diffused in the region of the liver, is a common symptom. It may be constant or intermittent. It is increased by pressure, and its character varies from sharp and severe to dull and persistent. If the peritoneum is involved, the pain is of course increased. A friction sound has been described as occurring in cases of perihepatitis.

Digestion is always interfered with; there are a loss of weight, and often ascites. The temperature is normal, and the pulse is but little accelerated. The symptoms of interstitial hepatitis due to syphilis do not differ materially from cirrhosis produced by other causes. There may be ascites consequent upon chronic peritonitis or pressure upon the portal vein. Generally speaking, jaundice and ascites are not present until there is considerable hepatic enlargement.

The later symptoms, such as loss of appetite, vomiting, diarrhea, gastric and intestinal hemorrhage, and hemorrhoids, may be ascribed to parenchymatous degeneration of the liver rather than to the effect of gummata.

Diagnosis.—It is of great importance that an early diagnosis of hepatic syphilis be made, as the subsequent treatment will wholly depend upon the same. If a history of specific infection can be obtained, and the patient is enjoying reasonably good health, and the liver is found to be enlarged and its outline irregular, it is proper to conclude that the case is one of syphiloma.

Syphilis of the liver may also be mistaken for cancer of that organ. In the former there is usually a specific history.

The progress of cancerous growth is rapid, while that of gummata is more gradual. There is more pain in cancer than in syphilis.

The spleen is usually enlarged in syphilis, but is not in cancer, unless the organ is involved by the malignant growth.

Prognosis.—The prognosis depends upon the stage of development of the disease when first subjected to treatment. If the case is seen and properly treated early, the prognosis is good; if late, not so good. Although, as a rule, favorable as regards life, still, if ascites has developed, gastro-intestinal hemorrhage, a noticeable cachexia, or persistent diarrhea, has occurred, the prognosis is much more unfavorable. The occurrence of diseases of other organs complicates the prognosis exceedingly.

SYPHILIS OF THE PANCREAS.

In the few cases of hereditary syphilitic pancreatitis which have been reported the organ seems to have been greatly enlarged, its weight increased, and its tissue found to be quite unyielding. On section the divided surfaces presented a white, glistening appearance, the parenchyma apparently having suffered in consequence of the great connective-tissue hyperplasia. The most extensive changes were found in the head of the pancreas.

Taylor suggests that this degeneration of the pancreas is one of the causes of gastro-intestinal disturbances in hereditary syphilis.

In the adult the pancreas may be the seat of gummatous infiltration, either alone or synchronously with other organs.

The general pathology of this organ is still somewhat obscure.

SYPHILIS OF THE NERVOUS SYSTEM.

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THE effect of syphilis upon the nervous system may best be studied by the simple classification of the subject into three divisions: 1. Cerebral Syphilis; 2. Spinal Syphilis; 3. Neural Syphilis. Each of these divisions will be separately considered from pathological and clinical standpoints, but the subject of the treatment of the various syphilitic neuroses will be described in detail in a special article.

CEREBRAL SYPHILIS.

The cerebral lesions arising from syphilis may be found in the vascular system, the meninges, the brain, and the inner surface of the cranial bones. Probably the first perceptible changes occur in the vascular system, and consist in a proliferation of endothelial cells between the endothelium and the membrana fenestrata. As this exudation increases in quantity it gradually assumes more and more the appearance of connective tissue. Round-cells emigrate into it from the vasa vasorum, giving it the appearance of a granuloma. This thickening of the inner coat of the vessel diminishes the caliber of the lumen. In many instances the endothelium is torn away from the membrana fenestrata, and is thrust into the lumen, effectually blocking the passage of the blood-current. Sometimes the vessel is completely occluded by the simple thickening of the intima due to the exudation. In either event, as the lumen gradually diminishes in caliber, the cerebral structures supplied by the diseased vessels suffer from insufficient nutrition, which increases in direct ratio to the occlusion of the lumen.

The various functions of the brain cannot operate to the best advantage unless the requisite nutrition is properly maintained. Partial closure of the arterial canals may at first, when the disease is in its incipency, be unattended by any noticeable secondary pathological changes, but, as the endarteritis progresses and the passage of the blood-current is more and more impeded, degenerative changes take place in the cerebral tissue supplied by the diseased vessels; and, if the lumen, from either of the previously mentioned causes, becomes completely occluded, necrotic softening of the parts deprived of nutrition must be the inevitable consequence. The larger vessels are much more liable to undergo syphilitic degeneration than the smaller. The carotids and their ramifications, particularly the lenticulo-striate artery, which traverses the internal capsule and sends branches to the basal ganglia; the Sylvian artery, the basilar artery, and those vessels which compose the circle of Willis, are usually the first to show evidence of syphilitic disease. But the syphilitic process does not stop here. Unless the disease is arrested, the smaller vessels in turn become affected, and a general arterial degeneration results, with more or less consequent cerebral degeneration or softening.

Very frequently degenerative changes occur in the middle and outer

coats of the arteries from defective nutrition due to syphilitic disease of the vessels which nourish them. In such cases the muscular coat of the arteries is greatly weakened, rendering them liable to rupture, and of course causing a hemorrhage into the brain-substance. Cerebral hemorrhage from this cause seems to occur most frequently from a rupture of the lenticulo-striate artery in its transit through the internal capsule, causing hemiplegia upon the side of the body opposite to the lesion. The meninges are subject to inflammatory changes, either in consequence of pressure from syphilitic exostoses upon the inner surface of the skull or else as the result of syphilitic pachymeningitis. Gummatous growths of the meninges are also of frequent occurrence. Exostoses by continuous pressure upon the dura give rise to a slow but progressive inflammation, accompanied by thickening of the dura and adhesions to the pia and arachnoid on the one side, and to the skull on the other.

A similar condition of pachymeningitis occurs primarily in the dura. It is often circumscribed, particularly if the meningitis is the result of pressure from a bony growth, but in other cases the entire meninges seem to be implicated. In many instances the whole surface of the dura is so adherent to the skull that it can only be separated, post-mortem, with the greatest difficulty, and the meninges become so agglutinated to each other and to the brain that they cannot be stripped off without tearing away portions of the cortex also.

Gummatous growths of the meninges are very common. They occur with more frequency in the membranes covering the vertex than the base of the brain. They are found as moderately soft nodules between the meninges, sometimes located in the center of a circumscribed area of fibrous pachymeningitis, and again as a distinct tumor on the outer surface of the dura. Syphilitic lesions of the dura frequently give rise to severe headaches. The pain is usually circumscribed, often confined within a space one or two inches in diameter. Percussion over those areas either aggravates the headache or gives rise to independent and quite distinct pain or soreness.

Syphilitic otitis or periostitis of the skull may be either diffuse or circumscribed, the latter condition being more common. Gummatous inflammation of the bone or periosteum may be present, either as a single focus or as several foci. Syphilitic lesions of the cranium do not in themselves give rise to symptoms referable to the nervous system, but the development of syphilitic nodules and exostoses on the inner surface of the skull results in pressure upon the contiguous meninges and underlying brain-tissue, or else the inflammation of the periosteum extends to, and often through, the membranes, giving rise to a meningitis of greater or lesser extent. Lesions of this kind produce a great variety of symptoms according to the topographical location of the morbid process. Over the superior and lateral surfaces of the brain, disorders of the mind; impairment of motility upon the side of the body opposite to the lesion; epileptic seizures, perhaps localized in certain groups of muscles and preceded by a sensory aura in the same locality (Jacksonian epilepsy); disorders of sensibility; and localized cerebral pains,—are the symptoms most frequently met with. Lesions of the bone forming the floor of the skull frequently result in injury of one or more of the cranial nerves, paralyzing them upon the same side as the lesion. If, in addition to this, the descending motor fibers in the crus are also involved, the cranial-nerve paralysis will be accompanied by paralysis of the body upon the side opposite to the lesion, thus producing a form of crossed paralysis.

Syphilis affects the brain-tissue by the formation of primary growths

(gummata, syphilomata), which may be found in any part of the brain, and by cerebral softening, which is the secondary result of a primary syphilitic disease either in the cranial bones or in the cerebral arteries. Syphilitic growths vary from the size of a pea, and even smaller than this, to the size of an egg, and occasionally very much larger. They are irregular and nodular in shape, do not seem to infiltrate the surrounding tissue—which is, however, somewhat softened—and vary in consistency in different parts of the same growth. Soft, cheesy spots are separated from each other by bands of firm fibrous tissue. They are found mainly in the cerebral hemispheres, but occasionally develop in the pons, and more rarely in the cerebellum and basal ganglia. They are usually situated near the surface, and in such instances seem to be attached to the pia and often to the dura, from which membrane many of them originate and extend, probably along the course of the blood-vessels, into the brain-substance. Other gummatus growths occur in the form of small nodules which seem to spring from the outer coat of the arteries and follow the course of the vessels, often from beginning to end. The presence and location of these growths can only be determined from the peculiar symptoms referring the lesion to some circumscribed region of the brain, to the presence of optic neuritis, and, if the growth is situated near the cortex, to cephalalgia.

The objective symptoms arising from syphilitic growths are not characteristic of syphilis, but are commonly met with in other forms of cerebral tumors. Paralysis, either involving an entire side of the body, or else, as is more frequently the case, limited to a single limb, follows the development of growths in the motor tract. If the motor cortex is invaded, the paralysis may be accompanied by some disorder of sensibility, which, however, in the majority of cases, is not profound or of long duration. Growths in other parts of the hemispheres, particularly if the cortex is involved, are accompanied by symptoms of derangement of the special senses, disorders of the mind, and impairment of sensibility, according to the topographical position of the lesion. On the base of the brain syphilitic growths are very liable to implicate one or more of the cranial nerves, arresting their functions either partially or completely, and gummata affecting the crura, pons, and medulla are followed by paralysis, disorders of sensibility, and impairment of the cranial nerves, though growths of slow development may occur in these regions, and in fact in many other parts of the brain, without definite symptoms, so that in such instances the location of the lesion cannot be positively determined during the life of the individual. As a rule, however, syphilitic growths are rapid in evolution, and their presence is usually accompanied by well-marked symptoms. Gummata of the cerebellum when situated in the lateral lobes rarely give rise to symptoms of any kind, but when the middle lobe is invaded nystagmus and staggering gait become prominent symptoms.

Optic neuritis with choked disk is perhaps not so frequent an occurrence from syphilitic tumors as from other varieties of growths. Syphilomata are more frequently situated in the cortex or directly adjacent to the cortex than other varieties of tumors, and growths in this situation are not so liable to be accompanied by optic neuritis and choked disk as when they are situated in the corpora quadrigemina, cerebellum, pons, and centrum ovale. Nevertheless, optic neuritis, characterized by amblyopia or amaurosis, and either with or without choked disk, is undoubtedly a consequence of a small proportion of syphilitic growths.

Headaches, either general or circumscribed, may accompany syphilitic growths as frequently, and even more frequently, than other kinds of tumors.

Syphilomata being commonly located near the cortex, and frequently attached to the meninges, exert more or less pressure upon the sensitive nerves of the dura, giving rise to pain which may vary in intensity from a slight dull ache to the most acute agony. One circumstance often differentiates the pain of syphilitic growths from the headache caused by other tumors, and that is the circumscribed limitation of the pain. Generally speaking, the headache accompanying cerebral tumors is diffuse, or if not diffuse is spread over a comparatively large surface. The headache of a syphilitic growth, particularly if it is located in or directly adjacent to the cortex, is often confined to an area not extending more than an inch in any direction from a given center. The gesture an individual uses in locating the pain is highly characteristic. In a diffuse headache the palm of the hand is laid upon the head, so as to cover as much surface as possible, thus indicating a wide area of pain, while in the circumscribed syphilitic headache the painful area is indicated by touching the scalp with the tips of one or two fingers only. Another feature peculiar to syphilitic cephalalgia is the tendency to nocturnal exacerbations of pain. A headache characterized by this symptom and confined to a small circumscribed area is almost always indicative of a syphilitic growth.

The cerebral diseases caused by syphilis are mainly paralytic dementia, meningitis, motor paralyses, motor spasmodic disorders, and affections of the various cranial nerves or their nuclei.

Paralytic dementia is generally admitted by most observers to be caused, in some instances at least, by syphilis. This fact is, however, of no great importance clinically, as the symptoms of the specific form are identical with those of the non-syphilitic variety, and the prognosis, course, and duration of both forms are absolutely the same, both terminating fatally without exception. Cerebral syphilis may result in dementia and paralysis, but such symptoms, when they occur, must not be confounded with true paralytic dementia. The former condition is usually preceded by violent headache, with nocturnal exacerbations. The paralysis which develops is not general, as it usually is in paralytic dementia, but frequently shows itself simultaneously in different tracts, such as, for instance, the right arm and left leg, or right hemiplegia with aphasia. Anesthesias of various areas either precede or accompany the paralyses. The characteristic feature of the paralysis is the slow advent, the equally slow decline, and the tendency to shift from one locality to another. The dementia is of the pure type; that is, there is a simple obliteration of the mental faculties, usually without pronounced delusions. Although death sometimes supervenes in a few months, other cases may live for five or six years, and others, again, recover.

Syphilitic meningitis is usually chronic, and is very frequently confined within a small circumscribed area. It is almost always associated either with a syphilitic growth or else with syphilitic degeneration of the walls of the arteries. The symptoms of syphilitic chronic meningitis vary according to the topographical situation of the lesion. Paralysis of the whole or part of one motor tract, paralysis of one or more of the cranial nerves, convulsions either general or limited to a particular area, stiffness or rigidity of particular groups of muscles, and various disorders of sensibility are among the usual symptoms of this affection. Headache is a frequent symptom, and local tenderness on percussion or pressure over the seat of the inflammation is not unusual.

Motor paralysis may result from compression or destruction of the cerebral motor tract, either from meningitis, from syphilitic neoplasms, from hemorrhage, or from thrombosis.

Basilar meningitis is more liable to be followed by paralysis of one or more of the cranial nerves than it is to affect the direct cerebral motor tract. The nerves supplying the ocular muscles and the facial nerve are the ones generally affected, although the optic nerve is sometimes implicated, while the other cranial nerves usually escape, but not always. Meningitis on the basal surface of the brain may cause partial hemiplegia from compression of the motor fibers in the crus. Rarely the motor tracts in both crura are implicated, thus causing bilateral paralysis, but in such cases the paralysis is gradual in onset and seldom becomes complete.

Motor paralysis frequently results from cerebral hemorrhage due to syphilitic degeneration of the cerebral arteries. Hemiplegia occurring in young people or before middle age should always excite the suspicion of its probable syphilitic origin. The degenerated muscular coat of the vessels becomes brittle, and eventually loses its power to resist the pressure of the blood-current. A rupture occurs, and the blood pours out into the cerebral tissue. Of course a rupture may occur in any vessel which is sufficiently degenerated, but it seems as if the lenticulo-striate artery is particularly susceptible. This artery crosses the internal capsule in its motor division, and a rupture at this point tears through the motor tract, causing paralysis of all the muscles upon the opposite side of the body supplied by the injured motor fibers. The clinical picture of syphilitic hemiplegia of this form differs in no respect from hemiplegia due to cerebral hemorrhage from other causes.

Usually there are prodromal symptoms, such as insomnia, headache, irritability, flushing of the face, and inability to perform mental labor, but in other cases these symptoms are absent, the attack coming on with absolute suddenness. If the hemorrhage is not of such a character as to destroy life, the individual, when he regains consciousness, is found to be paralyzed upon one side of the body—upon the side, of course, opposite to the lesion. Usually the leg and arm are at first completely paralyzed, the face either escaping or, as is more usually the case, being slightly paralyzed, more so in the lower than in the upper half. There may or may not be aphasia. If there is, it is most likely to be of the purely motor form; that is, there is a loss of the memory of how to make the complex movements of the lips and tongue necessary for articulate speech. In the majority of cases there is no aphasia. There is almost always difficulty in articulating distinctly, but this is the result of slight labial paralysis, and should not be confounded with aphasia. In a short time, usually in about two weeks, but it may be much longer, improvement begins. The face usually recovers first, and in time may show no trace of paralysis. The arm and leg regain motion slowly, but are seldom if ever restored to full strength. As the hemorrhage becomes absorbed pressure is removed from those motor fibers which were only paralyzed by compression; hence the partial recovery. But those fibers which were ruptured by the sudden pouring out of blood never reunite again; hence the permanent paralysis. The severed fibers degenerate downward from the point of their rupture, and this degeneration, when it reaches the cord, is shown by the stiffness and contractures which soon show themselves in the paralyzed muscles, and in the exaggerated reflexes, and clonus, which can then be readily demonstrated.

Motor paralysis, usually of the hemiplegic form, may also result from syphilitic thrombosis. Beginning as a syphilitic endarteritis, the lumen of the vessel, as has been described on page 690, becomes more and more occluded, and is finally closed altogether. The cerebral tissue which was supplied with blood by that particular vessel is almost cut off from all nutrition. Prodromal

symptoms, such as were spoken of in "Cerebral Hemorrhage," are much more liable to be experienced than in the latter condition. At the moment of complete occlusion the individual usually loses consciousness, just as he does in cerebral hemorrhage, and on regaining consciousness is found to be paralyzed upon the opposite side of the body. Aphasia, either motor or sensory or both combined, is not an infrequent accompaniment of cerebral thrombosis. The disease frequently attacks the middle cerebral artery or its ramifications. This vessel supplies a large cortical area, including the motor centers grouped around the fissure of Rolando, the center for visual word memories in the angular gyrus, and the center for auditory word memories in the posterior half of the superior temporal gyrus. The moment the blood-supply is abolished all the motor centers thus impoverished cease to perform their functions, and therefore the muscles supplied by these centers become paralyzed. In the same way there may be motor and sensory aphasia (word-blindness and word-deafness) if the centers for these memories are deprived of blood. Unless collateral circulation is soon established—and most often it is not—the cerebral tissue deprived of nourishment necessarily degenerates. Even if collateral circulation is effected, it rarely occurs in time to prevent a certain amount of degeneration, which, descending as it invariably does, gives rise to the symptoms of stiffness, contractures, clonus, and exaggerated reflexes, already spoken of in connection with degeneration of the motor tract when considering the subject of cerebral hemorrhage. One important distinction between the symptoms of cerebral hemorrhage and cerebral thrombosis lies in the thermometrical variations. In cerebral hemorrhage the temperature usually rises soon after the onset of the disease, and often reaches a maximum of from 103° F. to 106° F. In thrombosis a high temperature is rare, the thermometer seldom indicating higher than 101° F., and frequently even less than this.

Motor paralysis from syphilitic growths is not uncommon, and yet growths of syphilitic origin, as well as other tumors, may exist in the motor regions of the brain or elsewhere with few or no indications of their presence so far as any disturbance of motion is concerned. Where there is motor paralysis from a syphilitic growth, it is usually gradual in its onset, affecting perhaps the face first, and then the arm, and then the leg, as the growth in its development successively encroaches upon one center after another if the growth is cortical, or upon the different sets of fibers coming from these centers if the growth is subcortical. The growth may involve any of the cerebral centers or their afferent fibers primarily, and may either then extend in any direction, so as to affect secondarily contiguous centers or fibers, or the growth, failing in its development, may become arrested at any point. It has already been stated that syphilitic growths may exist in the cerebral motor tract without there being any paralysis at all. In such cases the motor fibers or cells are either pushed aside by the extending growth, or else, if they become incorporated in the morbid material, they preserve their integrity perfectly or else nearly so. It is not at all uncommon to discover cerebral tumors of considerable magnitude directly in the motor tract unaccompanied by paralysis. The diagnosis in such cases is usually determined by the presence of headache, choked disk, and convulsions either general or Jacksonian. When paralysis does occur, and it is observed to spread slowly, so as to affect one group of muscles after another, the presence of a neoplasm should always be suspected; but other symptoms of cerebral tumor are necessary before the diagnosis can be confirmed.

Motor Spasmodic Disorders.—Syphilis is a frequent cause of epi-

leptic seizures, either in the form of general convulsions or of localized or focal spasms. General convulsions result from the cerebral irritation which necessarily follows such gross morbid lesions as cerebral tumors, meningitis, arterial degeneration, and exostoses from the inner table of the skull. When the growths are situated deep in the cerebral tissue the seizures are similar in every respect to those of idiopathic epilepsy. The attack may or may not be preceded by an aura. There is the sudden loss of consciousness, the fall, and the general convulsions, followed by a period of somnolence. There are ordinarily other symptoms of cerebral tumor which can usually be detected. Thus there may be headaches, nystagmus, vomiting, paralysis, optic neuritis, and other symptoms, which vary according to the location of the growth. Meningitis, especially if it is not confined to a small area, produces similar seizures. Cortical tumors, or those just beneath the cortex, or circumscribed patches of meningitis, or exostoses, when situated so as to invade or irritate the motor regions of the cortex, frequently give rise to localized spasms limited to one side of the body or to one arm, leg, or one side of the face. The attack is usually preceded by a sensory aura, beginning in the foot or hand, which gradually extends upward. This is followed by unconsciousness either partial or complete, and by convulsions in the leg or arm or both as the case may be. Following the convulsion, the affected limb is weakened, sometimes completely paralyzed, for a short time, and there may be a certain amount of numbness or anesthesia. These symptoms are, however, transient, the limb finally recovering completely until the next seizure, when the entire group of symptoms is repeated. Cortical lesions in this and in other regions of the brain may cause general convulsions, but this form of epilepsy always indicates that the center of irritation is located in the motor center corresponding to the limb in which the aura, convulsions, and weakness are experienced. Mobile spasms, such as tremors, ataxic movements, athetosis, and chorea, have been observed to accompany syphilitic irritation of the motor cortex, and also irritative lesions of the basal ganglia. Of course these symptoms are unilateral, and are observed on the side of the body opposite to the lesion.

SPINAL SYPHILIS.

The syphilitic diseases of the spinal cord are mainly syphilitic tumors of the cord, syphilitic meningitis, and certain diseases of the cord itself, such as tabes dorsalis and a form of motor paralysis, with or without contractures, due to syphilitic disease of the anterior and lateral divisions of the cord. Occasionally one lateral half of the cord is either compressed by a growth, or meningitis has involved both motor and sensory nerves on one side only, or else one lateral half of the cord is invaded by syphilitic disease. In such a case there is seen that peculiar condition known as Brown-Séguard's paralysis, in which there is loss of motion below the lesion on the same side as the lesion, and loss of sensibility on the side opposite to the lesion. This condition is, however, rarely seen.

Syphilitic growths within the vertebral canal are usually situated in the meninges, but may also be found within the substance of the cord. When they are without the cord the first symptoms are those due to compression and irritation of the nerve-roots. If the tumor compresses the posterior portion of the cord, the symptoms will be mainly sensory. There will be pain in the back, radiating pains, and vaso-motor symptoms, such as livid and glossy skin, which may be either hyperesthetic or anesthetic. If the tumor

is on the anterior surface of the cord, so as to compress the motor roots, there will be progressive paralysis, muscular atrophy, and sometimes contractures. Any group of spinal symptoms, particularly if they are unilateral, whether motor or sensory, which come on insidiously and progress slowly, but steadily, should always arouse a suspicion of the presence of a spinal tumor. Tumors within the cord usually destroy gradually the tracts in which they lie, and the resulting symptoms will of course conform to those which invariably follow diseases of the different segments.

The symptoms of both intra- and extradural tumors vary according to which segment of the cord is invaded by the tumor.

Syphilitic spinal meningitis differs very little clinically from the meningitis resulting from other causes. There is usually pain in the back, which is increased by pressure and by voluntary movements. This latter fact is so thoroughly appreciated by the sufferer that the back is held perfectly rigid. This rigidity is augmented by the irritation of the motor roots, which greatly increases the muscular spasticity.

Cervical meningitis is almost always accompanied by retraction of the head. Radiating pains beginning in the cord and extending around the trunk are usually early symptoms. These pains are paroxysmal, and, like other syphilitic painful affections, are particularly liable to nocturnal exacerbations. The pains are often accompanied by numbness, hyperesthesia, formications, twitchings, spasms, and contractures. These symptoms correspond, of course, to the level of the cord affected.

There will be paralysis, atrophy of the paralyzed muscles, and loss of the reflexes, caused by compression of the anterior nerve-roots. If the cord becomes compressed, the paralysis and atrophy become more profound, control of the sphincters is lost, and deep and troublesome bed-sores are very liable to form. Sometimes the dura only is affected. In that case the symptoms are the same, only greatly modified.

Tabes dorsalis, or locomotor ataxia, though usually classified as a disease of the spinal cord, is probably, in many cases at least, merely the manifestations in the cord of a general and diffuse cerebro-spinal disease.

The influence of syphilis as an etiological factor in the development of tabes is undoubted. Probably there is no other disease of the cerebro-spinal system so liable to follow syphilitic infection. We are inclined to believe there are at least three distinct morbid processes by which syphilis causes tabes. First, there is the necrotic degeneration of the posterior columns caused by defective nutrition the result of endarteritis, which gradually occludes the lumen of the vessels. This process has already been described on page 690. Secondly, there seems to be in many cases an infiltration of syphilitic material of a gummatous nature into the posterior columns, causing degeneration of the fibers from compression. Thirdly, in other cases there is an abnormal development of the connective tissue, which, as in the second instance, compresses the nerve-fibers and destroys them. The principal symptoms in the early stage of the disease are the sharp, shooting, lancinating pains, the loss of the knee-jerk, and the inability to stand upright with the eyes closed and the feet together. Later, the ataxic walk is manifested; there are disorders of sensibility and frequently loss of the sphincter reflexes. The pupil reflex to light is sometimes lost early in the disease. This is known as the "Argyll-Robertson" pupil. Occasionally it is one of the earliest symptoms, and is always of great value from a diagnostic standpoint. It is rarely observed in any other diseases except paralytic dementia and tabes. If the former disease can be excluded, a diagnosis of tabes can be

made with almost absolute certainty. There are many other symptoms, which cannot be considered here, but it is perfectly safe to make a diagnosis of tabes if the first three symptoms mentioned can be obtained.

Syphilis invades other parts of the cord besides the posterior columns. Sometimes there is a gradual paralysis of the legs or arms or both. A peculiarity of this form of paralysis is that one leg or one arm is at times more paralyzed than at others. Sometimes the trophic cells in the anterior horns are degenerated, and then the paralysis is accompanied by atrophy and the reflexes are lost, but, as a rule, the lateral pyramidal tracts are more likely to be affected. In that case spasticity and contractures accompany the paralysis, and the reflexes are exaggerated. Sometimes there is severe pain or there may be anesthesia.

If the cervical region only is invaded, there will be paralysis, atrophy, and loss of reflexes in the upper extremities, and spasticity, contractures, and exaggerated reflexes in the lower limbs. There may be also a loss of the vesical and rectal reflexes. In the dorsal and lumbar regions the symptoms are identical with those observed in ordinary myelitis, the symptoms varying, of course, with the level of the segment diseased.

NEURAL SYPHILIS.

Syphilis affecting the nerves is mainly observed in relation to the cranial nerves, though, doubtlessly, other nerves are sometimes, if not frequently, injured by syphilis. In many cases disorders of the cranial nerves are the only symptoms which can be discovered. In others, again, the neural palsy is accompanied by motor paralysis elsewhere of a distinctly syphilitic character, or else syphilitic cortical disease, either in the form of mania or dementia, greatly facilitates the diagnosis. When, however, the neural paralysis is the sole evidence of disease, the diagnosis of syphilis, though it may be suspected, cannot be made with certainty. Any one of the cranial nerves alone, or any number of them together, may be affected either by periarteritis, syphilitic meningitis, or the pressure of a syphilitic growth. Sometimes the nucleus of the nerve is the seat of the lesion. If so, the symptoms are identical with a lesion of the nerve itself. The cranial nerves most liable to be affected seem to be those causing oculo-motor and facial paralyses, but cases of paralysis of the other cranial nerves are frequently reported. Sometimes the sciatic nerve, either from malnutrition due to periarteritis or to syphilitic degeneration of the vessels supplying the nerve or to the pressure of syphilitic growths, gives rise to intense pain. Other nerves, to a lesser extent, may be similarly affected. Thus neuralgias, often of a very severe character, follow syphilitic infection. These neuralgias are characterized by the paroxysmal character of the pain and by the tendency to nightly exacerbations.

PROGNOSIS OF SYPHILITIC DISEASES.

Most authorities agree that the prognosis of diseases of the nervous system, when caused by syphilis, is much more favorable than under any other conditions. Be this as it may, the opinion may be stated that the results generally obtained from the most scientific treatment do not warrant the presumption that syphilis of the nervous system is readily curable by any means. The prognosis of syphilitic paralytic dementia is as unfavorable as when the disease is due to other causes, and the same may be said of syphilitic meningitis. In the case of syphilitic tumors the prognosis is certainly more favorable than for any other

variety of growth. There is reason to believe that appropriate treatment sometimes effectually accomplishes their absorption, a practically unheard-of result with other growths. Hemiplegia from cerebral hemorrhage due to syphilitic arterial degeneration is no more likely to be recovered from than when the hemorrhage is the result of other causes. If the motor fibers are ruptured by the extravasation, there will be permanent paralysis, no matter whether syphilis was the primary cause or not. The same may be said of hemiplegia caused by syphilitic thrombosis. If cerebral degeneration follows before collateral circulation becomes established, the paralysis will be permanent.

In the early stage of *tabes dorsalis* the probability of arresting the progress of the disease is fairly good, but diminishes in direct ratio with the advance of the disease. In other forms of syphilitic myelitis the writer has seen great benefit derived if treatment is begun early before destructive changes in the cord have become pronounced. But, generally speaking, when degeneration of nerve-elements has once been accomplished, whether it be in the brain or the cord, the prognosis is most unfavorable, and even the most energetic treatment will in such cases be unproductive of benefit.

The prognosis of epilepsy is, as a rule, unfavorable. Operations for the removal of tumors and for excision of areas of diseased meninges have been successfully performed for many years. Time has proved that but a small proportion of cases recover. In the great majority of cases the attacks return even after the original cause has been removed.

SYPHILIS OF THE EYE.

By THOMAS R. POOLEY, M. D.

No part of the eye and its adjacent structures are spared during the course of syphilis, apart, perhaps, from the lens and vitreous, which are involved secondarily. All forms of the disease find their expression in the eye. The primary lesion, secondary and tertiary manifestations, and the hereditary form of the disease as well, all affect in various ways the structure of the eye.

In the following pages we shall take up, first, the affections of the orbit; then the eyelids; in successive order those of the various tunics of the eye from without inward; and, finally, the affections of the muscles of the eye. For the sake of condensation the hereditary forms of the disease will be considered briefly under the different divisions.

ORBIT.

The orbit may be affected either in its depth or marginal borders. Periostitis leads to caries and necrosis, especially at the rim of the orbit. Inflammation of the periosteum of the deeper parts necessarily produces the symptoms of tumor—*i. e.* protrusion of the eye in an opposite direction from the growth, impairment of mobility toward the side of the tumor, more or less impairment of function according to its position, especially when it is at the optic foramen and the superior orbital fissure, anesthesia of the cornea with its sequelæ (neuro-paralytic keratitis), neuralgias and paralyzes of the orbital muscles.

Added to these symptoms are those of inflammation, swelling of the lids, chemosis, and, later, signs of orbital suppuration, and fistulæ form. It must be said, however, that these symptoms are not to be taken as characteristic of syphilis.

The **diagnosis** depends upon the previous history and other evidences of syphilis, and in part, too, upon the result obtained by antisyphilitic treatment.

If the periostitis is located in the orbital margin (periorbitis)—and this, in the experience of the writer, is the more common—swelling of the lid and chemosis are the first symptoms. The globe is slightly displaced and prominent. Palpation between the eyeball and the orbital wall discloses at the affected place an exquisitely sensitive swelling, the pain from which extends to the brow and temple. This condition may be due to a simple irritative periostitis or a gummy tumor, which generally leads to thickening of the bone; in the second case, to ulceration through the skin of the lid, or breaking through the orbital wall into the cranial cavity or into one of the accessory sinuses.

The eyeball itself may be implicated in various ways: through the swelling in the orbit, or by the formation of exostoses in the vicinity of the

foramen opticum, neuritis may be developed of the character known as choked disk.

In the same manner, too, atrophy of the optic nerve may be induced, and even detachment of the retina as a cause of orbital periostitis has also been observed. In some instances the eye-muscles may be affected, causing diplopia. When a periosteal abscess at the margin of the orbit suppurates, a fistula leading to dead bone results. The discharge of pus continues until all the carious bone has been eliminated and the fistula heals, leaving a funnel-shaped scar adherent to the orbital margin, through which can be felt the defect in the same made by the loss of bone. Other disastrous results which remain are ectropion of the affected lid, and even lagophthalmos. The cornea also may be affected by keratitis from pressure or exposure; perforation may ensue and result in phthisis bulbi. Syphilitic periostitis is ordinarily met with only in adults, and only exceptionally in children (as a result of hereditary syphilis). It belongs to the third (gummatous) stage, generally appears in a chronic form of periosteal thickening, and much more rarely as an acute suppurative process.

Treatment.—This consists in an active antisyphilitic course, which usually brings about a rapid improvement when promptly initiated.

On account of the infrequency of the occurrence of suppuration, one seldom has to resort to incision, drainage, etc. But should signs of suppuration ensue, especially in deep-seated abscesses, no time should be lost in making an incision, instituting appropriate drainage, thus preventing the pus from burrowing beneath the periosteum and producing extensive detachment of the periosteum from the bone, or the process from being transferred to the brain.

Resulting ectropion and other deformities from loss of bony tissue of the orbital walls should be dealt with by suitably contrived plastic operations. All such operative procedures should be deferred, unless the cornea is in danger from exposure, until the disease has run its course and only cicatricial tissue remains.

Chronic periostitis of syphilitic origin may give rise to a gradual thickening of all the walls of the orbit, by which its cavity is rendered progressively smaller, causing exophthalmos and compression of the nerves which pass through the orbit, giving rise to paralyses and neuralgias.

Whether the osteomata (ivory exostoses) which sometimes develop from the orbital wall, but more frequently from one of the adjacent cavities, and grow very slowly, are of syphilitic origin is doubtful, although they have been so considered by some authors. The writer has seen quite a number, operated on several, but never has there been conclusive history of syphilis in any of his cases.

Tenon's capsule, or the fibrous capsule surrounding the eyeball, is sometimes, although extremely seldom, affected by syphilis, giving rise to a tenonitis. It is characterized by the same symptoms as tenonitis from other causes, which are, briefly, swelling of the lids, exophthalmos, chemosis, and restricted movements of the eyeball, sometimes diplopia, but little secretion, and associated with but moderate pain and a sense of pressure or tension of the eyeball.

THE LACHRYMAL ORGANS.

The lachrymal glands have in rare instances been found to be the seat of gummy swellings or to be attacked by an interstitial inflammation (Streatfield, Aldini, Adler, and Alexander¹). The tumor which results from the swelling

¹ Alexander: *Syphilis u. Auge.*, Wiesbaden, 1888-89, p. 36.

of the gland rapidly subsides under specific treatment after resisting all other therapeutic methods.

Affections of the tear-passages are of much more frequent occurrence. The lachrymal puncta may become everted from ectropion as the result of orbital periostitis, thus causing epiphora. But the occurrence of dacryocystitis, dacryo-cystoblenorrhœa, and stenosis of the nasal duct are more common. The disease extends in most cases from syphilitic affections of the mucous membrane of the nose, periosteum, and bone. The bony walls of the nasal duct are not infrequently involved, resulting in cicatricial stenosis and bony closure, thus naturally aggravating the prognosis because of the impossibility of restoring the opening by probing. In many cases there is caries of the bone.

The frequent occurrence of lachrymal affections in infants due to hereditary syphilis has been especially pointed out by Kipp of Newark.

The **treatment** of these cases, besides the proper use of appropriate anti-syphilitic remedies, will consist in the use of probes, injections into the sac; but in too many instances these are unavailing, and the operation for obliteration of the sac, either by dissecting it out or by destroying the mucous membrane by caustics, is to be recommended.

EYELIDS.

The eye may be the point of entrance of the infection. Such occurrence, although not common, has not been infrequently reported, and the hard chancre may be found upon the lid or its free margin or upon the conjunctiva at its inner surface. The most frequent site, however, is the inner angle of the lid, where a loss of substance is apt to occur from rubbing.

Like all diseases of the eye which are due to rubbing, chancre is more common in the right eye. Taylor¹ says: "They are usually of the erosive type, with either slight or decidedly marked induration." It, however, does not spread much around the original lesion (Plate 12, Fig. I.). The author is indebted to Dr. Robert W. Taylor for the sketch which is taken from a case of his drawn by Joseph Gaertner. The first appearance is usually a pimple, which ulcerates, becomes characteristically indurated about its base. The margin of the ulcer is clear cut, and its floor somewhat excavated and covered with a scanty grayish secretion. Occasionally no ulcer is present, but the entire lid is swollen and greatly indurated, purple, and shiny, and then the diagnosis may become very difficult. The induration lasts a long time. Recovery is usually complete, the swelling of the lid is only accompanied with epiphora, chemosis, and conjunctivitis; partial entropion and trichiasis sometimes result. The preauricular and submaxillary glands are always enlarged, which is a sign of great value in determining the diagnosis, although it must not be forgotten that even this sign may be found in other diseases.

Hard chancre of the lid might possibly be mistaken for chancroid, epithelioma, and inoculation from vaccine virus. Kneis² mentions two cases of chancroid at the inner angle of the eye. In epithelioma the age of the patient will usually, although not always, decide the diagnosis. Vaccination of the eye is very difficult to differentiate, and, as the enlargement of the glands referred to may be found in almost all these cases, we must wait for the appearance of the eruption to decide the diagnosis unless we can make a microscopical examination.

¹ *Venerical Diseases*, 1895, p. 558.

² *The Eye in General Diseases*, p. 405.

FIG. I

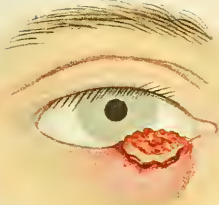


FIG. II

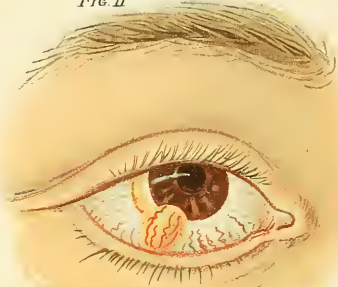


FIG. III

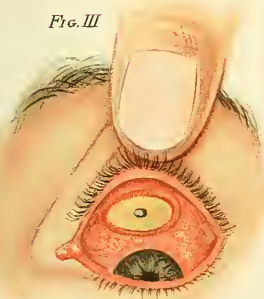


FIG. IV

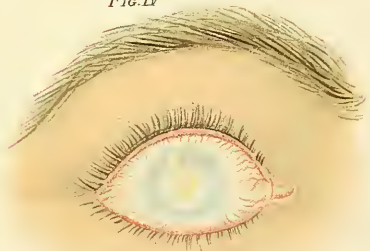


FIG. I.—Chancre of the inner angle of the lower lid. The case was that of a young girl affianced to a young man who had syphilis and active mouth-lesions. The infection took place either through his kissing her eyes or from her use of a handkerchief belonging to her lover. The picture is typical. (Drawn by Gaertner, from a patient of Dr. R. W. Taylor's.)

FIG. II.—Gumma of the conjunctiva. In the inferior temporal quadrant is a large gumma of the ocular conjunctiva, extending from the lower cul-de-sac to the corneal margin, and infiltrating the conjunctiva to such an extent that it envelops the cornea for some distance. On the temporal margin of the cornea is a small gumma adjacent to, and probably continuous with, the large gumma. (Case of Dr. C. S. Bull's, from Morrow's *System of Dis. of the Gen.-Ur. Organs.*)

FIG. III.—Gumma of the sclera. The entire ocular conjunctiva was injected. At a point 2 lines from the upper part of the limbus corneae the conjunctiva rose in an oval cushion-like swelling $\frac{1}{2}$ inch in its horizontal and $\frac{3}{4}$ inch in its vertical measurement, with a large central depression. Surrounded by pus was a dark spot about 2 mm. in diameter. The removal of the pus showed the base of the depression to be ulcerated, and the dark spot to be a projection through the ulcerated sclerotic. (Drawing by Dr. Jos. A. Andrews.)

FIG. IV.—Showing the late appearances of the non-vascular form of parenchymatous keratitis. The substance and posterior layers of the cornea are seen to be occupied by a dense deposit of gray-white lymph; the anterior surface of the cornea is quite free from leukoma, and is transparent, giving to the opacities the appearance of having been mounted behind thin laminae of glass. (Hutchinson.)

The manner in which the infecting matter can be carried to such an unusual place seems to be very varied indeed. Berry¹ mentions the occurrence of a chancre on the eyelid of a woman aged eighty-four who took care of an extremely syphilitic infant. Schmidt-Rimpler² reports the case of a physician in whose eye syphilitic secretion had flown, and a girl of fifteen, with an ulcer on the edge of the lid; examination gave no trace of syphilis—perfect virginity; roseola appeared later; infection was acquired by a kiss. De Schweinitz³ mentions as one of the possible ways of infection that it might occur from the filthy practice of attempting the removal of a foreign body from the eye with the tip of the tongue. A colleague has mentioned to the writer a typical case of hard chancre on the lower lid observed by him which was produced in this way, but the commonest cause of infection is kissing by persons with syphilis of the mouth or rubbing with unclean fingers. The integument of the lid is not infrequently affected in the eruptions of the early period of syphilis. According to Michel, this is especially the case in acne and roseola, in which case the cilia are often destroyed, but are replaced again.

Boucheron⁴ reports a well-authenticated case of chancre of the semilunar fold conveyed from mucous patches in the mouth in kissing, and refers to another in the same situation occurring in a physician who rubbed his eye to relieve itching with his fingers soiled in examining a case of syphilis.

Mucous patches also occur upon the conjunctival surface of the lids, especially upon the free margins, and often give rise to ulcerative lesions which are aggravated by the constant friction of the lids over the eye. The accompanying drawing (Plate 13, Fig. I.) shows an ulcer of the lower lid caused by an ulcerating mucous patch, observed by the writer some years ago in Charity Hospital. Such a condition may even be mistaken for chancroid or chancre, but the more superficial character of the ulceration will distinguish it from the one, and absence of induration from the other. Such ulcerations, too, may be observed in the later stages from the occurrence of rupia on the lids.⁵

Gummata and ulcers resulting from their breaking down have been observed upon the integument of the lids and upon their free margins. They commonly start from the tissue of the upper lid, particularly from the cartilage. They may develop quite early in the disease, even during the first year, according to various authors; grow to varying size, generally ulcerate rapidly, and cicatrize. Their most usual site is at the outer part of the upper lid. In some instances doubt may exist as to whether the tumor is a gumma or an epithelioma, and when a great part of the tissue of the lid is involved the differentiation from a primary chancre may be difficult. The nature of the surroundings of the ulcer, the course of the disease, and the influence of therapeutics thereon decide the diagnosis.

In the rapid evolution of the disease or by too long delay of appropriate treatment a great part of the lid may be destroyed or perforation may ensue. The resulting scars are the cause not infrequently of ectropion, or, if the gumma is located at the upper margin, the roots of the cilia are destroyed, and as a result the latter are permanently lost.

Fuchs⁶ describes *tarsitis syphilitica*, a non-gummatous inflammation occurring in the later stages, which occurs as a chronic, indolent infiltration; the skin and the conjunctiva are not affected; ulceration does not take place, but the lid is considerably thickened and hard. The cilia fall out and the

¹ *Diseases of the Eye*, p. 15.

² In his *Treatise*, 1892, p. 198.

³ Alexander: *loc. cit.*, p. 12.

⁴ Roosa's translation of his book, p. 388.

⁵ *Gaz. des Hôp.*, June 14, 1879.

⁶ *Text-book on Ophthalmology*, 1892.

glands in front of the ear become enlarged. After the swelling has remained for some weeks at the same height, it gradually disappears, until the tarsus has regained its former volume or in consequence of atrophy becomes smaller. Hutchinson, in his book on *Hereditary Syphilis*, describes a peculiar form of blepharitis due to hereditary syphilis. It consists of sharply defined ulcerations extending to the skin of the lid, and which attack by preference the commissure.

Treatment.—The first principle upon which the therapeutics rests in these cases is a constitutional one. In gumma it is especially incumbent to administer the iodide of potassium at once, so as to avoid a large loss of tissue of the lids. Irritation of the conjunctiva of the lids requires the use of soothing and astringent collyria. In many cases the sequelæ of these processes, such as ectropion, entropion, and the like, will have to be remedied by suitable operative procedures, but they must always be done after all active processes have quieted down.

CONJUNCTIVA.

Chancre of the conjunctiva is very rare. It is fortunate that this is so, as the induration and subsequent ulceration would be very apt to destroy the eyeball. Cases are reported by Rona.¹

The most frequent localization is the inner angle of the eye and the caruncle, where a small loss of substance is apt to occur from rubbing. It is not, as a rule, difficult to diagnose, and involves the skin of the surrounding lid. Any doubt as to its nature is soon dispelled by the occurrence of secondary symptoms.

Papular syphilides or mucous patches, as well as other forms of irritation, may appear upon the conjunctiva of the lid, globe, or caruncle, usually during eruptions on other parts of the body. They have the appearance of small reddish, lenticular elevations with moist surfaces.

Conjunctivitis of a catarrhal form, congestion, and the like are often found in syphilis without any real relation to this disease. They are sometimes produced, however, by syphilitic affections of the lid and like affections of the lachrymal organs. The observations of Goldzieher² and Sattler³ are the only reports concerning a specific trachoma-like disease of the conjunctiva, and Alt⁴ describes a recurrent conjunctival hyperæsthesia, the direct connection of which with syphilis may be called somewhat doubtful.

Treatment.—But few words are needed to denote appropriate treatment of these conditions. The conjunctivitis which may result from the irritation of the presence of eruptive processes should be treated with astringent and antiseptic collyria, and in all cases especial care should be given to thorough cleansing of the conjunctival sac. If the conjunctivitis is due to an extension of the inflammatory processes from the lachrymal to the conjunctival sac, an appropriate treatment will be required for this condition. The constitutional treatment indicated for the resolution of gumma elsewhere is here the more urgent because of the danger of destroying the eye by ulceration.

Gumma.—But few cases of gumma of the conjunctiva are on record. In most of them the product in the conjunctiva has appeared to be a simple extension from the adjacent lid or from the sclera into the conjunctiva. Cases have been reported by Weecker, Estlander, Trouseau, Bull, and others.

¹ *Mon. f. prak. Dermat.*, 1891, p. 462.

³ *Prag. med. Woch.*, 1888, No. 12.

² *Centr. f. Augenheilkunde*, 1888, p. 103.

⁴ *Centr. f. Augenheilkunde*, 1890, p. 373.

Bull's case,¹ with an illustration which is here shown (Plate 12, Fig. II.), is especially interesting.

CORNEA.

The occurrence of chancre on the cornea must be extremely rare, but at least one such case has been reported.² It is unnecessary more than to refer to the possibility of its occurrence.

In acquired syphilis specific disease of the cornea is rare. Diffuse interstitial or parenchymatous keratitis uveitis anterior (Stellwag), which is so frequent and characteristic of congenital syphilis, is only observed in rare cases and at a late period in the acquired form.

Mauthner³ describes a true keratitis punctata in syphilis. Opacities as large as the head of a pin come and go without ciliary injection in the various layers of the cornea; they never lead to suppuration. The disease is rare. Alexander⁴ has seen a similar condition associated with true keratitis.

Gumma.—Under the term gumma of the cornea Denaire describes reddish-gray, diffuse opacities associated with iritis, and Magni describes small opaque patches at the extreme periphery of the cornea; Knies,⁵ grayish-yellow infiltrations about 3 mm. in diameter, situated beneath the transparent epithelium, about 2 mm. from the rim of the cornea, to the outside and above. This had developed in an elderly person three years after infection. Anti-syphilitic treatment had but little effect, but the infiltration slowly disappeared, leaving a grayish, distinctly depressed patch. Knies concludes that this may have been a gumma, and the imperfect effect of mercurial treatment was due to the fact that it was situated in a non-vascular tissue.

Diffuse Interstitial Keratitis.—Diffuse interstitial keratitis, described by Jonathan Hutchinson as being so characteristic of congenital syphilis, usually begins between the age of six years and puberty, and occurs most frequently in the female sex. Exceptions to this statement, however, are perhaps not so infrequent. The writer has observed its occurrence at the age of twenty-four in a young man, and has now under treatment a girl of twenty-nine with marked parenchymatous keratitis of one eye, with a history of well-marked evidences of hereditary syphilis. While this affection of the cornea is so very suggestive of congenital syphilis, there are not wanting those who contend that there are many exceptions to the rule. The writer, for instance, has seen very many cases in which such connection could not be traced. It is true, however, of a large percentage (Horner, two-thirds; Mauthner, four-fifths). The corneal disease may be the sole symptom of the congenital syphilis; more frequently, however, there are other evidences of its presence, such as deformities of the skull, deafness, or other signs of meningitis, sinking in of the bridge of the nose, affections of the joints and their sequelae, especially of the knee-joints, enlargement of the glands and linear scars at the angles of the mouth, purulent rhinitis, etc. According to Hutchinson, a peculiar formation of the teeth, which is most marked in the upper permanent middle incisors, is extremely characteristic of congenital syphilis. In many cases examination and previous history of the parents furnish the most certain evidence of congenital syphilis. It is not alone in poorly-nourished, badly-developed children that disease of the cornea occurs, but also in many others who are otherwise physically and mentally well developed.

Symptoms and Course.—The disease may run its course in two ways,

¹ *Am. Journ. Am. Sciences*, Oct., 1878.

³ *Zeissl's Lehr. d. Syph.*

² Julien: *Mal. Vener.*, p. 585.

⁴ *Loc. cit.*

⁵ *Loc. cit.*

according to whether it begins at the center or margin of the cornea. If the disease begins at the center first, there are small, deep-seated, gray maculæ in the cornea; the surface of the latter is lustreless and dull. The number of the maculæ increase, and they steadily encroach more and more upon the margins of the cornea, but they are always more abundant in its center, where they frequently become confluent. Since even the spaces between the maculæ are not clear, but hazy, the whole cornea assumes an opaque appearance resembling ground glass. As soon as the corneal opacity is somewhat advanced, vessels make their appearance from the circumference of the cornea and penetrate into it, resembling pannus, except that the vessels are more deeply seated in the cornea and dimly seen because of its cloudiness. In cases where the disease begins at the corneal margin, the first thing observed is that the membrane has become cloudy at some parts of its margin. The opacity is deep-seated—with the naked eye looks gray, but when examined by oblique illumination the cloudiness can be resolved into spots or parallel stripes. As the disease increases more spots appear at different parts of the corneal margin, and push their way through toward its center. Simultaneously with the appearance of the spots vascularity of the limbus begins; the vessels from the limbus advance but a little way on the corneal margin, where it looks red and swollen. The deep vessels which come out from the limbus extend more into the cornea and follow closely upon the opacity which lies over them. These vessels now have the appearance, as in the other form, of being deeply seated.

When the inflammation has reached its height the entire cornea has become so opaque that we can scarcely see the iris through it. It loses its lustre; with a convex lens we can see that the epithelium is raised, which makes the surface rough. Sight is reduced to the mere perception of the movements of the hand or to the recognition of light from darkness. The process of recovery now begins by the cornea first clearing at its margin, the vessels decreasing in number. The center of the cornea clears up last, but finally clears too, leaving only a diffuse haziness. These maculæ, with a few fine vessels only to be made out by a magnifying glass, often remain for years, and are certain tokens of a parenchymatous keratitis which has once existed.

There are cases in which the cornea remains throughout the entire course of the disease without the formation of blood-vessels.

Parenchymatous keratitis always runs a chronic course. It always lasts several months before improvement begins; then the irritative symptoms rapidly subside, and in favorable cases clearing up of the opacity of the cornea begins from its margin, and the membrane is entirely restored to its normal condition, or only faint maculæ remain. It requires, however, a long time for the cornea to be restored; the center remains particularly opaque for a long time, requiring from half a year to a year fully to regain its normal transparency. Different degrees of severity are observed, however; some cases do not reach the intensity described, and hence are completed in a shorter time; thus the process does not go farther than the formation of a few maculæ, which soon disappear without the inflammatory symptoms reaching any great height. On the other hand, fortunately not very often, dense corneal opacities remain as a permanency, or, owing to the infiltration, the cornea becomes soft and gives way under the intraocular pressure, producing staphyloma of the cornea, in which case the cornea remains opaque to a marked degree. In other cases the dense parenchymatous infiltration leads to sclerosis and flattening, and dense opacity by subsequent shrinking of the exudate, in which case the sight is nearly or quite lost.

The degree to which vascularization of the cornea goes also varies as much as do the degree and density of the opacity, so that we may distinguish between a vascular and non-vascular form of the disease (as shown in Plate 12, Fig. IV.; Plate 13, Fig. III.), in many cases the whole cornea remaining vascular, so as to look like "red cloth;" in others, on the contrary, being almost devoid of blood-vessels and looking like ground glass.

The subjective symptoms accompanying parenchymatous keratitis are usually of the irritative kind—viz. pain, photophobia, and lachrymation. Sometimes these symptoms are slight, and again very severe, being, as a rule, more marked when vascularity of the cornea is excessive. In nearly all cases the uveal tract is involved by hyperemia of the iris, iritis, or iridocyclitis, in some instances leading to the formation of posterior synechiæ, exclusion, and occlusion of the pupil by the formation of an exudate upon the posterior surface of the iris. The worst cases are those in which plastic irido-choroiditis occurs, causing a flattening of the cornea and even phthisis bulbi.

Increase in tension of the eye may occur, in which, the cornea being clear enough to admit the use of the ophthalmoscope, excavation of the optic nerve has been observed.

Parenchymatous keratitis generally involves both eyes, but, as a rule, not at the same time, the intervals being often as long as several years. Relapses take place, but they are rare.

Prognosis.—The prognosis of the disease is on the whole favorable as regards the final outcome, but it is not to be forgotten that the disease drags on for months and even years. This fact should always be made known to the parents at the same time that an ultimate hope as to the recovery of a serviceable degree of sight is held out.

Treatment.—This must be both local and constitutional. The eyes are to be protected from the light—without the patient being confined to the house—which is to be done by protective glasses of blue or London smoke. Atropine should be used throughout the height of the disease to allay pain and irritation and to prevent synechia in case of iritis. One of the most distressing symptoms—that of photophobia—is best combated, according to the writer's experience, by immersing the face frequently in cold water. Moist warm compresses (especially in the non-vascular form) relieve the symptoms of irritation, and apparently exert a favorable influence upon the course of the disease.

In cases of iritis and cyclitis leeches should be applied to the temple, atropine more frequently instilled, and the patient be kept temporarily in a dark room. When the activity of the disease has subsided, as shown by the departure of all signs of irritation, an irritative remedy should be used to bring about absorption of the opacities, such as the insufflation of calomel, the ointment of the yellow oxide of mercury, wine of opium, hot applications, and the like.

If protrusion of the cornea is threatened, it should be combated by the use of the pressure bandage, paracentesis of the anterior chamber, or iridectomy.

The general treatment should be of a character calculated to sustain and improve the general health. Mercurials have little if any effect upon this form of disease, and the energetic use of them is hardly to be advised excepting in very severe cases. In children especially it is best to give only small doses of mercury with chalk, minute doses of sublimate, etc. It really seems to those who have observed such cases that treatment is powerless in cutting short the progress of the disease. Of much more importance is it, in

the writer's experience, to give food and in an easily digestible form, to pay attention to the general health, frequent bathing, out-door exercise, and to give cod-liver oil, iron, iodine, and other tonics.

SCLERA.

Inflammations of the sclerotic frequently occur as part of extensive syphilitic inflammation of the uveal tract or cornea, which may recover, but may also leave scleral staphylomata. It was doubted for some time that scleritis existed at all as an independent affection. Inflammatory affections of this membrane are certainly rare, whether due to syphilis or not, and the fact that they do not always yield promptly to specific treatment has caused some to doubt their syphilitic nature. Mooren in 1867 was the first to describe a case of syphilitic episcleritis; soon after others were published by Galezowski and Higgins. The following are the forms in which they occur: episcleritis or superficial scleritis, episcleritis parenchymatosa, and scleritis gummosa, or gummy tumors of the sclerotic.

Episcleritis.—Episcleritis is the name given to one or more deep patches of congestion of the eyeball of varying size, accompanied by more or less swelling of the sclerotic and the episcleral tissue, with swelling and elevation of the conjunctiva which covers it.

The vascular injection is of a deep-red almost purple hue, and resembles more a blotch or splash than a congery of distinct blood-vessels. Several such patches may be present, but it is characteristic of the disease that they never surround the circumference of the cornea entirely. This injection is deeply seated and masked by the intense injection of the conjunctiva which covers it, thus obscuring the limits of the underlying scleral injection. The patches of infiltration and injection may occur at any place on the eyeball, but usually in the ciliary region, and they may extend backward to the equatorial region of the globe. The elevation is usually but slight, and pain not severe. Involvement of the iris is not common.

The course of the disease is chronic and lasts for months, recurring patches springing up before the original ones have disappeared. Resolution generally takes place without leaving permanent changes. It is certainly more common in gout and rheumatism than in syphilis; of all the cases treated by the writer, none of them could be traced to a syphilitic origin.

Episcleritis Parenchymatosa.—The parenchymatous form is only a severer type, involving the deeper layers of the sclerotic. The patches are usually circumscribed, although there may be several of them. Injection of the sclerotic is deeper in color, the infiltration more extensive, and the elevation of the conjunctiva by reason of the exudation more prominent.

In like manner, the irritative symptoms are greater, there is more pain, which causes a sensation of pressure and boring in the eye, and a dull aching over the brow.

The infiltration is in the parenchyma, and iritis or cyclitis may exist. The disease is chronic, may run its course without complications of the uveal tract, and never results in suppuration or ulceration. It always leaves traces behind, as blue or bluish-brown discoloration, which may be due to a pathological change in color of the tissue or to the pigment of ciliary body or choroid showing through the sclerotic, or atrophy of the sclerotic. In some cases, through the occurrence of thinning and atrophy of the sclerotic, ciliary and equatorial staphylomata take place.

Scleritis gummosa, or gumma of the sclerotic, is of very rare occur-

rence as an independent process. The gummata more frequently start from the ciliary body or choroid, and thus invade the sclerotic. They make their appearance through a bulging of the sclerotic, caused by a localized infiltration into and upon this membrane, usually circumscribed, but with diffused margins, without marked inflammatory symptoms. The infiltration is so extensive and well limited in many instances as to make the tumor project to a considerable distance above the surrounding surface, as seen in Plate 12, Fig. III., case of Dr. Andrews,¹ a drawing of which was kindly given the writer by the author. Cases of gumma of the sclerotic have been reported by Hirschberg, Barber, C. S. Bull, Loring, Sturges, Alexander, Andrews, and others.

The course of invasion is usually from within outward, although the gummata have been known to grow in an inverse direction. Their usual site is in the course of the recti muscles, and they are more frequent on the temporal side than elsewhere; which has led to the view by some that they develop from the tendon or capsule of Tenon. They are of a yellowish color, moderately hard, slightly nodular, tender to the touch, and well supplied with vessels. The conjunctiva is usually movable over the growth, and very much congested. There is some pain, stiffness in movements of the eye, and photophobia, but no restriction in mobility.

The **diagnosis** is confirmed by other evidences of syphilis. Gumma may ulcerate or as a result of treatment disappear, only a slate-gray depressed spot marking its former seat.

In regard to the **treatment** of these several affections, hot applications are of service in bringing about absorption of the infiltration in scleritis. Atropine and cocaine allay pain and irritation, but if there is no tendency to iritis, either eserine or pilocarpine will give better results; iodide of potassium and mercury should be used alternately and long continued. The writer has had better results with hypodermic injections of pilocarpine and salicylate of soda than with any other therapeutic measures, and, although there has been no history of syphilis in his cases, would use it even in such cases in conjunction with other remedies. Iodide of potassium is the appropriate treatment here as in the treatment of gumma elsewhere.

IRIS AND CILIARY BODY.

The different forms in which inflammation affects the iris are as follows: plastic iritis, serous iritis, iritis gummosa or papulosa, or, when the inflammation is very acute, iritis gelatinosa or fibrinosa.

Plastic iritis is the commonest form in syphilis. It generally begins with pretty severe inflammatory symptoms; sometimes with marked ciliary injection, photophobia, and pain which extends from the eye over the brow, temple, and face; in other cases it begins with only slight symptoms, the eye being only slightly reddened and but slightly painful. In cases where the ciliary body is involved there is pain on pressure over the ciliary region and in the movements of the eyeball; there are also present in such complications fever, gastric irritation, and pain.

The iris is discolored, swollen, and has a lack-luster appearance. The pupil is contracted, and acts sluggishly or not at all to the influence of light and shade. When forcibly dilated by atropine it dilates only in places, and shows numerous posterior synechiæ. As the exudations increase in quantity the whole pupillary margin of the iris is fringed by them, or they coalesce, uniting the whole edge of the pupil firmly to the lens capsule, leaving the

¹ *Archives of Ophthalmology*, vol. xi. p. 458.

center of the pupil clear enough to admit of good vision. This condition is variously named *circular* or *annular* synechia and *exclusion of the pupil*. We must distinguish between this condition and the invasion of the area of the pupil by lymph, which is sufficient to fill the entire space, and is known as *occlusion of the pupil*. But the exudation may not be confined to the pupil and its margin. It may extend to the ciliary margin of the iris, producing broad and firm synechiæ. The surface of the iris may be covered with a film of exudation, or the exudate may be mixed with aqueous humor, giving it a turbid appearance, or it may be precipitated against the posterior wall of the cornea, reaching a considerable size, and may even extend into the parenchyma of the cornea itself. Other complications, such as choroiditis, retinitis, are not infrequent in syphilitic iritis.

Serous Iritis.—In serous iritis there is usually but slight circumcorneal injection. On the posterior wall of the cornea a large number of grayish-white or brownish, small punctiform precipitates or deposits are found, which are often arranged in the form of triangles with the points directed upward. The iris is slightly changed in color, the pupil generally reacts to light, and under atropine dilates quickly, revealing but few posterior synechiæ. The anterior chamber is abnormally deep, and there is at times an increased tension of the eyeball (consecutive glaucoma).

Iritis Gummosa or Papulosa.—In this form of the disease (which may be considered diagnostic of syphilis), in addition to the other symptoms of iritis, yellowish-red or dirty orange-colored nodules appear in the tissues of the inflamed iris. Their favorite situation is in the vicinity of the border of the pupil, especially below (see Fig. IV., Plate 13, showing these formations in both eyes of the same patient—a rare occurrence), but they are found occasionally in other parts (see Fig. II., Plate 13). They are seated in the depth of the iris-tissue, and the reddish color is seen on close inspection to be due to a congeries of blood-vessels surrounding them. A small hypopyon is sometimes present, and its appearance is usually coincident with the disappearance of the severe pain which previously existed. Symptoms of an irritative kind are often of a very mild type in iritis papulosa. These so-called gummata are sometimes single, or there may be a number of them, in which case they surround the pupil like a crown. Sometimes they reach the posterior border of the cornea, which is especially the case when they are seated on the ciliary margin of the iris, where the anterior diameter is more shallow; in which case, too, it happens that they sometimes break through the cornea and sclera in the neighborhood of the sclero-corneal margin.

These little nodules may entirely disappear under suitable local and general treatment, but they generally leave a broad synechia and a discolored atrophic patch.

In severe complications of the ciliary body edema of the lid and chemosis are present. These symptoms, taken in conjunction with the pain in the ciliary region (aggravated on touch) and the appearance of opacities in the anterior part of the vitreous humor, are evidences that they do not depend upon iritis alone, but are due to an extension backward to the ciliary region.

As an occasional or unusual occurrence, but which does not occur alone in syphilis, a peculiar form of exudation sometimes makes its appearance—the so-called gelatinous exudation first described by Schmidt of Marburg.¹ Following him, Gunning reported similar cases.² This form of exudation in

¹ *Klin. Monat. für Augenheilkunde*, p. 94, 1871.

² *Loc. cit.* p. 7, 1872; *Arch. of Ophth. and Otol.*, vol. iii. No. 1, p. 20.



FIG. I.—Ulcerated mucous patch on the free margin of the lower eyelid. Patient in the stage of early secondary syphilis, with syphilides over the body, and numerous mucous patches in the mouth and throat. (Case of the author's in the Charity Hospital, New York.)

FIG. II.—Iritis gummosa (papulosa). The gumma in this case starts from the periphery or ciliary margin of the iris, in which situation the occurrence of gummata is unusual. There are synchia and circumcorneal injection. (Drawing by Dr. J. A. Andrews.)

FIG. III.—Vascular parenchymatous keratitis, showing a condition of extreme vascularity of the cornea, from a case of parenchymatous keratitis in which softening was threatened in the center of the cornea. (Hutchinson.)

FIG. IV.—Iritis gummosa (papulosa) of both eyes. Shows the occurrence of this affection in both eyes at the same time. The nodules are situated on the pupillary edge of the iris, where they usually occur. Corresponding to the situation is a broad synchia posterior, and the whole eye is intensely injected. (Drawing by Dr. J. A. Andrews.)

severe cases comes on abruptly, soon more or less fills the anterior chamber, is made up of fine filaments which cross each other at different angles and form a network which closely resembles the gross structural arrangement of sponge. Absorption takes place rapidly, without alterations in appearance, or the exudation may first be changed into a bluish-white homogeneous and sharply defined mass.

Course and Termination.—The duration of specific iritis is very variable. The shortest duration may be said to be from two to three weeks, the longest many months. It must, too, be borne in mind that relapses are very frequent. The most favorable termination must be considered that in which recovery takes place without synechia, and in which the only remnants of the disease are small spots on the lens capsule which do not interfere with the sight, marking the place in which the iris was adherent.

Those cases in which a membrane forms in the pupil have more serious consequences. When there is closure of the pupil from the pupillary border becoming attached to the lens capsule, the results are still more disastrous; the iris is pressed forward, surrounding the pupil like a wall, while the pupil itself is like a crater. From this condition increased tension, so-called secondary glaucoma, may arise. If the exudation into the posterior chamber is very great, it leads to adhesion of the entire posterior surface of the iris to the lens capsule, not only at its pupillary margin, but through its whole extent (total posterior synechia); but this will only occur in cases which are complicated by cyclitis. This condition is recognized chiefly from the altered form of the anterior chamber. As the exudate shrinks it draws the iris closer to the anterior surface of the lens, so that the posterior chamber is obliterated, and the anterior chamber rendered proportionately deeper, especially at its periphery, where the iris is displaced farthest backward. In some instances such exudations push the lens forward; the anterior chamber thereby becomes shallow or completely obliterated, and opacity of the lens, *cataracta acreta*, is caused; or, if the entire vitreous becomes filled by such exudates, the retina is detached, and atrophy of the eyeball ensues. In cases where the ciliary body is detached from the sclera, irritative processes are set up which may give rise to sympathetic ophthalmia in the other eye.

Choroiditis or retinitis is a not infrequent complication of specific irido-cyclitis. According to some authorities, retinitis is always present, and often continues after the iritis is well, leading to atrophy of the retina. This broad statement is certainly not true, but in most instances there is hyperemia of the retina. As in many cases the sight is not seriously affected by the presence of retinitis, the importance of examining all such cases with the ophthalmoscope before the patient is dismissed from observation must become apparent.

Period of Syphilitic Infection in which Iritis Occurs, and its Relations to the General Disease.—Iritis generally appears during the early stage of secondary syphilis, commonly associated with eruptions, but sometimes even before these have made their appearance. The writer has usually found it to appear within six months after contagion, and frequently as early as the second or third month, while in one case there was indisputable evidence of its occurrence, one month after the contraction of the disease,¹ and Knies² has seen typical iritis papulosa or gummosa as the first and sole secondary symptom three weeks after a hard chancre. While iritis may appear as the first evidence of syphilis, it will more commonly be found associated with, or

¹ See paper by author on "Syphilitic Iritis," *Ohio Med. Surg. Journ.*, vol. i. p. 214.

² *The Eye in General Diseases.*

to have appeared before, other symptoms of the disease, such as alopecia, engorgement of the cervical ganglia, mucous patches, erythema of the skin, papules. It does not appear that iritis is associated with any particular form of eruption. In 15 out of 50 cases observed by the writer it is noted that other secondary symptoms were present, such as roseola, papular eruptions, sore throat, and the like. According to some statistics, 75 per cent. of all cases of iritis are due to syphilis; according to others (Graefe), 60 per cent.; Alt, only 25 per cent. The writer's own observation has been that at least 50 per cent. are due to this cause. It is only in 15 to 20 per cent. of the cases that the iritis appears in a manner which is characteristic of syphilis (iritis gummosa, condylomatosa, papulosa). Great as is the percentage of cases in which iritis is due to syphilis, it is not to be lost sight of that the existence of syphilis does not render one immune from iritis due to other causes. It is difficult to arrive at any accurate determination of the percentage of syphilitics in which iritis occurs. According to Seggel, 1.05 per cent. of all syphilitics suffer from iritis.

Iritis may happen in the later stages of syphilis, although it is comparatively rare, and then the disease is more insidious and chronic in character. It also occurs in hereditary syphilis. By far the most careful study of all such cases is by Hutchinson,¹ who collected all the cases on record at the time of the publication of his book in 1863, and added 16 more afforded by his experience. The symptoms were those of plastic iritis of an insidious form, with slight or no acute inflammatory symptoms, in many cases synechiæ and copious exudations into the pupil; the cornea was unaffected in nearly all. In Hutchinson's publication no mention is made of the occurrence of gumma or papules of the iris, but cases are reported by Alexander,² Trousseau,³ Watson,⁴ and Liebreicht.⁵

The disease is most frequent from twenty to forty, which is explained by the preponderance of the general disease at this period.

In spite of the constitutional cause, only one eye may be affected, but it is more usual for both to be affected, although at different intervals.

Diagnosis.—If we inquire whether we can diagnose iritis depending upon syphilis from other forms, we may answer in the affirmative in most of the cases that come under our care. It must be admitted, however, that only one form of iritis, taken independently of other symptoms, is diagnostic of syphilis—the so-called iritis gummosa. According to some writers, even this condition can be mistaken for granuloma or tuberculosis of the iris, but these affections are so eminently rare as not to be worth considering. The tendency of the injection to assume a partial character corresponding to the swollen part of the iris is also characteristic. For the rest, we cannot in any given case be positive that the iritis is due to syphilis without concomitant evidence, such as the admission of infection, the presence of other secondary manifestations, the cicatrix of a chancre, etc. Even when iritis occurs soon after the healing of a chancre we cannot be quite sure of its syphilitic origin, but the presumption is so strongly in favor thereof that we ought to treat it as such. The effect of antisypilitic treatment is often useful as an aid in determining the specific character of the disease.

Prognosis.—The prognosis hangs on the general condition of the patient and on the condition of the eye. In patients whose general condition is weak and are poorly nourished, iritis runs a severer course than in those who are strong and otherwise healthy. Dr. Bull has pointed out the particularly

¹ *Loc. cit.*² *Loc. cit.*, p. 196.³ *Ann. de Dermat. et Syph.*, vol. vi. p. 415.⁴ *Ophth. Hosp. Rep.*, vol. xi. Part 1, p. 65.⁵ *Mon. f. Aug.*, 1891, p. 184.

bad results of iritis in the colored race. Old age, too, makes the prognosis worse. In serous iritis the termination is often more favorable than in the severe forms of plastic iritis. The more the ciliary body is affected the more serious becomes the prognosis for a complete recovery. In cases where former attacks have existed the prognosis is worse, since it then runs a more chronic course and frequent relapses are liable to happen.

It is to be borne in mind that syphilitic iritis is usually of the parenchymatous type and accompanied by considerable exudation of lymph, not only at the edge of the pupil, but also into the structure of the iris; which fact renders the prognosis graver than in simple idiopathic iritis, where there is less exudation. Then, too, the tendency to the implication of the other tunics of the eye is not to be lost sight of.

The prognosis for the future of the eye is always rendered more or less grave when synechiæ are left, for their presence predisposes to attacks of recurrent iritis and glaucoma.

While, as a rule, the percentage of recoveries in syphilitic plastic iritis is large under appropriate treatment, the inflammation leaves sequelæ which renders a full restoration of the eye to its normal functions more or less doubtful. Exclusion and occlusion of the pupil always have a bad effect upon the nutrition of the eye, and not infrequently lead to phthisis bulbi and loss of sight.

Newly-formed products of inflammation (gumma)—not, however, those which occur in the early stages, which are more properly called papules, but true gummatous formations of the later stages of syphilis—impair the function of the iris, break through the eye, or by the formation of cicatricial tissue add to the gravity of the prognosis.

Treatment.—This must be both local and constitutional. In the writer's opinion, the first point to be secured in the treatment of iritis (which is too often neglected) is perfect rest for the eye, and this can only be secured by keeping the patient in a darkened room. It is of great importance to keep the pupils widely dilated: this should be done as soon as possible, and the dilatation maintained throughout the entire treatment of the attack. To accomplish this a strong solution of atropine (at least 1 per cent.) is required. The frequency with which atropine is to be used depends upon the case in hand. If the synechiæ are firm and numerous, or if the pupil be much contracted or dilates but slowly, a drop may be put in as often as every hour or two. In patients whom we are obliged to treat as outdoor cases the atropine should be put in by the surgeon at short intervals until some effect has been produced upon the pupil or the result be negative. It sometimes happens that the use of atropine is followed by an irritation of the conjunctiva, vascularity, swelling of the lower lids, and the formation of granulations, in which case some other mydriatic, such as duboisine or scopolamine, must be substituted. In frequent instillations pressure should be made for a few moments after each use of it over the lachrymal sac to prevent passage of the solution into the throat. In cases where the pupil refuses to dilate under the use of atropine the alternate use of cocaine (4 per cent.) with atropine produces a good result.

The abstraction of blood from the eye by the application of leeches to the temple is a most valuable adjunct in allaying pain and favoring the action of the atropine. From four to six leeches are to be put on the temple, taking care not to set them too near the eye. They should be allowed to remain until they drop off of themselves, and the bleeding promoted by hot applications.

For the relief of pain, which in syphilitic iritis is always worse at night, some narcotic will be required, but the less use of such remedies the better. The relief of pain secured by leeches and atropine is more permanent. The author usually gives bromidia or an injection of morphine. Hot applications are often of great service in allaying pain and hastening absorption. In all cases the frequent use of a free mercurial purgative is useful.

Operative interference will be necessary in cases of recurrent iritis dependent upon broad synechiae, and in exclusion and oclusion of the pupil, when iridectomy must be done. The same procedure may be required if there should be glaucomatous complications, or it may be necessary in some instances, when the iris and the lens have grown together and cataract results, to remove the lens as well. As a rule, however, no operative procedures should be made during the acute stage of the disease; they are particularly indicated for the conditions which remain when all inflammation has subsided.

In regard to constitutional treatment but little need be said in such a treatise as this. It consists in the energetic use of mercury, and the inunction treatment is the one to be preferred.

CHOROID.

Gumma.—Large gummatous neoplasms of the ciliary body and the anterior part of the choroid are of occasional though rare occurrence, and it is usually impossible to secure their resolution without causing destruction of the eye.

Inflammatory Conditions.—Cyclitis and choroïditiis may develop in every possible degree of violence and duration. The affections of the ciliary body, however, have already been considered in connection with the iris.

This inflammatory process may be either diffuse or focal (disseminated choroïditiis). The two forms can only be differentiated with the ophthalmoscope, on account of the implication of the pigment epithelium in the disseminated form. The microscope shows that the inflammation is mainly focal in both forms, but specific changes in the arteries are widely diffused.

The forms of inflammation which affect the choroid in syphilis are, as in iritis, of the plastic type. We shall consider them under the following heads: (1) Diffuse choroïditiis; (2) Choroïditiis centralis; (3) Choroïditiis disseminata; (4) Choroïditiis anterior.

In **diffuse choroïditiis**, which is spread diffusely over the whole choroid, and is therefore ordinarily known as retino-choroïditiis or chorio-retinitis, the entire retina is cloudy, and, furthermore, the picture of the fundus is veiled by a fine punctate cloudiness of the vitreous. Again, a circumscribed exudation may be present between the choroid and retina. In the later stages the cloudiness of the retina disappears, to be followed by atrophy or a migration of the pigment under the form of numerous black spots, which take place in the retina, especially at the periphery, so that the appearance is very like that known as retinitis pigmentosa, which latter disease is held by some authorities to be due to syphilis.

Choroïditiis centralis is characterized by an exudation, usually isolated, directly in the region of the macula lutea, which causes a central scotoma, and as the exudate absorbs leaves an atrophic spot with a permanent scotoma. Such exudations, which are frequently due to other causes, in the writer's experience, are by no means rare in syphilis.

Choroïditiis disseminata is the commonest form of syphilitic cho-

roiditis, and is characterized by numerous round or irregular, ill-defined, yellowish-white spots which appear beneath the retina over the red fundus (Figs. I., II., Plate 14).

It is an eminently chronic form in which new exudations are being formed all the while, until ultimately the choroid is studded all over with such spots, which in many places become confluent.

The sight may remain very good unless the neighborhood of the macula is involved. In the beginning of the attack hyperemia of the disk and retina are present, but later both become atrophic. As the exudate disappears the choroid again comes into view, but in an altered state; it is atrophic, deprived of its pigment, in part converted into cicatricial connective tissue, and becomes a lighter color, and where it has grown altogether atrophic a white spot exists because the sclera is seen through. Afterward the pigment of the choroid proliferates, so that the atrophic patches appear lined with black pigment or covered with black spots. The papilla assumes a dirty grayish-red color and loses its sharp outline. The retinal vessels are fewer and greatly contracted.

A special form of choroiditis disseminata is the choroiditis areolaris, first described by Förster. In this the first development of the disease is at the yellow spot, while the exudates which develop subsequently make their appearance at a constantly increasing distance from the latter; the most recently developed foci are therefore at the periphery. The behavior of the individual spots is directly the inverse of the ordinary course of choroiditis patches: the most recent ones are entirely black, and afterward grow slowly larger, and at the same time become decolorized from the center toward the edge, so that at last they are almost entirely white.

In **choroiditis anterior**, in which the anterior part of the choroid is the one principally involved, deposits of exudation are found at the periphery of the choroid. These exudations are very easily overlooked if we neglect to examine the anterior parts of the fundus with the ophthalmoscope.

Choroiditis anterior is quite frequent, and is sometimes combined with a choroiditis surrounding the papilla. In young persons it often occurs as a result of hereditary syphilis; usually the periphery of the fundus in such cases is studded with rounded ink-black spots.

Symptoms.—The initial clinical symptoms are vague, and point to irritation or loss of function of the outer layers of the retina. They include distorted vision, photopsia, photophobia, hemeralopia, micropsia. These symptoms indicate destruction of individual groups of rods and cones. The symptoms progress gradually or quite suddenly into a central, often very dense, and usually positive scotoma, which is seen as smoke or mist. Diffuse implication of the retina may produce blindness. The accompanying opacities of the vitreous, which nearly always exist, add greatly to the impairment of sight, especially in the variety known as diffuse choroiditis.

The **course** of the disease is almost always chronic, but it may come on, or rather the relapses especially may, with a great loss of sight and diffuse opacities of the vitreous.

The **termination** in mild cases may result in complete restoration of sight, but the ophthalmoscope will nearly always show traces of disease. On the other hand, defects in the field of vision and central scotoma may remain, or complete atrophy of the optic nerve and the retina, causing amaurosis, ensue.

Choroiditis may occur in hereditary syphilis, and it has been known to take place during intra-uterine life. It is, however, more frequent in the latter part of the secondary or the beginning of the tertiary period; and

often occurs after many years of immunity from all other symptoms, which is strikingly shown in a case now under the writer's care in which both eyes are affected by a diffuse choroiditis with dense vitreous opacities in a patient in whom all other evidences of syphilis have been wanting for a long period. Most of the cases occur in people of a somewhat advanced age, the patients being generally past their thirtieth year.

Prognosis.—The prognosis is usually doubtful as to the complete restoration of the functions of the eye. The sooner the patient is placed under treatment the more hopeful is the prognosis. Cases in which there is extensive exudation into the retina always give a bad prognosis, as the disease runs a chronic course, and during its progress is always aggravated by any use of the eyes, and subject to frequent relapses. A prolonged period of disuse of the eyes is always to be recommended.

Treatment.—The treatment consists in an energetic antisyphilitic course, which leads to a speedy improvement in most cases, and often an entire cure. Diaphoresis by means of pilocarpine or salicylate of soda is often very useful. In marked hyperemia of the fundus the abstraction of blood by the use of the artificial leech is to be recommended. While employing such remedies we should enjoin the avoidance of any straining of the eyes, and the protection of them from the light by the use of dark glasses or, when necessary, by rest in a darkened room.

THE RETINA.

As we have already seen, the retina is often affected in the choroiditis which is due to syphilis, but it may also be primarily the seat of the disease. The retina may be affected in the following ways: (1) Simple retinitis; (2) retinitis with exudation along the blood-vessels, or exudative retinitis; (3) retinitis hæmorrhagica, in consequence of disease of the vessels and the formation of thrombi; (4) chorio-retinitis or retino-choroiditis; (5) retinitis recurrens.

Retinitis simplex, shown in Fig. III., Plate 14, first described by Jacobson, is rarer than chorio-retinitis. It is usually diffuse in character, and the ophthalmoscopic appearances are as follows: the fundus may be cloudy and indistinct, or there may be distinctly defined, mist-like, grayish opacities extending over the papilla and like rays along the course of the blood-vessels toward the periphery. Toward the equator of the eyeball this mist disappears entirely and the fundus assumes its normal appearance. The outlines of the disk are blurred, and it is entirely surrounded as well as covered by a zone of gray hazy retina. The disk may appear more hyperemic than the rest of the fundus. The arteries are reduced somewhat in size, or seem so by comparison with the enlarged veins. The latter are only partially concealed by the general edematous cloudiness, and in places appear clearly without a widened irregular reflex. They are often very tortuous. There are no vitreous opacities to prevent clear reflex of the retinal opacity.

Retinitis Exudativa.—In addition to the symptoms indicated, there are sometimes to be seen whitish radiating patches situated in the inner layers of the retina, usually following the course of the blood-vessels, extending from the border of the papilla or situated near to the same, located within the inner layers of the retina, which exert a pressure upon the blood-vessels so as to diminish their size and interfere with their course. This form, moreover, is sometimes accompanied by hemorrhages, but not always. (See case of the writer's, Fig. IV., Plate 14, in which such plastic exudation is shown



FIG. I.—Choroiditis disseminata, showing the early stage of this form of this disease, occurring in a patient with a distinct history of acquired syphilis five years ago. Scattered over the fundus were innumerable whitish-yellow circular patches, which are seen in the figure to occupy not only the region of the periphery, but also that of the macula. (Critchett and Juler.)

FIG. II.—Later stage of disseminated choroiditis; patches distributed over the fundus either toward the periphery or near the central region. The recent ones have a yellowish-red appearance; when more advanced, a yellowish-white color; and still later become quite white and glistening, with little aggregations of pigment attached to their edges or in some part of their area. Fig. 2 is a typical case of this kind; in the left eye both fundi were affected. (Juler.)

FIG. III.—The condition usually shown in the fundus in syphilitic retinitis. Diffuse cloudiness of the retina, more marked in the region of the papilla; the outlines of the papilla indistinct; the vessels in the retina hazy; exudations under the form of sharply defined maculae; distention and tortuosity of the veins, while the arteries are small from compression by the exudation. (In this figure the representation of the arteries is too white.)

FIG. IV.—Syphilitic retinitis exudativa. From a case of the writer's which occurred in a patient with very severe late secondary manifestations. Shows exudations in the retina following the course of the blood-vessels, with extreme hyperemia of the veins and great diminution in sight. (Drawn by Gaertner.)



occurring in a patient with severe secondary manifestations about six months after infection.)

Retinitis Hæmorrhagica.—In this form the retina is uniformly hazy, of a bluish-gray color, and the larger vessels are congested. The papilla is hyperemic and its borders ill-defined. The veins are dilated, engorged, and scattered throughout the fundus are to be seen numerous hemorrhages which often have a sectiform arrangement, and besides these hemorrhages there are collections of spots in the retina. The vessels are surrounded by white stripes or in places assume a whitish appearance. This appearance of the vessels, and also the shrinking of the hemorrhages in some parts of the retina, show that the conditions are mainly due to a change in the character of the blood-vessels. A case is described by O. Bull where, not far removed from the papilla, an oviform mother-of-pearl white tumor was found, surrounded by a white stripe.

Chorio-retinitis.—A pigment degeneration of the retina which shows itself by the formation of pigment spots, which do not, however, assume the shape resembling bone-corpusele, such as are seen in true retinitis pigmentosa following the course of the vessels, occurring first in the periphery of the fundus. Atrophy of the pigment epithelium of the choroid, atrophy of the retina, and finally of the papilla ensue, and, as a complication, opacity of the posterior pole of the lens is sometimes observed.

Retinitis Recurrens.—An entirely different form of retinitis is described by Graefe under the term of *central recurring retinitis*, in which the papilla appears to be entirely unaltered in appearance. The macular region shows a diffuse grayish opacity in which small spots are to be seen.

Symptoms.—The subjective symptoms of these various forms of retinitis may be considered together. In hemorrhagic retinitis one usually observes a defect of central vision without any corresponding defect in the field of vision. In the central relapsing form central scotomata occur, which, however, entirely disappear for some time, and then reappear with the same ophthalmoscopic symptoms after several weeks or months. Metamorphopsia and micropsia are also present. The relapses are often accompanied by photophobia, ciliary injection, and complicated with irido-choroiditis and opacities of the vitreous. Relapses are very frequent. In simple retinitis acuteness of vision is interfered with, and there are often irritative symptoms, such as those mentioned as occurring in the relapsing form. The symptoms of retinitis pigmentosa depending upon syphilis are similar to those of the other forms, and consist in a diminution in acuteness of vision and hemeralopia, but the shrinking of the field of vision is often relatively less, in comparison with the diminution of the central vision, than in cases which are not of syphilitic origin. Complications such as iritis and paresis of the ocular muscles render the presence of syphilis as a cause more certain.

Course of the Disease.—Syphilitic retinitis may affect one or both eyes. Retinitis pigmentosa or chorio-retinitis affecting only one eye occurs only in syphilitic cases. Retinitis occurs mostly in the latter part of the secondary stage. In the few cases of relapsing retinitis so far observed some time had elapsed since the first appearance of syphilis had been observed. In some instances retinitis is an early symptom. The duration of the disease is always long.

The diagnosis of the disease can be made only by taking into consideration the other symptoms.

With the exception of retinitis pigmentosa the prognosis is favorable.

The therapeutics is the same as in choroiditis.

OPTIC NERVE.

Syphilis of the optic nerve, whether in its orbital, intracranial, or inter-cerebral parts, cannot be certainly diagnosed by the quality or intensity of the symptoms, but rather by the peculiar combination of symptoms in a given case.

There may be changes in the nerve marked by visible changes in the papilla of three kinds: (1) Choked disk, or papillitis, as a symptom of various intracranial processes; (2) neuro-retinitis descendens, accompanying the various changes in the brain and its meninges which have extended along the sheath of the optic nerve or due to gumma; and (3) there may be atrophy of the nerve the result of choked disk, or neuritis descendens depending upon intracranial processes or meningeal disease or due to some spinal lesion.

Papillitis, or Choked Disk.—In the course of syphilis, papillitis occurs which does not differ from that which is due to other causes. The papilla is obscure, swollen, the vessels tortuous, the veins engorged, and the arteries narrowed. Occasionally even the star-formed figure at the macula lutea has been observed, as is usually seen in the retinitis of Bright's disease, and hemorrhages with white spots; this form corresponding to what is usually known as choked disk. This form of papillitis depends upon an inflammation of the optic nerve due to a gummatous growth at the base of the brain itself, or an exostosis in the foramen opticus. Papillitis as the result of an inflammation of the stem of the nerve and of exostosis of the foramen opticus may be one-sided. In other cases from other causes both sides are affected.

Neuro-retinitis Descendens.—In neuritis descendens the swelling is slight, and so is the distention of the veins, and the exudation made patent by the cloudiness and discoloration of the disk comes more into prominence. Moreover, the exudation extends beyond the edge of the disk into the adjacent retina, so that the disk appears enlarged; thus frequently the picture of neuro-retinitis is produced. There is no well-marked line to separate the two forms of choked disk and descending neuritis. In this form of the disease there is, as the name implies, an extension along the sheath of the optic nerve, or there may be a gummatous infiltration of the nerve itself.

Simple atrophy of the optic nerve without any inflammatory symptom also occurs as the result of syphilis. The papilla appears white, blue, or grayish-white, with its borders sharply defined. The smaller vessels have disappeared, and the larger ones, especially the arteries, are diminished in caliber. In the atrophy which results from choked disk the color of the nerve is of a dirty white and the borders somewhat obscure. In the atrophy which results from lesions of the spinal cord the discoloration of the nerve is of a bluish hue.

Symptoms.—From the ophthalmoscopic examination alone the diagnosis cannot always be made; we must take into account the presence or absence of other evidences of syphilis. Both choked disk and neuritis descendens due to syphilis usually affect both eyes. The subjective symptoms consist of disturbance of vision, in most cases very considerable when the neuritis is severe, but cases of marked swelling associated with normal sight do also occur in choked disk. Contraction of the field of vision is frequently found, sometimes under the form of hemianopsia.

Neuritis runs a chronic course. It takes months for the inflammatory phenomena to disappear, and then atrophy of the disk is apt to remain. Whether the vision grows better or remains permanently enfeebled or is

annihilated depends upon the degree of atrophy. In any case the prognosis of neuritis is serious. The symptoms of atrophy of the nerves are those of progressive amblyopia and contraction of the visual field, generally resulting in complete amaurosis.

The **prognosis** is always worse in those cases in which there is concentric limitation of the field of vision. Accompanying the advance of amaurosis there are always dilatation and sluggishness of the pupil, and finally immobility of the same.

Treatment.—The treatment of optic neuritis, especially where there is severe swelling of the nerve (choked disk due to intracranial syphilis), should consist in the most thorough antisymphilitic course. The writer has now under treatment a patient with marked choked disks in both eyes, depending upon intracranial syphilis, in which complete absorption of the exudate was brought about in two months, with a restoration of the disks to almost their normal appearance and vision of $\frac{2}{15}$. In other cases, where the condition of the optic nerve depends upon a gumma, the use of the iodide of potassium in large doses may be more efficacious.

In all cases the eyes should be guarded from exposure to bright light, and it is preferable during the course of treatment to keep the patient in bed in a darkened room.

A similar line of treatment may be followed in cases of atrophy of the nerve, although it must be admitted that in most instances a favorable prognosis is hardly to be hoped for. The use of strychnia in such cases, although highly commended, has in the author's experience been of but little value.

Where there are no demonstrable ophthalmoscopic changes in the eye the following conditions may exist: (1) Amblyopia, or amaurosis syphilitica, either transient or permanent, which depends upon changes in the blood-vessels and results in atrophy of the nerve; (2) hemianopsia of different forms, dependent upon disease of the cortex or optic tract between the optic chiasm and the occipital lobes, which generally leaves a permanent defect in the field of vision; (3) flitting scotoma.

Amaurosis and amblyopia which depend upon syphilis may be thus summarized: If loss of vision is in one eye, the lesion may be in front of the chiasm, though it may be cerebral in origin and situated in the posterior part of the internal capsule or even in the cortex. If it is in the internal capsule, there is also present contra-lateral anesthesia of other cranial nerves and of the body which will not be present if the lesion is in the cortex. In many such cases atrophy of the optic nerve may finally ensue.

Hemianopsia may exist in either of the well-recognized forms—homonymous hemianopsia, in which either the left or the right halves of the two fields of vision are cut off, or temporal hemianopsia, in which the outer halves (temporal) of the two visual fields are suppressed. The first of these is by far the most common. In it there is a lesion in the optic tract—in left-sided homonymous hemianopsia situated in the right optic tract, in right-sided homonymous hemianopsia situated in the left optic tract, between the chiasm and the occipital lobe of the cerebrum, and usually between the peduncle and the chiasm. Moreover, the lesion may exist in the cortex and the tract itself be intact.

The temporal form, which is of extremely rare occurrence, need not be mentioned, but it is conceivable that a syphilitic lesion might be so disposed as to give rise to it—viz. in the anterior or posterior angle of the chiasm, where decussating fibers of the optic nerve alone are situated. In most of the cases ophthalmoscopic changes are wanting, although sometimes there

may be changes in color of one-half of the disk, and exceptionally, as observed by the writer, the occurrence of choked disk with hemorrhages.¹

Under the term of hemianopsia fujax (flittering scotoma) or oscillatory bitemporal hemianopsia² is described a form of hemianopsia characteristic of syphilis, which is of transient duration, and in this connection it suffices merely to refer to it.

In all of this class of cases the **prognosis** is bad, as a rule, since they depend upon cerebral processes; in hemianopsia there usually remains a permanent defect of the field of vision. To this statement, however, exception must be noted (see case by Dr. Oswald Baer of Breslau,³ and also that of the writer's,⁴ in both of which there was a complete restoration of the fields of vision, the result of antisyphilitic treatment).

Treatment.—The treatment to be instituted in all such cases will consist in rest, administration of mercury, the iodide of potassium—the latter in large doses, especially, as is commonly the case, should the hemianopsia be due to gumma of the brain.

THE EXTRINSIC MUSCLES OF THE EYE.

Affections of the orbital muscles are extremely common as a result of syphilis. Badel found 144 cases of paralysis in 631 cases of ocular syphilis.⁵ It is due to the disturbance of the functions of some of the motor nerves of the eye; one muscle or any number of muscles may be affected. Syphilitic paralysis of the eye-muscles may be due to various causes: the muscle itself may be diseased; specific neoplasms in the orbit, especially at the orbital fissure, may affect the nerves and the muscles; growths within the brain may injure the motor nerve-roots and nuclei, or if situated within the corona radiata and cortex give rise to conjugate deviations and paralyzes. In all these cases such paralyzes are usually combined with other evidences of syphilis. Isolated paralyzes of the eye-muscles are not infrequently the first symptoms of syphilis. They are due either to neuritis or perineuritis of the roots of the nerve and at the base of the brain, or they may have their origin in other causes. Although every muscle is occasionally affected in syphilis, certain combinations are especially frequent. In about 75 per cent. of the cases the motor oculi is affected; in 23 per cent., the abducens; the trochlearis in 2 per cent.; and the facial with equal rarity. Paralysis of the two latter nerves is usually combined with paralysis of the motor oculi or abducens.

An especially frequent form of paralysis in syphilis is unilateral ophthalmoplegia interna, or paralysis of the sphincter of the pupil and of accommodation. According to Alexander,⁶ 75 per cent. of such cases are syphilitic, and according to Uthoff, only 25 per cent.; and in this statement the writer fully concurs, his experience having shown that all the cases of one-sided mydriasis, either with or without the accommodation being involved, observed by him were due to syphilis.

Symptoms.—It would be manifestly out of place to enter into a minute consideration of the differential diagnosis of the muscle or muscles affected from an ophthalmological standpoint. In general terms, however, they may be summed up as follows: The subjective symptoms of greatest

¹ *Arch. Ophthalmology and Otology*, vol. v. p. 149.

² Oppenheim: *Berl. kl. Woch.*, 1887, p. 666.

³ *Sammlung klinischer Vorträge in Verbindung mit Deutschen Kliniken*, No. 246.

⁴ *New York Med. Journ.*, Jan. 22, 1887.

⁵ *Archives d' Ophth.*, vol. vi. p. 301.

⁶ *Loc. cit.*

importance are—diplopia, vertigo, and headache, the latter aggravated by the use of the eyes and caused by the effort of the patient to fuse the double images. The objective symptoms are—strabismus, the deviation being in an opposite direction from the affected muscles; complete or partial loss of mobility in the direction of the affected muscle; the occurrence of diplopia when an object is carried in the direction of the same; and the false sense of projection, so that the patient does not see objects in their true position; maintenance of a false position of the head, etc. These symptoms are sufficient to make a diagnosis if the recti muscles are the ones affected, but in paresis of the obliqui, and in some cases where there has been a secondary contraction of some of the other ocular muscles, a careful interpretation of the position of the double images can alone determine which is the muscle affected.

In cases of paresis of accommodation we have, as a rule, although the pupillary branch alone may be involved, ptosis, dilatation of the pupil, with paralysis of accommodation.

Syphilitic paralyses of the eye-muscles are usually found in the later stages, rarely in the first six months. They may develop rapidly or slowly; they are usually obstinate, recover slowly or not at all. Knies¹ says there is no hope of recovery if evidences of improvement do not appear after a rigorous treatment for two weeks. According to this writer, this is a very important and truthful statement. In two cases recently treated by him, in which there was complete recovery from paralysis of the motor oculi, recovery began soon after the beginning of a vigorous course of mercurial inunctions, and went rapidly on to a full restoration of the function of all the muscles involved. A few cases in which the ocular muscles have been involved have been reported as occurring in congenital syphilis: Graefe,² paralysis of the left oculomotor; McKenzie,³ double abducens paralysis and ptosis; Lawford,⁴ two cases of incomplete paralysis of the right pupil. Knies⁵ adds a case of isolated paralysis of the right pupil which lasted two years in a girl of nine years; the father was syphilitic and also suffering from unilateral mydriasis, a sister from diffuse interstitial keratitis, and two other sisters had died with specific symptoms soon after birth.

Treatment.—The first of all in importance is an appropriate constitutional treatment, and, as has already been said, recovery sometimes rapidly ensues. In the writer's judgment mercurial inunctions should be given a fair trial before giving the iodide of potassium. The latter will no doubt be more efficacious in some cases. Whether the lesion is of a gummatous origin or depends upon perineuritis or orbital thickening decides which remedy will be most efficient.

The local application of electricity, principally under the form of the constant current, exercise of the paralyzed muscle with the aid of prisms, and traction of the affected muscles made by means of fixation forceps through the conjunctiva, will sometimes do good.

The diplopia which is always the most annoying feature of the disease is to be relieved during the cure by exclusion of one eye, which is best done by the wearing of spectacles with a ground glass before one eye and a plain glass before the other, with a reversible bridge, so that the ground glass may be worn alternately before either eye. In cases of paralytic strabismus tenotomy of the antagonistic muscles or advancement of the paralyzed ones may be necessary.

¹ *Loc. cit.*

³ Quoted by Alexander: *loc. cit.*, p. 207.

² *Arch. für Ophthalmologie*, Part 1, vol. i. p. 433.

⁴ *Ophthalmic Review*, Apr., 1890.

⁵ *Loc. cit.*

HEREDITARY SYPHILIS.

BY ABRAHAM JACOBI, M. D.

Pathological Anatomy.—When parents (mostly the father) are thoroughly under the influence of syphilis during a successful cohabitation the disease is communicated to the first-formed cells, and through them to all or most organs. The result is death of the embryo or young fetus after a very few months. When death takes place before the end of the fourth month of utero-gestation, no characteristic tissue-changes are found anywhere. They are met with, however, when a fetus dies about the fifth month or later. One of the most frequent occurrences is enlargement of the spleen. Instead of exhibiting the weight of the healthy spleen, which amounts to .33 per cent. of the body-weight, its bulk is increased to .76 per cent. It is dense, with a thickened capsule. Its hypertrophy is mostly generalized; sometimes, however, lobular; always hard. Syphilitic endarteritis has also been found.

The syphilitic affection of the placenta may be found on the maternal or on the fetal side or on both. The first-named occurrence is but rare. It is observed when the woman was infected before conceiving, no matter whether from a healthy or a syphilitic man, or where she was infected during pregnancy. In these cases the maternal side of the placenta is the seat of the interstitial hyperplasia which begins in the decidua serotina, and, while not always extending into the fetal placenta, is sufficient to destroy the fetus by induration of the placental tissue and by compression of the blood-vessels. The fetal placenta, however, is more frequently affected, the changes beginning in the villi and resulting in nodulations which compress the circulation in the maternal placenta.¹

Osteochondritis is a constant accompaniment of hereditary syphilis. It begins with the fifth month of utero-gestation. Our principal authority on that subject is still George Wegner.² Between the diaphysis and the epiphysis of the fetal and infant bone there is normally a straight whitish layer 1 mm. wide. It is here that the normal calcification of the cartilage takes

¹ According to Albert Schwab (*Syphilis of the Placenta*, Paris, 1896), the placenta has characteristic alterations which, when syphilis is acquired during pregnancy, may be trifling and therefore not injurious. The syphilitic placenta is large, soft or hard; the normal placenta weighs one-sixth of the weight of the fetus, the syphilitic placenta at full term one-quarter, and that of the syphilitic fetus born at the seventh or eighth and a half month of utero-gestation two-sevenths of the weight of the fetus. There are constant microscopical alterations; a diffuse cirrhosis both of the maternal and of the fetal placenta. The villi of the chorion are hypertrophic and show endo-periarteritis and endo-periphlebitis. Thereby many vessels are obstructed. The epithelium of the villi is often destroyed or proliferating; the membrana chorii is often thickened and its vessels changed as above. There are no macroscopic, but sometimes microscopic, gummata in the placenta. According to him, hemorrhages, fibro-fatty deposits, and white infarctions do not prove the presence of syphilis. In some of these hemorrhages the placental tissues are destroyed, and may facilitate a direct communication. That is why, in his new edition of 1896, Taylor states that full infection may in rare cases occur when the infiltrating powers of the placenta have been impaired by morbid changes.

² *Virchow's Archiv*, 1870.

place. In syphilis this zone is larger; it is dry, not straight, but dentated and hard. (In rhachitis it becomes soft.) It extends in both directions—namely, into the diaphysis and into the epiphysis. There is no vascularization, no swelling. (In rhachitis there is both vascularization and swelling.) In syphilis it is of a sclerotic density. The spaces between the solid tissues are narrow; the organic part of the bone is more or less absent. While lime is being constantly eliminated, no young bone-tissue is formed, and calcified cartilage is found in place of durable bone. Thus the syphilitic bones become fragile; a dry separation of the epiphysis from the diaphysis takes place without deformity. (In rhachitis deformities are the rule, and it is the inorganic part of the bone which is not developed on time.)

The diaphysis of a syphilitic bone, however, is sometimes pultaceous. Even abscesses are formed, but only when the process is of a mixed character. The changes above described are mostly found on the lower epiphysis of the femur and of the fibula and tibia, also on the upper extremities. In all of these places it interferes with the growth of the extremities. The stunted condition of syphilitic children is of frequent observation. On the other hand, there are a few cases of gigantic growth which are also attributed to hereditary syphilis. Other places where similar changes are found are the vertebræ, the pelvis, and the scapula. Recovery is apt to take place when under the influence of specific treatment new osteoblasts are formed in the medullary spaces. It has been claimed, mainly by Braunschweig, that isolated particles of cartilage remain in the newly-formed healthy bones and may give rise to the formation of enchondroma.

Affections of the labyrinth, with irreparable deafness and certain malformations of the teeth, are frequently found. The temporary teeth do not often suffer from hereditary syphilis, for they develop at a period of fetal life which, if the infection of the embryo and early fetus were very pronounced, would terminate in abortion. The condition known as "Hutchinson teeth" refers, as a rule, to the permanent teeth. It is mainly the upper central incisors which are affected. They develop in their alveoli between the seventh fetal and third infant months. The whole substance of the teeth is affected. They are small, dwarfed, notched on their cutting edges, separated from each other, turned around their axes, divergent, and have a deformed crown.

The *liver* is of large size. The enlargement is more diffuse than localized. The tissue is either dark and hyperemic or of lighter color, with interspersed small yellowish spots, and of solid cirrhotic condition, with heavy, obtuse edges. The yellowish spots are of different sizes, from that of a miliary tubercle upward. Cicatricial lobulation is frequent. When such changes occur near the portal vein, cirrhosis of the liver will follow: when around and in the biliary ducts, with or without the duct of Arantius, jaundice. The microscopic appearance in all of these deposits, like that in other organs, is that of a round-cell infiltration, besides proliferation and induration of the interstitial tissue. In infants born alive with syphilis, particularly those who survive after a successful specific treatment, the liver is not always swollen. Hochsinger found in 148 cases of such hereditary syphilis 46 times enlargement of the liver and of the spleen, without any icterus or ascites, and without syphilitic endarteritis in his 5 autopsies. On the other hand, Neumann found syphilis of the liver without alteration of volume. The case of cirrhotic atrophy of the liver demonstrated by the writer before the Children's Section of the American Medical Association at Richmond, 1880, was probably of syphilitic origin, and as such very rare. Bernhardt found parenchymatous changes only, and but indistinct traces of interstitial alteration;

Chiari, no hypertrophy of the liver and no affection of the portal vein and hepatic arteries, but enough hyperplastic infiltration in and about the biliary ducts to cause jaundice. It is evident, therefore, that not in every case should we expect uniform results, but it is certain that the characteristic changes of the liver, hypertrophy included, are more frequent the earlier and the more intense the ravages of syphilis have proven to be.

The *pancreas* is sometimes found large, with diffuse, solid, whitish deposits of the interstitial tissue.

The *kidneys* are not frequently affected. The changes met with in them are of three kinds—interstitial hyperplasia, gummatous infiltration with round cells, and endarteritis. That nephritis may be the consequence of hereditary syphilis is claimed by H. A. Robins, who quotes Barthelemy and Hock.¹ The accessory kidneys were once found large by Baerensprung. They contained miliary gummata.

The *testes* are liable to be large, dense, sclerotic. In the newly-born interstitial-tissue hyperplasia is more frequent; in older children, gummatous degeneration.

The *digestive tract* in hereditary syphilis is not liable to exhibit many changes. In rare cases infiltration or ulcerations were found in the mucous membranes or in the muscular layers of the stomach and intestines.

The *lungs* are diseased in cases of early and intense infection. In those dead or dying in or after a birth premature by four or six weeks the lungs were large, solid, yellowish (the so-called white pneumonia), sometimes with interspersed softening or nodes. These processes are usually interstitial, with alveoli narrowed by compression.

The *bronchial glands* were enlarged, gray or yellow. Other lymph-bodies are not infrequently affected. They are rather soft and small.

The *thyroid gland* was found by Demme to contain gummata in retarded syphilis.

The *thymus gland* is affected by hereditary syphilis more frequently than is generally assumed to be the case. However, since the contributions of the writer to the anatomy and pathology of the thymus gland² very little has been added. The blood-vessels were very much changed; indeed, no single coat was affected, but a general thickening took place. In some instances the vessel was simply replaced by a ball of connective tissue. Thus alterations in the vessels looked like those of hepatic or other interstitial inflammations. Such interstitial hyperplasia would be found in the thymuses of syphilitic infants whether the glands were large or small. Besides, abscesses were found by Dubois, by Hangsted in two young men with persistent thymuses, and by Mewis, and hemorrhages by Fuerth, F. Weber, and others.

The *heart* is rarely affected. Still, two changes have been met with—namely, fibrous myocarditis and gummata, both in the newly-born. The small arteries showed endarteritis. Kantzow and Virchow have the case of an eight-month fetus, still-born, with a myoma at the base of the heart and miliary gummata on the right ventricle near the cone of the pulmonary artery, together with white hepatization of the lungs and hemorrhagic pleurisy. Hutchinson has the case of a child of one year with syphilitic myocarditis and ecchymoses of both ventricles, and ulcerations on the thighs. The infant died suddenly in orthopnea. Wendt observed a still-born infant with fibrous myocarditis of the right ventricle, gummatous endocarditis of

¹ *Virginia Medical Monthly*, May, 1895.

² In the *Transactions of the Association of American Physicians*, 1888, for which Henry Koplík did the highly meritorious anatomical and microscopic work.

the tricuspid and of the pulmonary valves, and stenosis, of the latter; Morgan, an infant who died at the age of a few months with a gumma of the anterior surface of the heart and a gumma of the liver.

In the *pericardium* miliary syphilomata were found, with obliterating adhesions.

The pathological anatomy of the *nervous system* in hereditary syphilis is but little known. The so-called encephalitis of the newly-born, of which so much was made a decade ago, has been proven by Jastrowitz to be no encephalitis and not syphilitic. Hemorrhagic pachymeningitis is rare. Internal hydrocephalus has often been observed in hereditary syphilis, but endarteritis has been proven in but few instances, and gummata still less. Rosa Engelman published a case of cerebral syphilis in a ten-month-old child.¹ Rumpf has but 2 cases. Starr declares it to be quite rare, and cerebral gummata are very scarce, according to him, below the twelfth year of life.

In his last researches on spinal localization of hereditary syphilis² G. Gasne arrives at the following conclusions: That the meningo-medullary changes in the fetus, infant, and adult are identical—that the ganglia are infiltrated, with the nerve-cells mostly normal. There is a fibrous thickening or infiltration with embryonic cells and by connective tissue, particularly of the septa and blood-vessels. These infiltrations are sometimes of a gummatous, round-cell character. That process is disseminated, mostly, however, posterior both in medulla and meninges. But, indeed, no part was found absolutely normal.

Symptomatology.—The syphilitic fetus is of more anemic, ashy appearance, and of less weight than the healthy one of equal age. When it dies its macerated tissues are speedily filled with blood. When death occurs in the early months no pathological changes of a specific character can be made out. When it is prematurely born and alive it almost always dies soon. When it is born at a full term, but thoroughly syphilitic, it is generally dead when born or exhibits some unmistakable symptoms. The soles of the feet and the palms of the hands, either at birth or within a week, are covered with pemphigous bullæ, with a very shallow, if any, hyperemic edge. The bullæ are quite numerous, mostly solitary, sometimes confluent, rarely ulcerous at first. Besides a moderate coryza, there is no visible symptom of syphilis except the universal feebleness. Atrophy is not met with in every case. The voice is pitiably thin. Most of these cases will die; many will live if the treatment is as active as it should be gentle.

In most cases of hereditary syphilis, however, the infant is born apparently healthy. Mostly between the fourth and seventh weeks the nasal respiration becomes impeded and noisy, with or without a nasal discharge. Dry crusts are more common. The nostrils are dry; there are rhagades. In but rare instances the bones or cartilages of the nose are affected. In that case a saddle nose, like that of tertiary syphilis in adults, may be the result.

Soon after the skin shows eruptions in all varieties of exudation, infiltration, and pigmentation. Sometimes the nail and its matrix participate in the process. Sometimes these changes are accompanied with fever. The skin becomes dry; there are rhagades of lips, nose, ears, eyelids, mouth, and anus. Three stages of the eruptive process may be distinguished—that of hyperemia, of extra-vascular infiltration, and of thickening of the epidermis.

The forms of cutaneous eruption at this stage are—roseola with or without the changes alluded to before, reddish, copper-colored, its outlines mostly

¹ *In Medicin*, Nov., 1893.

² Published in *Nouvelle iconographie de la Salpêtrière*, 1896.

resembling measles. This macula becomes a papula by exudation and infiltration, which need not be general, but occupies the center of the macula only. The epidermis becomes very thin and shining, of an indefinite yellowish color. The macula may also become a squama through the process of a dry desquamation. In the center of the papule, which often changes into a vesicle, a depression is liable to take place, or the vesicle is transformed into a pustule, or, when the process of granulation and pus-formation is very vigorous, into a rupia. In the neighborhood of secreting surfaces the infiltration of the tissues and the constant presence of mucus causes the removal of the epidermis and the production of condylomata—for instance, near and in the mouth, ear, eye, and nates. The fingers, mainly the last phalanges, are red, infiltrated, and peeling; the nails exhibit papular infiltration, vesicles or pustules about the matrix (*paronychia syphilitica*), condylomata, and hemorrhages. The bones of the phalanges will swell; their medullary canal is changed into a large cavity; the bones become thin and necrotic. Intertrigo is common. It differs from the common form in this, that real infiltration of the surface and a turbid yellow color are more frequent.

The mucous membranes suffer at an early time from every form of catarrh to ulceration; the nose, lips, cheeks, gums, also the transition membranes, are mostly affected—the soft palate not so often as in acquired syphilis. The conjunctivæ are frequently catarrhal. The cornea is liable to be infiltrated or destroyed. Iritis, retinitis, and turbidity of the corpus vitreum must be looked for. The lashes and brows fall out. The rectum, which is sometimes prolapsed, is ulcerated or condylomatous. The lymph-nodes (rarely the cubital) are swelled. Anemia is marked, and the spleen feels mostly enlarged.

Recovery, however, is apt to take place under proper treatment, but relapses are frequent.

Visceral syphilis need not be general or intense, but it may persist into infancy and childhood. The liver is mostly affected. It is large and hard. Sometimes there is ascites. Jaundice is occasionally seen. It appears mostly a few weeks after birth, and may thus be diagnosticated from the common jaundice of the newly-born. The absolutely bad prognosis of Heubner is not borne out by the author's experience. He has a distinct recollection of two such cases; both children are now alive and in fair health. The spleen may often be felt under the ribs.

Syphilitic osteochondritis is often unaccompanied with serious symptoms, and therefore is liable not to be diagnosticated in the beginning. There may be no or very little swelling. The joints are not affected. In many the bones feel slightly swollen. When the swelling is more pronounced it is conical and painful. Sometimes the skin is reddened. Finally, the separation of epiphysis and diaphysis may take place, and crepitation is observed, with less pain than might be expected. This condition is found mostly on the humerus. In that case the arm is useless and pronated. This condition has been described by Parrot, no matter whether separation was complete or not, as pseudo-paralysis, and goes by his name. That excellent author deserved a better fate. Not only is his name connected with a pseudo-paralysis which is neither "pseudo" nor "paralysis," but imitators have since spoken of a pseudo-paralysis in rhachitis. Next time we shall hear of a pseudo-paralysis in a genuine fracture of the thigh, in sprain of the ankle, or in lumbago.

Whether intestinal syphilis persists into later life has not been demonstrated; cases of early diarrhea may terminate fatally. Under the heading

"*atrophia lævis baseos linguæ*" there is a paper by Lewin and Heller in *Virchow's Archiv*, vol. 138. They describe a smooth atrophy of the base of the tongue, which is claimed to be characteristic for hereditary syphilis. They also refer, quoting Robinson of London, Fournier, and Hyde of Chicago, to the existence of linear, radiated cicatrices around the mouth from the same cause.

Hemorrhages caused by hereditary syphilis are mostly punctated, petechial; they are found on the skin, in the muscles, in serous and mucous membranes, in the glands, such as thymus and thyroid, on the pleura and pericardium, with or without numerous blood-points in the lungs. The writer has often seen them either immediately after birth or within a few weeks. In a few cases they were subperiosteal, on the humerus, sometimes large, but isolated, and not connected with scurvy. One of the first to point out the syphilitic character of these petechiæ was J. Lewis Smith in 1855. The usual lesion found is endarteritis. Mrazek found also cells containing fat on, and dilatation of, capillaries, and a nuclear proliferation on the vasa vasorum. Finkelstein reports the presence of a bacillus hæmorrhagicus, like Kolb, who found it in morbus maculosus (Werlhof). Still, it ought to be mentioned that septic microbes are often found in syphilitic infants with hemorrhages, even in the fetus; and, besides, not every such hemorrhage ought to be taken as a positive proof of syphilis. Septic infection of any kind in a vulnerable body may have the same effect. Neumann once found bacillus pyocyaneus, once staphylococcus pyogenes aureus, once streptococcus. Whether Winkel's disease, the so-called cyanotic icterus cum hæmoglobinuria, is now and then of syphilitic origin remains to be seen. In it streptococci, bacilli enteritidis, and bacteria coli communia have been noticed.

Such hemorrhages do not occur, as Buhl claimed, in prematurely still-born or dying infants solely. He observed them himself in children in whom syphilis appeared after birth. Max Stoops reports the case of a female child of three months of a syphilitic father. At that age moist spots appeared on face, hands, and soles; around the nates the skin was red. In a few hours the nates, genitals, hands, feet, lips, and nails were blue with hemorrhages, and on the same day there came blood from the stomach and anus. The loss of blood was accompanied by a sunken fontanelle and a temperature of 35.2° C. The treatment consisted of calomel, warmth to the body, and iced milk. The patient recovered.

Appropriate treatment is very apt to procure more or less complete recovery of many syphilitic infants who enjoy good care and proper feeding. If the prognosis be declared to be absolutely unfavorable in all those cases of such infants brought up on artificial food, the fault is to be found with the selection of an improper one. Still, it must be said that the prognosis is doubtful even under favorable circumstances. The object to be accomplished is not only the saving of life, but the procuring of permanent health. This is no easy task even in reference to those who never exhibit any structural syphilitic symptoms, but suffer from such low vitality that even sudden deaths are not very rare. In such babies we notice anemia, debility, low weight, and retarded development. When in later years, in children of six or eight years, we meet low weight, muscular debility, defective general development without a tangible cause, it is worth while to remember that this condition may date from the influence worked by extinct paternal syphilis. There is also moderate swelling of lymph-nodes, and a great size of the spleen, and still more of the liver. The blood-cells are less in number. Like those in rickets, they are apt to be nucleated. There are more, and peri-

nuclear, leukocytes, and myeloplaques are frequent. Bronchitis and pneumonia are often met with; eclampsia and chronic hydrocephalus are no infrequent occurrences.

In spite of treatment and apparent recovery, however, syphilis may undergo further development, and reappear after some time in the shape of relapses, but the nature of its symptoms will change. In place of an almost exclusively interstitial process, gummata and syphilomata will be observed, and on the mucous membranes there is more tendency to ulceration. The same disposition is met with on fingers and toes, on cranium, lips, tongue, tonsils, eyelids, ears, skin, and anus. The long bones will exhibit some periostitis, and now and then dry caries. But it is principally the cranial and facial bones and the sternum that are affected. The testicles become gummatous, and show now and then a complication with caseous degeneration. The liver furnishes a complication of syphiloma and interstitial hyperplasia. So do the skin and subcutaneous tissue. The nervous system, so rarely affected in the fetus, exhibits endarteritis with or without gummatous infiltration. Thus nervous symptoms are by no means uncommon. Sometimes epilepsy, imbecility or idiocy, debility or convulsions, or contractures are the first for a long time, sometimes the only symptoms of reawakened hereditary syphilis. Atrophy of the optic nerve and blindness, which are very exceptional occurrences amongst adults, appear at an early time. As early as 1868, Mendel drew attention to the influence of hereditary syphilis in the causation of mental diseases, and again, in 1896, he furnished valuable material in the same direction. In progressive paralysis hereditary syphilis is no uncommon factor; although it generally does not appear before the first decade of life, Mendel has the case of a girl who, after having had her first cutaneous eruption at the age of seven months, died when eighteen years old. Wigglesworth¹ collected 8 cases with an average at the time of death of fourteen years. Middlemass² published 5 cases of his own, in 4 of which hereditary syphilis could be made out distinctly. Thus it becomes apparent, what Virchow stated in *Morbid Tumors*, vol. ii. p. 447, that cerebral syphilis is as manifold as that of the skin, and that the lesions are sometimes very apparent—sometimes, however, difficult to find without the most painstaking histological examination.

Complications of hereditary syphilis with other diseases, forming what has been termed mixed infections, are caused in two different ways. Either the power of resistance on the part of the patient is diminished by the disease, no matter whether fully developed or not—in that way the above diseases are fully explained—or the vulnerability of the tissues permit the invasion of known or unknown microbes. Through the medium of abrasion of pemphigus or other eruptions septic infection and furunculosis are not uncommon. Affections of the nose and ear give rise to meningitis. In a similar way pyothorax, purulent peritonitis, articular and periarticular abscesses, also tuberculosis, find their ready explanation. The latter has been made the subject of special research by C. Hochsinger. Complications of syphilis and tuberculosis are found at a very early age when syphilis is inherited from the father and tuberculosis from the mother. Caseous conglomerates are often claimed for both affections. When found, however, in hereditary syphilis they ought to be considered syphilomata only when no tubercle bacilli can be discovered. But it is noteworthy that there is great histological resemblance between gummatous and tuberculous products. Both contain giant-cells, and tubercle bacilli are also stained according to the

¹ *Brit. Med. Journ.*, Mar. 25, 1893.

² *Journ. of Med. Sci.*, Jan., 1894.

method of Lustgarten and Giacomi. As far as the pneumonia of hereditary syphilis is concerned, it ought to be diagnosticated only when there is vasculitis and interstitial granulation; the so-called pneumonia alba of hereditary syphilis and caseous degeneration are by no means identical. When genuine caseous infiltration is found in hereditary syphilis, we have to deal with a mixed infection.

Etiology.—The contagium of syphilis is not known. Its transmissibility through generations and the uniformity of its effect prove its organic character. Its virus is located in the pus of the chancre, in the secretion of condylomata, or in the blood of secondary syphilis. Therefore it is either attached to the tissue-cells or suspended in the blood or lymph of the patient, or in both. In an adult its transmission takes place through inoculation on sore surfaces only.

The fetus or infant becomes syphilitic from the father (paternal infection), from the mother (ovular infection), or from both.

I. **From the Father.**—The syphilitic virus is in the spermatozoon which combines with the healthy ovum. In that case the woman may remain uninfected. Still, that occurrence is rare. In some of these cases the mothers remain well until they become diseased through kissing or nursing their syphilitic babies or through a primary chancre contracted about the end of their pregnancy. In a very few instances it has also been observed that a woman who had syphilitic children with syphilitic men had a healthy child afterward from a healthy man.

II. **From the Mother.**—The syphilitic virus is in the ovule which combines with the healthy spermatozoon. Besides, the embryo or fetus may be infected by syphilis contracted by the mother during pregnancy, or it is even possible that the ovule not infected by a former syphilis may become infected through the circulating blood. Syphilis is not necessarily ubiquitous in the body, and may affect one or other of the organs or tissues. All this is in opposition to those who deny the possibility of the infection of the fetus through the placenta.

When both parents were syphilitic, or when the woman was infected during or about conception, abortion will take place in the early part of pregnancy.

When in one or both the syphilis was less pronounced, no matter whether treated or not, the fetus will be carried longer, will be born premature with morbid changes in skin and viscera, and die soon, or it may be born on time with symptoms of syphilis, and either die soon or not, according to the amount of virus in circulation.

When the virus is still less poisonous, the fetus may be born on term, and after having lived a few weeks may develop symptoms of syphilis. It may even happen that the first symptoms become manifest in later years—according to Kassowitz by the fourteenth, Fournier the twenty-fifth, Hænoch the twentieth, Robert J. Lee the thirtieth or later.

All these conditions may be experienced in the same family. From year to year the virulence of the syphilitic infection may decrease either through treatment or spontaneously, and pregnancies following each other may result consecutively in abortion, in premature birth, in birth on time with immediate syphilis, in birth on time with syphilis showing its first symptoms after weeks or after months, or perhaps even after years, or in the birth of a healthy baby who remains healthy, or in the birth of a healthy baby that may never be genuinely syphilitic, but exhibit gradually some constitutional disorder—the parasyphilitic symptoms of Fournier.

This diminution in the influence of the virus is slow in some, more rapid in others. It need not, however, be gradual or regularly progressive. On the contrary, it is a fact that in families so affected healthy babies are succeeded by diseased or dead ones.

Why should such an occurrence take place? The explanation of this interesting fact lies in the inequality in the infection of different tissues or organs of the parent or parents, for the power of resistance of certain cell-conglomerates is an element of importance in our calculations. Some organs may be comparatively intact, and still infect (through the poisoning influence of the circulating virus) at some later period. This appears established. Thus the testes or the ovaries may be intact at one time, and a healthy baby be produced and diseased at a later period; or one of them only may be diseased, or isolated parts of one, or cells; and the result, whether a thoroughly diseased baby or one mildly so, or a constitutionally infirm or a healthy baby, may depend on the mere accident of the presence of a healthy or tainted spermatozoon or ovule.

Few mothers appear to be infected from their embryo or fetus or child. This observation was first made by Baumes and by Colles. By the latter's name this law is known amongst us. It has been confirmed by Ricord, Diday, Fournier, and others. Certainly it can be more easily understood, and particularly in the line of recent bacteriological knowledge, that there should be or may be a great difference between the microbic virus which infects directly and its toxin which may cause immunity for the mother (and possibly for the child, which may become, not syphilitic, but constitutionally infirm).

For it is a fact that healthy mothers do in many instances not share the manifest syphilis of their offspring, which, while unable to infect their mothers, may at any time injure an attendant or wet-nurse. In this way a woman may have healthy children from healthy men, syphilitic children from syphilitic men, in alternation. This very fact of possible infection of a succeeding baby after a healthy one, and the observation of cases in which mothers were undoubtedly made syphilitic by their syphilitic fetus, renders immunization very questionable as to its power or durability. Altogether, our power to immunize by the toxins of microbes leaves yet much to be desired. A certain amount of preventive effect may exist in healthy babies born of syphilitic parents; and if Fournier contends that such a child cannot be infected by its syphilitic mother, he is borne out by some of our experience. But we ought not to forget the difference in this respect between the syphilis contracted during conception and that acquired from a mother who became syphilitic during pregnancy. This syphilis may be, and frequently is, transmitted to the baby during birth and later. There are even a few cases of hereditary syphilis which were not protected against a new infection. Nature is not so positive and categorical and imperative as not to permit of modifications and exceptions.

The communication of syphilis to the offspring from a mother who became syphilitic during pregnancy is, however, rare, for the corpuscular virus of syphilis does not, like that of anthrax or tuberculosis, easily penetrate the walls of blood-vessels. But when the maternal and fetal sides of the placenta become diseased at the same time the infant may become syphilitic. In the immunity of mothers Fournier does not believe, but he proclaims an indefinite period of latency. A man with latent syphilis infects the embryo, thus the mother. She becomes secondarily syphilitic, directly from

the child without a bubo; after that no more infection can take place from her offspring.

According to Fournier, when both parents were syphilitic, the mortality of the offspring was 68½ per cent.; when the mother, 60 per cent.; when the father, 28 per cent. When there were acute symptoms in the parents during the year preceding conception the cases were grave. Even the absence of syphilitic symptoms during three years before conception yields only a doubtful protection, which, however, becomes more certain when the father (mother) is treated successfully during that period.

The transmissibility to the fetus of syphilis acquired by the mother during her pregnancy has been lately¹ discussed by Abner Post. According to him, the difficulty of diagnosis is confounded by three other possibilities besides this transmission of acquired syphilis—namely, the syphilis of the infant may have been inherited from the syphilitic father before the mother contracted her syphilis; or the mother may have been syphilitic before the symptoms of alleged acquired syphilis showed themselves, or the infant may contract its syphilis during birth. He decides, however, in favor of the transmission as above stated, led by a few cases sufficiently well authenticated. Indeed, variola and malaria are thus transmitted. The microbes of anthrax, glanders, pneumonia, typhoid, tuberculosis, and *b. coli* commune pass the placenta. Cannot the unknown bacillus of syphilis do the same? It is true that there is no direct communication between the maternal and the fetal side of the placenta, but there are exceptions, and, as stated above, many of them. The intra-uterine infection of syphilis is too well known to be denied, though the explanation may appear insufficient.

Retarded Syphilis (Syphilis Tarda).—The appearance of tertiary symptoms of syphilis is sometimes retarded until the fifth, tenth, twentieth, even thirtieth year of life. There is no unanimity, however, as to their origin. Some assert their appearance at that late period in cases where no syphilitic symptoms ever existed before. Others take them for the reappearance of syphilis after it has been observed and treated in infancy. Both the long latency and the long intermission are hard to understand, unless by assuming that the virus was communicated to or stored away in a single organ or a few organs which were not, or need not be, in very active communication with the rest of the body (bones or capsulated lymph-bodies). In connection with this fact it is noteworthy that the limitation of syphilis to certain organs is quite frequently a peculiarity of this retarded form, which will certainly in many instances appear even when the children were under specific treatment up to an advanced age (Kassowitz). In 40 per cent. of such cases Fournier and Hochsinger found bone-diseases, either as osteitis or periostitis. The hyperplastic form of the latter caused hard, not very painful, and sloping swellings, mostly on tibia, humerus, or forearm. The gummatous variety on tibia, sternum, or head is softer. It may terminate in an occasional spontaneous recovery or in permanent depressions, or in tophi or in ulcerations. When it extends to bones, it causes loss of substance (Virchow's dry caries) with destruction of bone or atrophy of cartilage. The gummatous form of osteomyelitis is mostly seen in the epiphyses during the advanced period of childhood.

The *joints* are often the seat of "rheumatic," "rheumatoid" pain. Occasionally "growing pains" are of that character. Chronic synovitis (white swelling), when bilateral, is apt to be syphilitic; when unilateral, tuberculous. In rare instances it assumes the character of arthritis deformans.

¹ *Boston Med. and Surg. Journal*, 1896.

The *skin*, mainly of the face and the calves, exhibits gummata or hard nodulations of pinhead or pea size, of dark-brown color (lupus is bright red). Originating in the cutis, these reach the surface, where they form crusts or ulcerations in circular or semicircular shape.

The *mucous membrane of the nose* is merely catarrhal or thickened at first. It is covered with crusts or excoriations in the interior or on the *alæ*. The respiration becomes difficult and snoring. Nodulations and ulcerations make their appearance, with *ozena*. The latter may accompany the hyperplastic, the atrophic, or the ulcerous rhinitis. Loss of substance follows the ulceration; perforation takes place in the septum, the ethmoid bone, and the superior maxilla, until finally the osseous foundation gives way and the nose sinks in.

The *pharynx* and *palate* are affected similarly. The first change is of a catarrhal nature. A dark, erythematous redness is observed first, with or without condyloamatous patches. Gummatous infiltration and nodulation, adhesions between soft palate and posterior wall of pharynx or between tongue and pharynx, and perforation of the palate, mostly in its median line, will follow.

The *tongue* exhibits gummata, undermined ulcerations, and radiated cicatrices, and the epiglottis multiple polypoid hyperplasias.

The changes in the *larynx* look innocent enough at first, when catarrh and erythematous redness alone are discovered. The malignant character is often developed quite rapidly, with the appearance of cicatrices, gummatous infiltration, ulcerations, and tumors. In all such cases the prognosis is worse than in those of acquired syphilis.

In the *sexual organs* Fournier found gummata in rare instances. In the muscles they have been mistaken, as also in acquired syphilis, for sarcoma.

The *lymph-nodes* are not frequently large, but they are swelled in most cases about the neck, in the axilla, and in the groins. Heubner found the cubital glands also enlarged. Usually these swellings are painless.

The *eyes* suffer in advanced childhood, mostly about the tenth or twelfth year, from a peculiar form of interstitial keratitis. It exhibits local or universal turbidity, a milk-glass color, with nodular or general vascularization, brownish or whitish (leukoma). The latter form is mostly incurable; the other variety may recover. This keratitis, however, is not always syphilitic. Some authors attribute 35, others 80 per cent. of this retarded form to syphilis. Retinitis is often found with it (Hirschberg). Iritis is not a tertiary, but a secondary, symptom of syphilis only.

A painless *otitis media* has been observed by Fournier. Labyrinthine (nervous) deafness may, if noises and dizziness appear first, occur about puberty. It is incurable.

In connection with *keratitis* and *deafness* there is a peculiarity of the two inner permanent incisors. These three anomalies Fournier named the "Hutchinson trias." These incisors are small, low, narrow, notched, distant from each other and the other teeth, and turned round their axes. The lower incisors and the canines will sometimes participate in this morbid condition, which is caused by the fact that they are all formed in their alveolar sacs in the first few months of life, at a time when the temporary teeth have already been supplied with their dentine.

The *liver* and *spleen* are often found enlarged, hard, nodulated. This process is interstitial, and may result in cicatricial induration. Amyloid degeneration is also found. Ascites is rare. Jaundice has not been observed. These changes are not often noticed before the tenth year.

The *kidneys* are but rarely found with interstitial or amyloid changes.

The alterations of the *nervous system* are probably identical with those of acquired syphilis. Headaches, tinnitus, dizziness, alteration of temperament, idiocy, epilepsy, sometimes hemiplegia (this may be the result of an epileptic attack), have been found. Fournier observed myelitis, tabes, and multiple sclerosis.

There is no positive experience with regard to the *sexual organs*. If the ova, or testes with their spermatozoa, were affected, transmission to the third generation would be possible. Hitherto it has been denied.

Diagnosis.—When abortion takes place before the fifth month no diagnosis of syphilis can be made. When near the normal end of utero-gestation there is an epiphyseal osteochondritis, mainly of the lower extremities. The spleen exhibits mostly gummatous tumors, with cicatricial tissue and adherent peritonitis. When the fetus lives nearly up to the close of utero-gestation the anatomical proofs of syphilis increase in number. When born at full term the infant may exhibit pemphigus of the palm of the hand or of the sole of the foot, also visceral changes. Those less thoroughly poisoned show a pale-red or brown exanthem on face, hands, feet, and genitals, also coryza, also rhagades of lips and at anus, described above, and oftener swelled spleen. The coryza may be dry, the exanthem absent, and there is only a grayish-yellowish discoloration and squamous condition of the surface. All these syphilides may be complicated with an innocent intertrigo. The latter is so common, with or without furunculosis, that particular care should be taken not to mistake it for syphilis. When the infants live to the second or fourth year condylomata may point equally to hereditary or to acquired syphilis. Small, thin cicatrices on the nose mean mostly heredity. After the second dentition Hutchinson's teeth are mostly, not always, met with. Anemia is profound, the complexion yellowish. In retarded syphilis the testes may remain small, with no or little hair on pubes. The mammae are small or quite infantile, the nose small and deformed. There are cicatrices on the lips; the hair is thick and dry and misshapen. Excessive mortality amongst the children in a family is suspicious.

Prognosis.—The great mortality of infants suffering from actual or modified symptoms or consequences of syphilis makes the prognosis very doubtful. Mild cases and infants at the breast have a better chance than others. In crowded public institutions they die, as most other babies do, though ever so well and healthy on admission. The retarded form, with bone affections solely, is promising; with affections of the skin and nodulations of the mucous membrane, less so. Its keratitis is pretty bad; deafness still worse; its tumefaction of liver and spleen is obstinate; many nervous derangements are remedial when taken in time. Relapses are frequent.

Prevention.—The prevention of hereditary syphilis is based in part on that of syphilis in general. Public hygiene is not benefited, as some try to do in New York, under the guidance of a combination of ignorance and hypocrisy, by disseminating venereal diseases throughout the whole city, but by wise superintendence and control of the "social evil." A syphilitic person must not marry. When a man has contracted syphilis he ought to be treated methodically two years, and before he marries three years ought to elapse after the last symptoms of syphilis were noticed. During pregnancy in suspected wedlock both man and woman ought to be treated.

Treatment.—An infant affected with hereditary syphilis will not infect its own mother, and ought to be nursed. A healthy wet-nurse may be infected by the nursing, and when hired ought to be informed of possible danger. Careful artificial feeding will render the necessity of employing

wet-nurses more and more superfluous to a certain extent. The treatment of a syphilitic infant should be continued several years. After the symptoms have receded it may be interrupted and recommenced. Relapses are too frequent not to be considered as great dangers. Hydrargyrum does not affect the mouth and intestines of infants and children as it does those of adults. Calomel should be given many weeks in doses of a twelfth to an eighth of a grain three times a day. When anemia is very urgent iron may be given at the same time. If in rare cases there be a gastric or intestinal disorder, this is corrected by a few drops of camphorated tincture of opium administered from time to time. The green iodide of mercury is not so well tolerated as calomel, and the oxidulated tannate of mercury recommended by Lustgarten does not seem to offer any advantages. Hydrargyrum cum creta may be given in three daily doses of one-sixth to one-third of a grain each. No reliance ought to be placed on mercury given to the mother or nurse, for its elimination through the milk is an uncertain process and an unknown quantity. Inunctions of five or ten grains of blue ointment daily have been employed by many authors. If there be any (rare) contraindications to the internal administration of mercury, they are, however, quite welcome. But the skin of babies is very vulnerable; that is why on no account oleate of mercury should be used. Widerhofer modifies inunctions by applying a mercurial plaster of the size of a hand to the intrascapular region. In urgent cases, mainly those in which symptoms of syphilis are observed in the newly-born, corrosive sublimate should be used subcutaneously. To prevent occasional indurations, the injections should be made into the muscular tissue, and the original solution of Lewin be diluted. A solution of 1 to 2 parts of corrosive sublimate and 2 of chloride of sodium in 400 parts of water is well tolerated. From ten to fifteen drops may be injected daily. Condylomata heal under the external application of calomel. The nasal ulcerations do well with red-precipitate ointment. This secondary stage of syphilis does not require iodides. Baths with corrosive sublimate (1 : 10,000) answer well in extensive cutaneous eruptions.

Syphilis tarda shows itself mostly in the bones. Iodide of potassium in three daily doses of from seven to fifteen grains each are well borne and effective. In iodism affecting the mucous membrane Rabl recommends the addition of atropine. The author has mostly added chlorate of potash in doses changing according to age (child of twelve years not more than half a dram daily). When abdominal viscera or the nervous system are affected at the same time, blue ointment, fifteen to twenty-five grains daily, is to be rubbed in for five successive days, with an interruption of two days afterward. Mineral baths containing iodine (St. Catherine's, Krenznach) are very wholesome. When ill-nutrition and anemia are very marked, arsenic or iron, or both, should be administered.

Sero-therapy, in the shape of subcutaneous injections, in the prior stage of syphilis, of blood-serum taken from patients affected with tertiary syphilis, have thus far been rather unsuccessful.

TREATMENT OF SYPHILIS.

BY ROBERT HOLMES GREENE, A. M., M. D.

THERE are few diseases in which it is possible to give a clearer history of its treatment than of syphilis. Appearing as a new disease in Europe in 1493, though many claim it to have been present through all time, it extended with great rapidity and in a severe form throughout the Continent; and from that time to this has attracted much of the medical thought of the world. Though innumerable experiments have been made and carefully recorded, and innumerable treatises have been written concerning its treatment, and many and divers opinions have been held regarding the nature of syphilis and its treatment, still the diverging lines of thought have, after all, been few, as a brief review of them will demonstrate.

History of Treatment by Mercury.—During the first few years after the appearance of syphilis there seems to have been little or no treatment adopted; but within a short time, probably within the first ten years, mercury, used in the form of an ointment, made its advent. Mercury had been introduced originally by the Arabians, and already had a certain reputation in the treatment of other diseases accompanied by cutaneous manifestations, and, naturally, from this it was discovered to have a beneficial effect on the lesions of syphilis. Its use was displaced temporarily, about the end of the first quarter of the sixteenth century, by a belief in the virtues of guaiac, sassafras, sarsaparilla, and other plants. The general use of these measures was, however, abandoned in a few years, and a return made to the use of mercury. The discovery, made about the middle of the sixteenth century, of the virtues of mercury when administered internally increased its popularity. This form, as well as the form of ointments, plasters, and baths, was used very generally for the following three hundred years.

There were two mistakes made, however, in connection with the administration of mercury, which for a long time confused our ancestors and tended to bring the use of the drug into ill repute. One of these mistakes was connected with the results following its administration; the other was a mistake concerning the nature of the disease for which it was used.

Until nearly the middle of the eighteenth century it was considered necessary to salivate in order to obtain the most beneficial effects from its use, while many of the phenomena due to salivation were attributed to syphilis itself.

The other error appeared to be due to the fact that chancre, chancreoid, and gonorrhœa were for a long time all considered as being manifestations of syphilis. This mistake in the nature of these diseases did not arise until several years after the appearance of syphilis in Europe, as at the time of its appearance—in fact, as far back as can be determined by medical history—chancreoid and gonorrhœa had been considered entities. These mistaken views have been entirely discarded and demonstrated to be false only during the

latter part of the present century. Before that time—in fact, until recent years—the administration of mercury had been recommended for them all.

It having been noticed by many observers, especially during the latter part of the first quarter of the present century, that some syphilitic patients, under the influence of change of climate, with good hygienic surroundings, improved without the use of mercury, its administration was by many practitioners once more discarded, but only gradually to be taken up again; and at the present time practically the whole medical world is convinced of its value, and for the treatment of syphilis recommends its administration in some manner. There still is, however, considerable divergence of opinion among syphilographers as to the best method of its administration in the general treatment of the disease.

Some syphilographers believe in the so-called “expectant” plan of treatment. However, these are few in number and apparently growing less. They recommend the administration of mercury in some form while the lesions of syphilis are apparent to view and easily demonstrated. As soon as such lesions have disappeared from view of the naked eye they stop its administration.

Another class rely largely upon mercury administered internally only, and lay stress upon so administering it from the time of the first appearance of the initial lesion—or at least from the time when the diagnosis can be made with any positiveness—and recommend the continuance of its administration in this manner for a period of from one to several years.

A third class advise waiting generally until the appearance of the erythema—that is, as a rule, about forty days—before commencing the use of mercury. They then prescribe its use internally, when possible, in doses calculated with great precision for a period of from one and a half to three years.

Still another class, at the present time as popular, and perhaps the most popular—particularly in Germany, but not in this country—defer the administration of mercury until the appearance of the erythema, and, while possibly prescribing its administration internally during the first few weeks or months of treatment, have greater belief in its administration by other methods, such as inunctions, hypodermic injections, fumigations, and baths.

Treatment by Means of Iodides.—The use of iodide of potassium as a remedy against syphilis was first suggested about the beginning of the middle third of this century. A knowledge of its virtues was quickly diffused throughout the medical world, and the good repute then established has since been sustained.

From the time of its introduction it has been the custom to administer the iodide of potassium or some of its combinations, such as iodide of soda, for the so-called later manifestations of syphilis, even if these so-called later manifestations should occur in the early course of the disease. Within a few years after its introduction it became the custom occasionally to administer the drug in very large doses—a practice which holds at the present time. The latest tendency of medical opinion seems to be that while its virtues are recognized, its powers have been extolled too highly, as against mercury, in the treatment of the later lesions of syphilis.

Where the iodides as ordinarily used seem to disagree with the intestinal canal, as is not infrequently the case, and an acid is not contraindicated, the syrup of hydriodic acid has been recommended in their place.

Gold, chemically combined with soda or in combinations with mercury, arsenic, and the iodide of manganese, has at intervals for many years been

recommended in the treatment of syphilis. The history of its use seems to show that while, as a general tonic, it may, by its stimulating effect upon the hematopoietic organs, improve general nutrition, it is in no way a specific for syphilis in the sense that mercury and the iodides appear to be. It is supposed to have—and probably to a slight extent it is true—some beneficial effect when used against sclerotic conditions caused by syphilis.

Serum-therapy.—During the last few years, the fact having been noticed that syphilis cannot be transferred to animals, a number of experiments have been made on the following lines :

The serum of the blood of rabbits, goats, and dogs has been injected into the blood of persons suffering from secondary syphilis.

The serum of individuals with tertiary lesions has been administered to individuals having secondary lesions.

The serum taken from the blood of children with hereditary syphilis has been used upon individuals with secondary lesions.

The serum of animals into whose veins has been injected, several days previously, the blood of men who were in the secondary stages of syphilis has been taken and used against the secondary lesions in men.

That the results achieved have been anything more than would follow a reaction of the system, such as is often seen when any of the animal extracts have been used for other purposes, has yet to be demonstrated.

From the use of thyroid extract no permanent beneficial effects have been noticed.

Attacks of erysipelas occurring in patients in whom secondary or tertiary lesions of the skin are present, even when such lesions were persistent and had resisted ordinary antisyphilitic treatment, have apparently caused the resolution of such skin-manifestations, but the erysipelas has not necessarily prevented the recurrence of other lesions of the skin later on.

The use of the toxin of erysipelas to counteract degenerations of the spinal cord in individuals who have previously had syphilis has so far been attended with negative results. The toxins of erysipelas, however, when properly administered, will cause a resolution, probably temporary, of the cutaneous manifestations of syphilis.

The inimicality of the infection of erysipelas to the infection of syphilis is a subject fully deserving further investigation.

Until we are better acquainted with the pathology of syphilis it will be difficult to make authoritative statements concerning the *rationale* of its treatment. That syphilis is due to a germ—reasoning from the strong resemblance it bears to other diseases of known microbic origin—there is but little doubt. If it be due to a germ, it must be one that passes beyond the blood-vessels and invades every tissue of the body.

It would be interesting to know how long such a germ takes to develop—to know whether or not there is an increased infection of the system some thirty to fifty days after the appearance of the initial lesion.

Is the small round-cell infiltration, the granuloma (the accumulations of which cause the various lesions of the skin in syphilis), due to, or is it the product of, the deficient action of the forces of the body on the syphilitic microbe? Does mercury act beneficially by stimulating the natural forces of the body to overcome the disease, or does it act beneficially by some chemically solvent action?

It seems at the present time to be quite clearly established that the body protects itself against microbic infection in a certain definite manner, and

we are daily becoming better acquainted with the plan which the body uses to destroy the enemies which attack it. That syphilis is due to a microbe can hardly be doubted, although positive proof is wanting. Therefore we may expect that any measures by which the natural forces of the body can be strengthened will result in the increased destruction of the microbes. In other words, by doing everything we can to put the body of the individual suffering from syphilis in the healthiest condition possible we are aiding the elements of the body in their fight for the destruction of the poisonous element by which it has been attacked.

The consensus of clinical experience shows the practical truth of this observation. How, then, may this best be done?

The space allotted to this article will not permit an exhaustive consideration of this subject; in fact, it would be necessary, to answer this question in the various forms in which it might be presented, to invade the whole field of therapy.

There are, however, certain inherent weaknesses in the constitution from which we find syphilitic patients prone to suffer. These weaknesses may have developed before the patients come to us for treatment, whether they may come in the earlier or the later stages of the disease; or they may develop while the patient is under treatment unless great care is taken. These conditions may be roughly classified as a tendency toward tuberculosis, rheumatism, gout, catarrhal conditions, and affections of the nervous system.

It will be necessary to inquire into the age and weight of the patients and the character of their urine. For instance, in old people, while the matter of diet may not be particularly influenced, the advice that might be given as regards hygienic conditions, the amount and time of exercise, bathing, and the like would be influenced by a loss of tonicity in the blood-vessels caused by age, and milder therapeutic measures would be adopted.

For those patients presenting evidences of the so-called tubercular diathesis a generous diet, with the addition of buttermilk, koumyss, and the like, to be taken two or three times a day, between meals and at bedtime, is recommended, as is also the inuring of the system to the cold-water plunge, the avoidance of exposure and sudden changes of temperature, and, above all, the adoption and rigid persistence in, for a considerable length of time, of some exercise or exercises tending to the development of the chest and the increase of respiratory capacity. In addition to these measures, if the patients are able to retain and assimilate small doses of arsenic, creasote, and cod-liver oil, in addition to whatever specific medication may be prescribed, it will be of great advantage. By such measures not only will the intensity of the syphilis be counteracted, but the patient's general condition will be much improved. Tuberculosis and syphilis are seldom found in one person at the same time, but when such a condition does exist the gravity of the situation is intensified.

Rheumatic patients should be warned of the dangers of exposure to cold and damp, and a close watch kept of the circulatory mechanism. In these patients the administration of alkalies, the salicylates, and digitalis is recommended. For the direct treatment of the syphilis earlier administration of the iodides for the relief of pain is recommended. The fact that syphilis itself, though rarely, may be responsible for the development of heart-lesions occurring in syphilitic subjects, should not be forgotten in this connection.

Gonorrhœal rheumatism may occur in a syphilitic subject, and will then demand proper attention, which should be directed not alone to that portion

of the body in which it is manifest, but to the posterior urethritis from which it so often originates as well.

Syphilis and gout are oftener found associated than are syphilis and rheumatism, as the latter is more generally a disease of the young. Gouty patients should be warned to refrain from the use of malt liquors, especially the beers at present manufactured in this country. Cold baths, exercise, diet, and, if necessary, the somewhat sparing use of colchicum and lithia, will in such cases aid us materially in obtaining good results. It should also be borne in mind that gout itself is capable of causing various lesions of the skin, certain ones of which may be very persistent.

Patients who suffer from catarrhal conditions or who are predisposed toward diseases of the nervous system are frequently benefited by a liberal addition to their diet of milk or preparations of the same, taken between their ordinary meals and at bedtime, also a cold plunge in the morning, and exercise in the open air. These cases are the ones that will be found most frequently to respond badly to the internal administration of mercury. In such patients it is often better to commence specific treatment with mercurial fumigations or inunctions.

The presence of oxalates, uric acid, or phosphates in excess in the urine shows that there is an interference with normal metamorphosis, and suitable measures, especially in the line of exercise and diet, should be taken to correct the condition.

Temporary glycosuria often accompanies syphilis in the acute stage of its early invasion. Many observers have found sugar in the urine at this time, and the fact that it sometimes disappears while the patient is receiving anti-syphilitic treatment lends probability to the view that such glycosuria is sometimes caused by the specific infection. Conversely, when individuals already suffering from glycosuria are attacked by syphilis the sugar frequently disappears from the urine temporarily.

A loss of weight should receive careful attention, and the cause should be sought for and removed as much as possible. Increased feeding by the liberal use of milk—plain, pasteurized, diluted with lime-water, or koumyss—in addition to the ordinary meals, should be advised until the lost weight has been regained and the general condition improved.

That syphilis tends to cause anemia has been very generally observed. To counteract this, as well as to relieve anemia present from any other causes, the administration of iron is of value. Its use should be persisted in at intervals throughout the whole course of treatment, unless contra-indicated. Unfortunately, from its irritating effects on the stomach it is sometimes difficult to administer it to the patients who are most in need of it.

Patients to whom the common preparations of iron (such as the chloride, the carbonate, and citrate of iron and quinine) can be given recover quickly from anemia, particularly if a respite be given in the administration of mercury. If these preparations are not tolerated, such bland and frequently efficacious preparations as the peptonates of iron or iron and manganese may be tried.

There are, however, two forms of iron that seldom give rise to irritation or constipation, which can be especially recommended. Iron—in fact, all tonics—are, as a rule, better borne when mercurial treatment is given to syphilitic patients by means of inunctions, baths, or hypodermic injections rather than by the mouth. The two forms of iron recommended are the *mist. ferri et ammonii acetatis* of the B. P. (Basham's mixture), taken in

tablespoonful doses well diluted with water three times daily ; and a German preparation of iron and manganese sold in the United States under the name of "Gude's pepto-mangan," the dose of which is from 2 teaspoonfuls to a tablespoonful, to be taken after meals, in water.

Constipation should be overcome by means of proper diet and exercise. A liberal use of hot water drunk early in the morning, to which should be added, if required, the dried phosphate of soda in teaspoonful doses, is recommended. In severe cases it may be necessary to use the compound cathartic pill of the U. S. P. occasionally, but a return to milder measures is advised as soon as possible. Contrary to its customary effect, the internal administration of mercury will occasionally cause constipation.

General tonics are of great value in the treatment of syphilis, because of their good effect on the general condition of the patient. They apparently act better when changed frequently, and the use of any one of them should not be persisted in for a longer period than two or three weeks, when another should be substituted, followed by a return to the one found originally to agree or to others that may be found beneficial from time to time.

Two tonic mixtures which have been found of great service are—

℞. Ext. damianæ fl.,	ʒjss ;
Tinct. cinch. co.,	ad ʒiv.

Sig. Teaspoonful in water before meals.

And

℞. Strych. sulph.,	gr. ½ ;
Calcii glycerophosphat.,	ʒiij ;
Aquæ,	ad ʒiv.

Shake bottle. Teaspoonful t. i. d., before meals, in water.

Damiana is of real value, but only when used in the form of the fluid extract. It is difficult to obtain a reliable preparation of the drug.

The great value of phosphorus has long been known. The glycerophosphate of calcium is a convenient form in which to administer it. The dose is from 5 to 8 grains.

As nerve-tonics preparations of coca or kola may be used for brief periods with benefit, but their prolonged use seems to interfere with the digestive processes.

A small amount—one-third to one-quarter of the ordinary glass—of a good extract of malt, taken with meals, with or without the addition of an equal amount of carbonic-acid water, makes a pleasant beverage and tends to increase the appetite and improve the digestion. As almost all extracts of malt contain alcohol in considerable quantities, care should be taken to use the one containing the least alcohol, and that too much be not taken. Cod-liver oil, when well borne, is of value in many cases.

The intelligent use of water plays an important part in the treatment of syphilis, as it does in so many other chronic diseases. The suitable use of water may render the patient much more comfortable by its soothing action on the peripheral nerves, or may tend by its stimulating action to increase capillary circulation and thus aid in the cure of the disease.

Generally, as regards bathing itself, the cold plunge, taken in the morning when possible to obtain it, will be found to be of immense value. Conditions of erythema and sleeplessness occasionally accompanying the nervous disturbances of syphilis are often relieved by immersions of from ten minutes to half an hour in a warm bath, temperature from 98° to 100° F., at bedtime.

The wet sheet is an invaluable remedy in certain severe forms of insomnia, and is a measure especially to be recommended when applied for a period of from one to three weeks, to tutor the skin to react from other applications of water that may follow its discontinuance, such as the cold plunge in the morning, which many individuals are unable to take without a previous training of the skin, their reactionary powers being feeble. The frequent use of hot baths has a depressing influence. They are well borne only by the strong, who apparently have little use for them, and tend to depress the circulation of those who may be already enfeebled. A mild form of Turkish bath, to be taken not oftener than once a week, in which the sojourn in the hot room is limited to a period of not over twenty minutes, is frequently of use, not only for the purpose of cleanliness, but to hasten the elimination of any mercurial preparations used from the system. With very old people all hydrotherapeutic measures beyond those necessary for cleanliness should be used with great caution.

Visits to the much-vaunted mineral springs of this or other countries are seldom to be advised for individuals in the early stages of syphilis, the beneficial results accruing from a change of air and scene and the relaxation from the cares of business seldom compensating the patient for the lack of comfort so often incurred by the removal from home, and the dangers involved of falling into the hands of conscienceless practitioners or charlatans so often found at such resorts.

Great benefit in certain forms of syphilis—particularly in syphilis of the nervous system—may be derived from the administration of electricity in forms suitable to the conditions present. The tonic effects of faradic and static electricity frequently accomplish much good, and in cases suitable for its administration a prolonged use of the galvanic current has often undoubtedly been found of benefit.

The influence of race and climate upon syphilis is a subject worthy of more study and investigation than it has yet received. That these factors undoubtedly exert some effect upon treatment itself it seems fair to presume. May it not be that some of the syphilographers of England, amongst whom are earnest advocates of the internal administration of mercury, if living in America, especially in the neighborhood of New York, where catarrhal diseases are much more prevalent than in England, would have cause to modify their exalted opinion of the treatment of this disease by the internal administration of mercury, and observe more clearly the benefits to be derived from its administration by means of inunctions, fumigations, and hypodermic injections?

In general, it may be predicted that a syphilitic patient will do better in a high, dry climate than in a low, moist one.

Concerning the **direct treatment** of syphilis itself, the question of the abortion of the disease by any manner of treatment at present known to us is first to be considered. Whether or not this disease could possibly be aborted has been the cause of divergent opinions for many years, the method advocated being the incision or destruction of the initial lesion.

The writer is of the opinion that syphilis cannot be aborted by any attempt at excision of the local lesion, and that by the time the first appearance of the initial lesion has shown itself such an invasion of the system has already taken place that no mechanical procedure, such as an excision of the chancre or of the surrounding glands, will prevent infection of the system, although the history of certain cases where the excision of the initial lesion has been performed by careful surgeons would make it appear that abortion

of the disease has taken place. However, the most enthusiastic advocates of these measures are able to cite but very few recoveries in proportion to the number of cases operated upon. The operation is therefore not to be recommended, unless for the purpose of making a microscopical examination for the recognition of the changes that have occurred in the lymphatics and blood-vessels, or possibly, in extremely rare cases, where it might be necessary to remove temporarily from view the characteristic appearance of the lesion.

Concerning the time that systemic treatment should be inaugurated there has been much dispute, many holding that it should be commenced as soon as the sore appears, particularly if we have reason to believe, from its aspect and the time of its appearance, that we are dealing with the primary lesion of syphilis. Some believe that by so doing in a certain proportion of cases the appearance of the secondary symptoms may be prevented, and argue theoretically that the earlier the disease is attacked by specific medication the easier it will be to destroy the infective processes.

The opponents of this view hold, in the main, that it is better to wait until the appearance of erythema or the general adenopathy, pain in the limbs, sore throat, and other evidences which render the diagnosis of syphilis absolutely certain. Some who hold the latter view consider also that about the time of the appearance of the erythema a sort of explosion of the disease takes place, and that the round infiltrating cells which accompany this stage of syphilis are thrown out in greater numbers at that time, and are more easily attacked by antisiphilitic medication. These latter claim that in the vast majority of cases earlier treatment will only retard, not prevent, the appearance of the secondary eruption, and that when these do occur they are generally much more difficult to get rid of than if treatment had been delayed originally until their first appearance.

It is exceedingly unwise to commence the treatment of syphilis in any given case until both patient and physician are absolutely sure that syphilis itself is present. As a matter of fact, this cannot in the majority of cases be determined much before the first appearance of the erythema. That there may be exceptions to this rule, owing to individual circumstances surrounding any given case, is easily apparent, but such exceptions are extremely rare. It is often difficult to determine by ocular inspection of the lesions whether chancre, chancreoid, or some herpetic eruption is present.

In the ordinary case of syphilis, in which the appearance of the erythema or of other symptoms has rendered our diagnosis certain—granting that the patient has been or is being put in the best physical condition possible in the way indicated in the preceding pages, and after a visit to the dentist has thoroughly removed any tartar from the teeth, and the scrupulous use of the tooth-brush, together with some mild antiseptic mouth-wash, has been recommended—systemic treatment may be commenced.

In patients of not over fifty, who are in good condition, the administration of mercury in the form of the protiodide, in a pill- or tablet-form, is most highly recommended. From $\frac{1}{4}$ to $\frac{1}{3}$ of a grain may be taken three times a day, after eating. The pills or tablets should be freshly prepared. Opium should not be used in combination with mercury, as has been recommended by some writers. It is better, if there seems to be occasion for the use of opium, either to change the mercurial preparation or to commence fumigations or inunctions, and discontinue its use internally altogether.

The tannate of mercury has been highly recommended of late, and deservedly. It may be given in $\frac{1}{2}$ -grain doses three times a day. It is gen-

erally conceded that this salt of mercury is more liable to cause salivation than the protiodide. In proper doses it can easily be given to children, as it may be mixed with milk.

Should the general condition of the patient remain good under this treatment or under some such treatment as has just been outlined, the erythema will soon disappear and the glandular enlargements gradually diminish. After six weeks' administration of the protiodide the erythema should have entirely disappeared, and the glandular enlargements will be greatly diminished.

It is now well to discontinue all specific medication for a week, and give a ferruginous tonic such as has been mentioned, and at the end of that time to commence a course of inunctions or fumigations. If, when we originally commence our mercurial administration, we have a patient suffering from very faulty digestion, such as a catarrhal condition of the stomach or intestinal canal, or any form of the so-called nervous dyspepsia, it is well to refrain from internal medication at the time, and to begin active treatment by the administration of mercury in the form of either fumigations or inunctions. In almost every case that comes under observation at the time of the erythema, inunctions should be begun after a preliminary six weeks' course of internal administration of the protiodide.

Much stress has been laid upon the fact that it is difficult to induce the patient to submit to the use of inunctions. The experience of the writer has been to the contrary. Patients with syphilis are most often seen in two classes: dispensary patients, to whom the presence of dirt is not, as a rule, particularly obnoxious; and the more intelligent class that appear as private patients, who will gladly co-operate with the physician, after he has advised them of the seriousness of their disease, in any measure that he may deem necessary for their welfare.

An argument that has great weight with syphilitic patients is to inform them that even after the erythema has disappeared microscopic examination of the skin would show it still to be infiltrated with the round-cells of so-called secondary syphilis; that a direct application of mercury to the surface will most easily destroy these cells; and that it is wise to have that application made by degrees over the entire surface of the body.

In using mercurial inunctions the ordinary ung. hydrarg. of the U. S. P. is to be recommended. It is very necessary, however, if we desire to obtain good results from the use of inunctions, that a freshly made ointment be used. On account of the length of time that it takes to do this pharmacists are very apt to fill the prescription of the physician by adding some simple softening material to any old preparation that they may have on hand. This should be looked out for, and positive directions to the contrary given.

In using inunctions it is well to divide the body into several divisions, such as the following: Neck and head, 1; both arms and axillæ, 2; one-half of the chest and abdomen, 3 and 4; groin and Scarpæ's triangle, 5; legs, 6; palms and soles, 7; back, 8. From 30 to 50 grains of the mercurial ointment should be used in one of these divisions daily until the whole body has been covered. Then a respite of from three to five days should be taken. Another similar course should then be ordered, to be followed by a period of rest of from five to ten days; and then a third course instituted, followed by a period of from ten days' to two weeks' rest; and a fourth course in the same manner. This will bring us to a period between the fifth and sixth month of the disease, at which time the diffuse adenopathy should be much diminished, and if a careful watch over the condition of the patient has been

kept, and the more or less faithful administration of tonics, especially those containing iron, continued, much favorable progress should be apparent.

In using inunctions, that portion of the body to which they are to be applied should first be scrubbed thoroughly with soap and water, followed by a mild carbolie lotion or a solution of soda. In applying the ointment it is well to obtain the services of a professional rubber when possible, in which case the ointment should be so well rubbed in that very little should remain on the surface—in fact, so slight an amount that the application of a little toilet-powder will prevent the staining of the clothing. Where it is not possible to obtain the services of a rubber the patient must make what frictions he can for himself or obtain the services of a friend, which will always be necessary for the inunctions to the back. Directions should be given that if the ointment is rubbed in at night the surface of the body to which the application has been made should not be washed off before morning, or if given in the morning it should not be washed off before night.

In order that the amount may be accurately measured, a little scoop, holding from 35 to 50 grains, according to the amount which it is desired to use, may be arranged, or the ointment may be measured out by the pharmacist in cachets of oiled paper of such size that each one contains enough for one application. A piece of ointment equal in size to the third phalanx of the first finger represents approximately 40 grains of the ointment, which is the amount to be used ordinarily for one application.

Hypodermic injections of mercury have been much vaunted, and a legion of mercurial preparations has been suggested to be administered in this manner, preferably the bichlorides. The fact that the administration of mercury in this way almost invariably gives rise to pain, and frequently to nodosities at the seat of injection, and occasionally to abscesses, will probably prevent this form of administration from ever becoming universally popular. That injections are of great value, however, for certain lesions cannot be doubted, especially for those which are deep-seated and solitary, and in which haste is required for their removal.

The easiest way to arrive at a conclusion, when in any given case doubt exists as to the advisability of giving mercury in any form, is to administer it by hypodermic injections for a few times and note the results. The two places on the body in which the injections may be most advantageously used are the gluteal regions and the regions between the shoulders, the part having been previously washed with some antiseptic solution, and, when possible, sprayed with chloride of ethyl to prevent the pain of the application.

Cataloguing of the various preparations of mercury suggested for this purpose cannot well be done here. Bichloride is probably as effective, when administered in this manner, as any preparation. It may be administered in the strength of from $\frac{1}{12}$ to $\frac{1}{8}$ of a grain, dissolved in from 20 to 40 minims of water, daily or on alternate days, with a hypodermic syringe with rubber mountings.

Mercurial Fumigations.—One of the earliest methods of administering mercury for the treatment of syphilis was by its vaporization through heat, the patient being placed in such a position that the vapor had free action on the skin. The application of mercury by this method is somewhat less reliable in its results than inunctions, and salivation is apparently more easily induced. It may be recommended, however, whenever the inunctions are indicated and it is impossible to obtain the consent of the patient to their use. It is of especial value in those cases in which the eruptions of syphilis are diffuse. In large cities there are generally to be found some institutions

where the fumigations of mercury can be applied in a proper manner. Where such places are not to be found the apparatus pictured in Figs. 222,

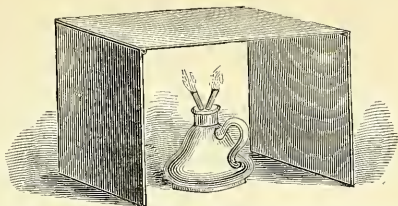


FIG. 222.—Van Buren's lamp. The patient, completely stripped and surrounded by a cloak of gum cloth or a blanket, is seated on a cane chair, beneath which the fumigating apparatus is placed.

223 will be found to work effectually. Useful results will be obtained from the fumigation of a combination of calomel and cinnabar.

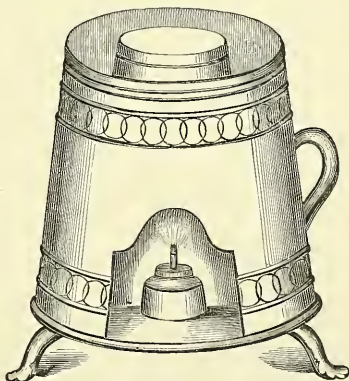


FIG. 223.—Lee's lamp, modified by Bumstead.

In commencing treatment by this method 20 grains of each drug is a moderate amount to use at a time. In proper cases a gradual increase of not over 5 grains of each at any one time may be used, and it is never safe to vaporize more than 40 grains of each at any one period. These fumigations, as a rule, should be administered only on alternate days, the patient's mouth being frequently examined for the purpose of discovering any premonition of salivation. Great watchfulness must be maintained on the part of the patient to avoid catching cold immediately after the application of mercurial vapor.

In the systemic treatment of syphilis after from 30 to 50 inunctions have been taken or a corresponding amount has been administered by means of fumigations for a period of from two to three months, it is well to return to the internal administration for a time. The use of the protiodide may be resumed, or the biniodide will be found to be of great value administered in doses of from $\frac{1}{16}$ to $\frac{1}{8}$ of a grain; its efficacy will sometimes be much in-

creased by the addition of minute doses of iodide of potash, 1 grain to the dose of biniodide, this combination apparently making the biniodide more absorbable. This, of course, is a smaller proportion of iodide of potash than is used in the so-called "mixed treatment."

This internal administration of whatever mercurial preparation may have been selected having been continued for a month or six weeks, it is well to return to inunctions for one or two courses, which in turn should be followed by a return to the method of internal administration after some period of rest. In this manner treatment for the first year may be carried out.

During the second year, particularly if they are well borne by the stomach and do not cause interference with the general nutrition, the iodides should be administered in the form of a solution of the iodide of potassium or soda, alone or in combination with some preparation of mercury, such as—

℞. Hydrarg. biniodidi,	gr. j-ij :
Potassii iodidi,	ʒiv-ʒj ;
Syr. rubri idæi,	ad ʒiv.
Teaspoonful t. i. d. after meals.	

During the second year of treatment, however, it is well to give at intervals a series of inunctions. Periods of rest should also be employed from the administration of any of the iodides or mercury, during which time tonics should be administered if there is any indication for their use.

Baths containing bichloride of mercury are sometimes used when there are extensive lesions of the skin, in the proportion of $\frac{1}{2}$ to 1 ounce in a bath of 20 gallons, at a temperature of 100° F., a quantity of chloride of ammonia (double that of the chloride of mercury) to be dissolved in the same bath. These baths ought not to be taken oftener than on alternate days, and very careful observation should be made of the condition of the mouth in cases undergoing treatment in this manner.

Patients coming under observation in the later stages of syphilis, as before stated, are benefited by mixed treatment or the administration of the iodides internally, with some external application of mercury, as inunctions; and this treatment should be inaugurated from the time the patient comes under observation. Occasionally in these cases of late syphilis very large doses of the iodides are administered, with apparently great benefit. Where large doses of the iodides are used, it is well to commence with an ordinary dose of from 8 to 10 grains, and increase the dose a grain each time it is administered. One of the best ways to administer iodide of potash is to dissolve the daily amount in a bottle of Vichy, and from this the patient may drink as often as desired.

Before commencing the treatment of cases apparently suffering from late syphilis great care should be used in making the diagnosis, in order to determine whether syphilis itself is present, or some other disease which may or may not have been caused by a preceding syphilis. Gout and rheumatism are sometimes confused with syphilis in making a diagnosis of the case of a patient who is suffering, or apparently has at some time suffered, from syphilitic infection.

One is often called upon to treat patients in the early stages of syphilis to whom treatment has been already administered by one or many practitioners. These patients frequently present conditions to which it may be worth while to call attention.

A quite characteristic class consists of individuals who have had internal

treatment while any secondary eruption has been present; treatment then being stopped, only to be renewed when any skin-manifestations again appeared; then stopped again until some easily-perceived lesion appeared, which again necessitated treatment. This is a class very frequently seen in hospital and dispensary-practice, patients who live carelessly and are prone to excesses. These patients are much benefited, as a rule, by a few vigorous courses of inunctions. If aged, they are especially liable to develop syphilitic degeneration of the blood-vessels, and secondarily of the nervous system.

Another class of patients not uncommonly seen consists of those who have had mercury administered by the mouth more or less continuously from the time of the appearance of the erythema. From this ingestion of mercury the patients have lost strength and weight, and a relapsing erythema may have made its appearance on which the continuance of the internal medication had no effect. In such cases it is advisable to stop all direct antisiphilitic medication for a week or two while we endeavor to build up the patient generally by the use of tonics, increased feeding, and similar measures; at the same time, however, treating directly any local lesions present by whatever treatment—whether antisiphilitic or not—that is indicated. When the general condition is somewhat improved a series of inunctions usually brings good results, followed by the disappearance of the eruption.

Another class of patients present themselves, giving a history of having had mercury administered internally since the appearance of the erythema, which still persists, and who have, in addition, large numbers of mucous patches on the lips or the inner surfaces of the cheek, and an extremely hyperemic condition of the nose and throat. In such cases also it is well to refrain from any specific treatment until a tonic has been administered for a few days, and such local applications to the nose and throat have been made as may be called for, which will cause them to take on a more healthy appearance. Then the administration of the protiodide will frequently cause the erythema to disappear quickly, or resort may be had to inunctions.

In some cases the pains and suffering accompanying the onset of the secondary symptoms are disproportionate in severity to the other manifestations of the disease. This is especially to be noticed in individuals who give a history of previous gout or rheumatism, and in those with so-called "nervous" temperaments. Such cases are much benefited by the early administration of the iodides, in addition to such other antisiphilitic treatment as may be indicated.

Patients are occasionally met with who give a history of the persistent internal administration of mercury from the appearance of the initial lesion, and in whom the delayed erythematous or papular eruption has made its appearance—an eruption which may have persisted for a long time, and which the continual internal administration of mercury has failed to ameliorate. In such cases inunctions should be used; but the disappearance of the eruption can be hastened by the administration also of the iodides, which should be administered to all the cases in which eruptions may have persisted for a long time.

Poisonous Effects of Mercury and the Iodides.—The administration of mercury, when causing harm, apparently does so by giving rise to two conditions—one salivation, the other cachexia. Just how its administration causes a cachectic condition is a matter of dispute. It shows itself in an irritated condition of the intestinal mucous membrane, attended with anemia, aches and pains resembling muscular rheumatism, and a general feeling of malaise. This condition is most apt to occur in individuals to

whom mercury has been administered by the mouth for a long period of time. It occurs less often where fumigations or hypodermic injections have been used, and less often still when applied by means of innunctions.

When such a condition exists it is better to stop temporarily the administration of mercury, give a tonic, and stimulate the various organs of elimination, remembering that excessive perspiration, unless brought about in some natural way, as through exercise, is very liable to weaken the individual.

Salivation of any severity need never occur in any case under close observation if proper prophylactic measures have been adopted and enforced. These consist in putting the mouth in the best possible condition by thoroughly cleaning the teeth and ordering filled or removed any dead or carious ones, and by causing the disappearance of any mucous patches that may be present by suitable measures before the administration of mercury has been commenced. While the patient is undergoing treatment the teeth and gums should be kept well cleaned with brush and powder, and some antiseptic and slightly astringent mouth-wash used after brushing and after each meal. In brushing the teeth the brush should be placed at the base of the gums and parallel to them. A turn of the wrist will then bring the brush at right angles to the gums and the teeth, both the front and back of which should be thoroughly brushed in this manner. By so doing the circulation through the gums will be stimulated; they will become tougher, and the base of the teeth will be kept freer from accumulations of tartar. Tincture of myrrh, of which from 5 to 10 drops may be used in half a glass of water, answers admirably as a mouth-wash. Two proprietary articles at present on the market, when properly diluted, are also useful for this purpose: one of these is listerine, the other boro-lyptol. The latter is to be preferred on account of the percentage of formaldehyd it contains—an antiseptic much valued by dentists.

The first indications of salivation are an appearance of pastiness of the gums and a rapid accumulation of tartar at the base of the teeth, followed by a feeling of soreness of the jaws and teeth, especially when the latter are struck forcibly and quickly together, the formation of a black line on the gums at the base of the teeth, a peculiar fetid odor of the breath, and a slight increase in the salivary secretions. Later on the symptoms become more pronounced; the salivary secretion is much increased, the teeth become loosened and perhaps fall out, and occasionally ulcers form on the mucous membrane of the mouth. The treatment of salivation consists in an immediate discontinuance of the administration of mercury, the removal, by a dentist, of all accumulations at the base of the teeth, and the administration of an astringent mouth-wash. In these conditions tannin (in a mixture consisting of half a teaspoonful of powdered tannin in half a glass of water) is of service, to be used as a mouth-wash several times a day or applied to the gums by means of a soft cloth. The continuance of the ordinary mouth-wash, or myrrh, listerine, or boro-lyptol, to which may be added chlorate of potash in the proportion of 10 grains to the ounce, in solution, previously recommended, should be persisted in. Bichloride washes and gargles are sometimes of service, and the following formula can be recommended:

℞. Hydrarg. bichlor.,	gr. viij;
Tinct. rhatany,	ʒjss;
Aquam,	ad ʒviij.

Sig. Use as mouth-wash and gargle.

If this solution is too astringent, dilute with equal parts of water.

always need the continuous application of some mercurial preparation. The mercurial ointment of the Pharmacopœia, of the same strength as previously recommended for purposes of inunction, can generally be used, and the surrounding tissues protected from the irritating effects of the ointment itself by the proper application of dressings. Should this ointment be found to be too irritating, one of the two following applications may be used :

R. Hydrarg. precip. alb.,	gr. xl ;
Adipis benzoinati,	ʒj.
M. Ft. ung.	
Sig. Apply externally.	

R. Ung. hydrarg.,	ʒij ;
Zinci ox.,	ʒij ;
Amyli,	ʒij ;
Adipis benzoinati,	ad ʒj.
M. Ft. ung.	
Sig. Apply externally.	

In chancres presenting an extensive ulceration the dusting powder of zinci ox. and hydrarg. chlor. mitis may be used, or aristol may be tried. These failing, resort must be had to iodoform. With ulceration and induration of any extent both present, these powers may be dusted over the ulcerated surface, and one of the mercurial ointments applied over the induration itself.

Ulcerated chancres occasionally become infected by pyogenic microbes and covered with necrotic accumulations. For the treatment of this type of chancre, and for this one only, need any cantherizing agent be used. Here one is necessary for the destruction of the false membrane. The most valuable is a solution of pure carbolic acid, applied by a piece of cotton on the end of a stick. The acid should be painted lightly over the membrane, the surface of the ulceration having previously been dried and a solution of cocaine applied. After the destruction of the membrane the chancre should be dressed with one of the dusting powders mentioned above. When the initial lesion is situated upon some portion of the body where pressure may easily be made, as in chancre of the finger, strips of mercurial plaster kept constantly applied will be found of much benefit in inducing resolution.

In any chancre where it is desirable to reduce induration, and neither ointments nor mercurial plasters are advisable, solutions of bichloride of mercury of a strength of from 1:4000-1:3000 may be applied constantly, their strength being reduced if too irritating to the surrounding parts.

The treatment of the erythematous or papular lesions of syphilis, as a rule, will be sufficiently fulfilled by the use of the systemic treatment previously recommended. Where the erythema has persisted for a long time or where papules show great slowness in resolution, prolonged frictions with mercurial ointment will generally be found efficacious, together with the internal administration of the iodides in some form.

The erythema of syphilis is rarely associated with a seborrheic process, giving rise to patches of a reddish color that are somewhat furred. The application of the following ointment to such patches will produce good results :

R. Resorcin,	gr. xxx ;
Adipis benzoinati,	ʒj.
M. Ft. ung.	
Sig. Apply externally.	

The syphilitic papules, especially those occurring in individuals of dissipated habits, occasionally become infected with pyogenic microbes; then from the papules pustules are formed, and a twofold condition is to be treated—the destruction of the pyogenic microbes is called for, as well as the absorption of the syphilitic infiltration which is responsible for the papules. The constant application of the following ointment to the pustules themselves is of great value:

R̄. Hydrarg. præcip. alb.,	ʒj;
Amyli,	
Zinci ox.,	āā. ʒij;
Vaselini,	ad ʒj.
M. Ft. ung.	
Sig. Apply to pustules.	

For general treatment in these cases the mercurial fumigations or mercurial baths may be used with benefit, and the persistent administration of tonics and a generous diet are called for.

In addition to the proper systemic treatment, curetting may be required for serpiginous syphilides if the lesions are persistent. Tubercular syphilides may be treated in a manner similar to that advised for the papular. All crusts forming on any syphilides should be removed by the application of warm antiseptic solutions, and proper medication applied to the clean surface. In all syphilides of the skin that have persisted for a long time iodide of potash, unless contraindicated, is advised, together with mercury given in the manner that the conditions present seem to call for.

Scaly syphilitic lesions of the skin, particularly those of the soles and palms, are sometimes extremely difficult to cure. They need to be softened by the application of alkaline baths, and the hard, indurated lesions are improved by the application of liquor potassii in either a pure or a diluted form. It should be applied until sufficient softening has taken place. When this has occurred a constant application of some mild mercurial ointment will be found of benefit. These scaly lesions, together with the papules, fissures, and excoriations occurring on the hands and palms, are frequently healed, only to recur in a manner which exhausts the patience of the practitioner and of the individual suffering from them. The constant application of some one of the following ointments in these cases may be of value:

R̄. Ung. hydrarg.,	ʒij;
Amyli,	ʒij;
Zinci ox.,	ʒij;
Vaselini,	ʒij.
M. Ft. ung.	
R̄. Hydrarg. chloridi mitis,	gr. xx;
Zinci ox.,	ʒij;
Amyli,	ʒij;
Vaselini,	ad ʒj.
M. Ft. ung.	
R̄. Ung. diachyli (fresh),	
Zinci ox.,	āā. ʒiv.
M. Ft. ung.	

R. Olei russi,	ʒj;
Zinci ox.,	ʒij;
Amyli,	ʒij;
Vaselini,	ad ʒj.
M. Ft. ung.	

The constant application of mercurial plasters in many of these conditions, when it is possible to apply them, seems frequently to do good in two ways—first, on account of the mercury they contain; secondly, because of the pressure exerted by them. For any syphilitic lesions occurring on the hands the wearing of gloves is advised, for purposes of both protection and cleanliness.

Condylomata and all excoriations occurring in connection with them need to have their surfaces protected, so that their secretions will not infect healthy tissue, as well as the continuous application of a dusting powder of calomel alone or combined with oxide of zinc. Vegetations, if profuse and not affected by the systemic treatment and by the application of calomel dusting powder, may be benefited by employing one of the two following preparations:

R. Hydrarg. bichloridi,	ʒj;
Collodii flexil.,	ad ʒj.
Sig. Paint on externally daily.	
R. Acidi salicylici,	ʒj;
Collodii flexil.,	ʒj.
Sig. Paint on externally.	

If the vegetations are very indolent, they may be snipped off by scissors or removed by the curette, cocaine having previously been applied. After their removal one of the above-named preparations should be applied for a few days to their base.

For almost all syphilitic lesions occurring on mucous membrane nitrate of silver is of immense value, in the form either of a stick or of a solution varying in strength from 5 to 20 grains to the ounce. Mucous patches, as a rule, heal rapidly from a few light applications of the solid stick or from the more frequent application of a solution in a strength of 10 grains to the ounce.

Hyperemic conditions of the throat and naso-pharynx are much benefited by a spray of nitrate of silver of a strength of from 5 to 10 grains to the ounce. Lesions of the nasal mucous membrane, when easily reached and of the same character as mucous patches, are benefited by the application of the nitrate-of-silver solution.

Small ulcerations occurring high up in the nasal cavity sometimes appear in late syphilis, and occasionally cause disturbances of smell and taste. They are benefited by sprays of chloride of zinc in a solution of 10 grains to the ounce, in addition to whatever systemic treatment may be indicated.

For the falling out of the hair so frequently noticed in secondary syphilis, due to the round-cell infiltration into the scalp around the roots of the hair, the application of the following ointment and wash will be of benefit:

R. Hydrarg. præcip. alb.,	ʒj;
Adipis benzoïnati,	ʒj;
Resoreïn,	gr. xx.—M.
Sig. Apply externally at night.	

This is to be washed off in the morning, and the following used :

Ry. Hydrarg. bichloridi,	gr. viij ;
Tinct. cantharidis,	ʒiij ;
Aquam,	ad ʒviij.

The hair in the later stages of syphilis will frequently be found to have fallen out. This condition is due apparently to an alopecia dependent, probably, upon the general condition of the system, with or without some microbic infection, but not due to the syphilis *per se*. In such cases the following lotion will be found to be of advantage :

Ry. Olei rosæ geranii,	gtt. viij ;
Quininae bisulph.,	gr. xx ;
Tinct. cantharidis,	ʒv ;
Tinct. jaborandi,	ʒj ;
Aquam picis,	ad ʒviij.—M.

Sig. Apply vigorously to the scalp daily.

Lesions of the tongue occurring in the early stages of syphilis are beneficially influenced by measures directed to the general system and by hygienic treatment of the disease. Much reliance can be placed upon the good effects of the local use of nitrate of silver in the form either of the solid stick or the solution, for any fissures or excoriations present. Care should be taken not to confound conditions of the tongue caused by treatment with the lesions caused by syphilis. Occasionally the administration of the iodides will give rise to lesions of the tongue simulating those caused by almost any disease, these lesions having been known to resemble epithelioma. The patches seen on the tongue of old syphilitics are sometimes due to a sclerosis. These patches are, as a rule, little influenced by antisiphilitic medication. They should be kept free from irritation by keeping the mouth in the best possible hygienic condition and by avoidance of tobacco and of everything in the line of food and drink that seems to cause the slightest interference with the digestive process. In a case of this description the author has known benefit to be derived from the internal administration of calomel and soda, their use being persisted in for some time. It is of the utmost importance that a tongue which has suffered sclerotic changes be kept in as healthy a condition as possible, as with advancing years these cases seem prone to the development of malignant growths.

Lesions of the bones may be benefited by the internal administration of the iodides, mercurial frictions over any of the tender surfaces that may be reached, and often by the continued application of mercurial plasters. Dead bone occurring in an individual suffering from syphilis needs the same surgical treatment as when occurring from any other cause.

Syphilitic infiltration of the muscles, a rare condition, yields to the usual systemic treatment for the disease itself ; and the same may be said of syphilis occurring in the liver, spleen, and other organs of the body. Generally, these cases require, as far as systemic treatment is concerned, the administration of the iodides, mercurial inunctions, and, when possible, the constant application of mercurial plasters to the adjoining surfaces of the body. General hygienic treatment should be instituted and care displayed in diagnosis, for often these lesions, though apparently due directly to syphilis itself, are really due to some condition caused by the syphilis or to conditions wholly independent of it.

Syphilis of the kidneys requires for its treatment greater care in the administration of mercury. Elimination being interfered with, salivation is somewhat more prone to occur. Otherwise it should be treated as are diseases of the kidney due to other causes.

Syphilitic affections of the eye are fully described and their proper local treatment given in other portions of this volume. Their systemic treatment will depend upon the conditions present. In almost all such cases mercurial inunctions will be found of value, together with a suitable administration of the iodides and tonics.

Syphilitic orchitis and epididymitis yield rapidly to general antisyphilitic treatment, together with the local application of mild mercurial ointment. The application of this ointment should be kept up as long as any infiltrated tracts can be felt in the testicle or epididymis, as these may act as a nidus for reinfection. When the use of the mercurial ointment is contraindicated the following ointment, applied as long as any infiltrated nodules can be made out in the testicle or epididymis, will be found of benefit :

R̄. Plumbi iodidi, ʒj;
 Adipis benzoinati, ad ʒj.
 M. Ft. ung.
 Sig. Apply externally.

The **testicle** and the **epididymis** are apparently favorite hiding-places of the syphilitic virus, and in any case where the diagnosis of syphilis is doubtful an examination of these parts should always be made.

For the purpose of treatment, although perhaps open to criticism from the pathologists, it may be well to divide the **syphilitic diseases of the nervous system** into two classes—the inflammatory and the degenerative.

In the inflammatory class belong such diseases as gummata occurring in the nervous system, pachymeningitis, inflammation of the dura of the cord, and some forms of neurasthenia occurring in the early periods of syphilis.

In the degenerative class may be considered such diseases as locomotor ataxia, myelitis, syphilitic spinal paralysis, general paresis, and cerebrospinal syphilis.

The inflammatory class may represent those lesions of the nervous system occurring in syphilis that are due to the infiltration of the syphilitic products.

In the degenerative class may be considered those diseases which are not necessarily caused by syphilis, and which histologically show no evidence of syphilitic infiltration; but in the history of individuals suffering from any of these diseases syphilis has been found to occur in such a vast majority of cases that it may be postulated as a cause.

These phenomena may be explained, perhaps, as being due to a syphilitic ptomaine. The syphilitic diseases which are designated as inflammatory are benefited by antisyphilitic treatment. The degenerative conditions are not only not benefited by antisyphilitic treatment, but are often injured by its persistent administration; with this exception, however—that in all sclerotic conditions small doses of bichloride of mercury and small doses of iodide of potash may have, by preventing hemolysis, an occasional beneficial influence.

The inflammatory diseases mentioned above as being benefited by antisyphilitic treatment do well under the administration of the iodides internally and the administration of mercury by some external method. The iodides in this class of cases are frequently of benefit if very large doses are adminis-

tered. By commencing with 10 grains of iodide of potash or soda three or four times a day, and increasing a grain at a dose until perhaps a dram may be administered three or four times during the day, favorable results may frequently be seen to follow.

The hypodermic injection of mercury in some forms of the disease in which there is great urgency for the treatment plays an important part in this class of cases, whether the lesions be diffused or circumscribed. Mercurial inunctions and baths, however, are oftenest of value.

While in the degenerative class of diseases of the nervous system of which syphilis seems to be the cause, little or no benefit, and often harm, results from the use of antisyphilitic medications, except in the form known as syphilitic spinal paralysis—a form of myelitis which may be considered as both inflammatory and degenerate—still, by persistent and continuous effort on the part of both patient and physician in other directions the extension of the degeneration may be retarded and the condition of the patient much ameliorated in almost every one of these diseases, except in general paresis, in which all therapeutic procedures are powerless to influence the disease. A liberal diet, various hydrotherapeutic measures, electricity and tonics, and, above all, intelligent rest, do much good in these conditions. Locomotor ataxia may be beneficially influenced by the application of galvanic electricity to the spine (5 to 10 ma. in fifteen-minute sances each day), and by the continual practice of purposive movements, known as Fränkel movements; while the pains which accompany it are often relieved by the prolonged and careful administration of nitrate of silver and arsenic. For acute paroxysms one powder of the following ingredients will be found of benefit:

R. Caffeine,	gr. ss ;
Phenol salicylate,	gr. v ;
Phenacetine,	gr. v.
M. Ft. chart. No. 1.	

The powders should not be repeated oftener than at intervals of every two hours, and not more than three or four should be taken during a period of twenty-four hours.

PROGNOSIS OF SYPHILIS.

In giving a prognosis of syphilis each case will have to be judged on its individual merits or demerits. While doubt undoubtedly exists in the minds of many that syphilis is ever cured—using the word to mean that all of the infective material has been destroyed and its product eliminated from the system—the great majority of cases, if seen early in the course of the disease and carefully treated, recover at least so far that in after-life they give no evidences of the disease, and life is not apparently shortened by it.

We have also quite positive proof, occasionally, of reinfection of syphilis in individuals who have previously had the disease. If this be so, it shows that positive cure of the original attack of the disease had taken place. A certain proportion of syphilitics—particularly those who have undergone treatment in a desultory sort of way, or have been addicted to undermining excesses and severe mental strain while suffering from this disease—and a still smaller proportion of those who have had persistent and regular treatment (perhaps in all 15 to 20 per cent.), at some time in their syphilitic history have late manifestations of the disease, principally in the skin, bones, organs of generation, intestinal organs, and muscles; and perhaps one-quarter of this 20 per cent. have syphilis of the nervous system.

The neurologist sees most of these cases of nerve-syphilis, and he is necessarily inclined to consider the proportion higher, while the syphilographer, seeing but comparatively few cases of syphilis of the nervous system, is apt to consider the number smaller than it really is.

After syphilis has once advanced so that tertiary manifestations occur, the prognosis becomes more doubtful. The majority of cases of tertiary syphilis who have had previously little or no antisyphilitic treatment respond readily to it, and can be cured in so far as to show no further evidence of the disease through life ; but they should be kept under continual observation.

The cases of tertiary syphilis who have already had such treatment have not as good a prognosis as those just mentioned. Where syphilis has attacked the nervous system the prognosis will depend upon the area involved, and will depend also upon whether inflammatory or degenerative changes of tissue have taken place. The majority of the inflammatory syphilitic lesions of the nervous system are resolved under antisyphilitic treatment. Quite a large proportion of these cases, however, later in life suffer from degenerative conditions if they have not been kept under continual observation and treatment.

The prognosis in individuals suffering from degenerative changes of the nervous system, and who have had syphilis, appears to be this : That as regards recovery there is no hope to be given ; but if the degenerative changes are not much advanced, and if other conditions are favorable, further progress of the degenerative changes may be retarded and sometimes stopped ; and that while great care must be observed throughout life by these patients and their physicians, life itself need be but little shortened. In fact, in this class of cases the prognosis as regards life seems more favorable than that given for them a few years since.

It has been the writer's experience in cases of nerve-syphilis that the patients very generally give a history of treatment, either desultory or prolonged, by means of mercury administered internally, and that few cases, if any, give a history of having had rigorous courses of iunctions, fumigations, or hypodermic injections of mercury. This may, however, be due to the fact that for many years the internal administration of mercury has been the most popular method of administering it in this country, although at the present time other methods seem to be either gaining or regaining popularity.

Age has great influence in modifying the prognosis of syphilis. To old people syphilis is an especially dangerous disease, owing to the degenerative changes going on in their blood-vessels, which it tends to accelerate. Indulgence by syphilitic patients in excesses of all kinds, whether excesses in smoking, drinking, venery, or work, renders the prognosis materially graver.

CHANCROIDS.

By JAMES S. HOWE, M. D.

THE chaneroid is a simple, contagious ulcer, its secretions always being auto-inoculable, as well as inoculable upon others. It is due either to inoculation with chaneroidal virus, or may arise *de novo* from contact with irritating discharges during the sexual act or from a pyogenic infection of a local abrasion of the sexual organs. It never produces constitutional symptoms, as does the initial lesion of syphilis, its action being a purely local one or extending to the lymphatic vessels and ganglia in immediate anatomical connection with the parts affected by the sore. By far the largest number of chaneroids are due to direct contact with the secretions of a chaneroid, a chaneroidal lymphangitis or bubo, or a chaneroidal serpiginous ulcer, and are the result of sexual intercourse. Aside from chaneroids thus acquired, we occasionally see sores, differing in no way clinically or anatomically from chaneroids, which are the result of infection by irritating pus. In making this assertion such a statement will be doubtless contradicted by those who believe that chaneroid is due to a specific microbe which is responsible for all such lesions. The chaneroid has two characteristics, which are well marked and which serve to distinguish it from the initial lesion of syphilis, these being its auto-inoculability and its lack of any marked period of incubation. Both these points can be well brought out by inoculations of the secretion of the chaneroid upon a person already affected with the disease, the secretions of the ulcer thus produced being again inoculable or auto-inoculable; but the potency of the infecting agent is slowly destroyed by each successive inoculation. Having thus considered briefly the characteristics of the chaneroid, let us examine more carefully its cause, course, clinical appearance, etc.

Etiology.—Authorities differ to-day as to the definite cause of chaneroid, two opinions only being worthy of consideration. That it is due to a micro-organism is now pretty generally conceded. This is evident from the highly contagious nature of its secretion, which retains its virulent properties in spite of dilution with water and neutral agents, while it is rendered innocuous by moderate heat and the various agents known as bactericides. This fact being recognized, opinions differ as to whether the chaneroid is the result of a special micro-organism or of simple pyogenic infection produced by the various micro-organisms found in pus. Many observers in the past have claimed to have found a special microbe as the cause of chaneroid, the work of Krefling, Ducrey, and Unna having attracted the most attention to this subject. Up to the present time, however, no one has succeeded in offering the only convincing proof necessary to the complete acceptance of their views, and that is the inoculation of pure cultures grown upon artificial media. Such authorities as Fournier and Keyes assert that chaneroid is always caused by contact with chaneroidal virus, while denying its existence from any other cause. On the other hand, Taylor asserts that "what we call chaneroid is

the product of many varieties of pus. It is therefore a hybrid, heterogeneous lesion, in all cases a septic ulcer, and in many instances simply an active form of wound-infection. This septic ulcer in some cases arises *de novo* from the contact of the pyogenic microbes with the raw surface, herpetic or eczematous excoriation, a chafe, etc., sexual contact then having nothing to do with its development." Finger says that the generally accepted theory at present is that the soft chancre is simply due to inoculation with pus, since such pus, under favorable conditions, is able to produce inoculable sores on all persons.

Inoculability of Chancroid.—Numerous experiments by different observers seem to point to the fact that the pus-corpuscles are the bearers of the contagious principle of the chancroid, since, if the pus-corpuscles be filtered from the chancroidal secretion, inoculation with the resulting fluid does not produce chancroid. It is not, however, to the inoculability so much as to the auto-inoculability of chancroid that we must direct our attention. A person having a chancroid can, by auto-inoculation, produce other similar lesions upon his own person, the secretions of such lesions being in their turn auto-inoculable; and this process may be kept up for a long time, although, as has been before stated, lesions of the successive inoculations have a tendency to become milder in type. Again, a person once having had a chancroid is not thus rendered immune from further accidents of the same kind. These two foregoing statements have an important bearing on the subject of chancroid, insomuch as they enlighten us in the former case as to the multiplicity of lesions as seen in chancroid, and to the successive appearance of fresh lesions on the affected parts; while in the latter case we see the difference between the chancroid and the chancre, the latter rendering its bearer, in the vast majority of cases, immune from a similar infection.

Modes of Contagion.—The chancroid is acquired ordinarily by direct contact, the secretion being transferred from one person to another during sexual intercourse. The method of mediate contagion in which the pus is transferred from some immediate object is rare, offering a direct contrast to syphilitic infection, which is very common by mediate contagion. The infecting material enters at the site of an abrasion, an excoriation, or a tear in the mucous membrane or skin, or even at the site of an herpetic vesicle. The irritating quality of the infectious secretion renders it highly probable that, deposited on the mucous membrane of the genitalia and retained there, favored by the heat and moisture of the parts, an actual erosion takes place, and so infection results. This erosive action may also take place when the pus is entrapped in the mouth of a hair- or sebaceous follicle, and in this way a period of incubation lasting for several days may result, clinical experience and observation warranting these statements.

Seat of the Chancroid.—The chancroid may appear on any portion of the mucous membrane or integument; but, as inoculation nearly always takes place during sexual intercourse, the vast majority of these lesions will be seen upon the genitalia or surrounding parts. In males the most common site of the sore is upon the sulcus of the glans penis, the internal surface of the prepuce, the frenum, and the sheath of the penis. In females the sores are seen most frequently upon the internal surface of the labia, the fourchette, and the introitus vaginae, while they are rarely seen upon the mucous membrane of the vagina. Extra-genital chancres are commonly seen about the anus, the perineal region, and the inner surface of the thighs, and are far more common in women than in men, since the vaginal discharges, mixed with chancroidal secretions, flow so readily over these parts.

Clinical Features.—Immediately after the virus of chancroid has

gained an entrance to the tissues pathological changes take place rapidly, a small point of redness being first noticeable at the point of entry, which, in from twenty-four to forty-eight hours, becomes an acuminated papule which is rapidly converted into a pustule. This pustule soon ruptures, displaying a small, punched-out ulcer which rapidly increases in depth and circumference. As seen by the physician and surgeon in practice, these stages of development have passed, and the chancreoid commonly appears as a well-developed ulcer, varying in size, depth, and shape. The ulcers are usually circular or oval in outline, with abrupt, perpendicular, or undermined edges; the floor is rough and uneven; its borders are reddened and edematous, and it is surrounded by an inflammatory area. The surface of the ulcer everywhere secretes a greenish-yellow or bloody pus. The floor of the ulcer is surmounted by a sloughing, pultaceous mass made up of the broken-down and disintegrated tissues. The tissues at the base of the ulcer, if unirritated, are soft and yielding; if irritated or inflamed, they become swollen and edematous, having a boggy, doughy feeling, which is very characteristic and quite unlike the induration of the initial lesion of syphilis. If induration is present, owing to irritation or caustic applications, it is not so hard and resistant to pressure as is the induration of the true chancre. This induration, besides, is compressible on firm pressure, and is not so sharply limited, and fades away gradually into the surrounding tissue. The form of the ulcer is often linear, owing to inoculation at the site of a rent or abrasion or in a fissure of the anus, and the oval outline is lost when two or more ulcers unite. Multiplicity of the lesion is also common, and serves as a diagnostic point of considerable value in differentiating it from the initial lesion. The tendency of chancreoid is an active progression for three or four weeks, then slow repair, and finally cicatrization, the scar-tissue left being at times smooth and soft or again hard and unyielding, thus becoming puckered and producing considerable disfigurement.

Varieties of Chancreoid.—The chancreoid lesion may present varieties in form from the usual appearances described above, due to the anatomical condition of the parts where inoculation takes place, as well as to the patient's constitution and physical condition. The follicular or acneiform chancreoid is produced by the implantation of the virus in the mouth of a follicle. It appears first as an inflamed, acuminate papule, which is later capped with a small pustule, and at this stage it resembles a simple acne-pustule. After rupture of the pustule a round, deep ulcer appears. This form of chancreoid is seen most commonly on the external surface of the labia majora. The ecchymatous chancreoid is commonly seen upon the integument, usually upon the sheath of the penis, and is marked by the formation of dark-colored crusts due to drying of the chancreoid secretion. On removal of the crusts a typical chancreoid ulcer is revealed. When the chancreoid is attended by marked inflammatory action, its surface is sometimes elevated above the plane of the surrounding tissues, and this form of a sore is known as the *ulcus elevatum*. If the lesion becomes chronic and progresses along at one part while cicatrization is taking place at another part, the lesion is called *serpiginous*. The chancreoid may undergo sudden inflammatory changes, and the ulceration may progress, undermining and destroying the skin, progressing steadily and often very rapidly. This condition is known as *phagedena*, and may progress in the form of a limited sloughing or may become gangrenous, rapidly destroying the tissues involved and progressing over large areas. In this way the scrotum may be destroyed, leaving the testicles exposed, and the entire penis may be destroyed as the result of this destructive process.

It may even extend into the groin, down the thighs, and over the surface of the abdomen. Sometimes it burrows beneath the skin and fascia, producing sinuses which are very troublesome and rebellious to treatment. Phagedena occurs most commonly in cachectic, strumous, and anemic persons, and those weakened and debilitated by debauchery, whose tissues seem to have no resistive powers to its onslaught.

The other complications of chancroid are lymphitis and lymphadenitis. Lymphitis is a rare complication. When present the lymphatic vessels on the dorsum or side of the penis are felt as tender, swollen cords, and in severe cases a reddened, hyperemic line may be seen. They commonly undergo resolution unless they are affected with the chancroidal virus, when suppuration takes place.

Pathology of the Chancroid.—Cornil says that we find cells in the superficial layers of the rete and epidermis containing a cavity between the nucleus and substance of the cells, and that these cells are the same as those always found in inflammatory congestion of the cutaneous papillæ. Lymph-cells in considerable numbers are found infiltrating the tissues of the papillæ in the neighborhood of the ulcer, and these cells are increased in size beyond their normal condition, and come, by a process of migration, from the interior of the blood-vessels. The layers of the epidermis are loosened at the borders of the ulcer from the congested and hypertrophied papillæ. In all parts of the inflamed integument, in the region of the dermo-papillary tissue, in the derm, and subcutaneous cellular tissue, there appears an infiltration of round-cells, between the elements of which the connective tissue is composed. The lymph-cells become more numerous in the vicinity of the ulcerated surface. The tissue of the granulation is granular, its fibers having been separated, softened, and destroyed. On account of this destructive process in the connective tissue the pus-corpuscles are set free, forming a layer upon the surface of the granulation. This infiltration of the granulation and the purulent secretion give to the ulcer its characteristic grayish color.

Diagnosis.—Chancroid is to be distinguished from chancre, herpes, simple abrasion, and tuberculosis. Its rapid appearance after exposure, its equally rapid development and progress, its auto-inoculability, and its own particular form of adenitis serve to differentiate it from the initial lesion of syphilis. Its auto-inoculability, however, is not an infallible test, since the pustular secretion of an ulcerated initial lesion may, by auto-inoculation, in some cases produce a simple ulcerating sore. Herpes is characterized by a group of vesicles surrounded by a reddened, inflammatory area, attended with smarting and itching. If ulceration takes place, due to irritation or uncleanness, there is no marked destruction of tissue, and recovery takes place rapidly. Tuberculosis is slow in its progress; miliary tubercles are to be distinguished at the borders of the ulceration, and it is, besides, a rare disease of the genitals. Then, too, sections of the diseased tissue or scrapings from the same will reveal, under the microscope, the typical tubercle bacilli. We must bear in mind, however, that chancre and chancroid may so simulate each other, and the mixed sore is so common, that we can never positively assure our patient that syphilis will not follow as the result of an apparent chancroid until three months have elapsed since the appearance of such lesion without any signs of constitutional infection.

Treatment.—Rest, if possible, and absolute cleanliness are the essentials in the treatment of chancroid. Actual destruction of the sore is of primary importance. For this purpose chemically pure carbolic or nitric acid, the galvano- or actual cautery, are the best means at our command.

Thorough and absolute destruction of all diseased tissue must be insisted upon, as any part left undestroyed is simply a focus or starting-point for a continued advance of the destructive process. Thorough cleansing of the sore with a spray of hydrogen peroxide and the application of a 5 per cent. solution of cocaine should precede operative measures. Where the amount of tissue to be destroyed is small carbolic acid should be used. It is best applied on a piece of absorbent cotton wrapped around the end of a wooden toothpick. If a deeper destruction of tissue becomes necessary, nitric acid may be applied in the same way or we may resort to galvano-cautery. Rest in the recumbent posture and the application of soothing lotions for twenty-four hours should follow all operative measures. Milder treatment, such as powdered iodoform, calomel, or a wash containing twenty grains of the tartrate of iron to two ounces of water, with absolute cleanliness and rest, with a frequent change of the dressing, will often prove very successful in the milder cases. Ointments of various kinds do not work well, as a rule. All irritation of the parts affected should be carefully avoided.

BUBOES.

The term "bubo" is applied to an inflammatory condition of a gland or glands in the inguinal region. This lymphangitis is the most common complication of the chaneroid. The severity of the chancre does not, by any means, serve as a guide to the danger of this accident, as many severe cases of chaneroid go on to recovery without a sign of a bubo; while, again, an almost insignificant chaneroid is accompanied or followed by a virulent bubo. Lymphadenitis occurs, according to statistics, in nearly a third of all cases of chaneroid, and is favored by debility, anemia, alcoholism, a low state of the general health, and violent exercise. By cleanliness, antiseptic dressing of the sore, and absolute rest this disaster can generally be avoided. Pain on walking or moving, seated in the groin, is the first symptom, together with a glandular enlargement, of the danger of bubo. The affected gland or glands are at first tender and swollen and freely movable beneath the skin. Later they are bound down, immovable, much swollen, and very painful on pressure. In some cases this is a simple inflammatory process, and the pus, if any forms, is non-inoculable. Again, we have a virulent form, seemingly due to the absorption of the chaneroidal virus or its toxins; and here the pus is inoculable and produces on inoculation the true chaneroid. The first form of bubo is of a mild type, tending to suppuration and recovery, like a simple abscess; but the virulent or chaneroidal form on breaking or being opened becomes a chaneroid, and as such is liable to extension, the development of deep sinuses, and phagedena. The scar resulting from bubo is, as a rule, extensive and productive of much disfigurement. Buboos must be opened, drained, and treated antiseptically, although absolute rest in the recumbent posture and gentle pressure will often abort a bubo before suppuration has taken place. If the bubo is of the virulent type, suppuration will surely ensue, and after opening the resulting sore must be treated as a chaneroid. In bubo constitutional treatment, looking to the general building up of the system, is of great importance.

DISEASES OF THE SKIN.



PART I.—INTRODUCTION.

ANATOMY AND PHYSIOLOGY OF THE SKIN.

BY JOHN T. BOWEN, M. D.

ANATOMY.

THE skin is the outer envelope or covering of the body, extending over its entire surface, and directly joining the mucous membranes at the entrances to the various mucous cavities. The color is not the same in all parts, varying partly according to the amount of the blood-supply and the development of the cutaneous vessels, and partly according to the amount of pigment seated in the epidermis. There are certain portions of the body where the pigment is almost always increased in amount, lending a darker color to the skin—viz. the parts about the nipple, the scrotum and labia, etc. In the colored races this pigment is distributed over the whole skin. Moreover, the surface of the skin is not perfectly smooth, but is occupied by ridges, furrows, hairs, and pores. The ridges are especially marked upon the palmar surface of the last phalanges, where they are arranged in crescentic lines. They are caused by the regular arrangement of the papillæ in rows. The furrows are of two kinds, large and small, the former situated chiefly at the joints, the latter more commonly on the extensor surfaces, where they intersect one another in such a way as to produce polygonal, triangular, and lozenge-shaped segments of the surface. The pores correspond usually to the openings of the hair-follicles and sebaceous glands upon the surface of the skin, and in some instances, as upon the palms, to the outlets of the sweat-glands. The hair covers almost all portions of the body, either as a coarse growth or in the form of fine, lanugo hairs. The palms and soles, the dorsal surfaces of the last phalanges of fingers and toes, the glans penis and the inner surface of the foreskin, and the edge of the lips are the only portions of the body entirely free from hair.

The skin is usually described as consisting of three layers—an outer layer, the epidermis, composed of epithelial cells and scales; a middle layer, the corium, made up of anastomosing fibrous and elastic tissue; and a lower layer, the subcutaneous tissue, which has no sharp boundary from the corium, and contains adipose tissue and fat-globules. Properly speaking, the skin is made up of but two layers, epidermis and corium, the macroscopical boundary-line between corium and subcutaneous tissue having given rise to the separation of the latter as a distinct layer.

Subcutaneous Tissue.—The subcutaneous tissue is made up of bundles of connective tissue attached to the fasciæ and deeper structures, anastomosing with one another, and containing in their interstices masses of fat-cells. These fat-cells give to the skin its support and fulness, and when they have

been absorbed or depleted, as in wasting diseases, their absence is expressed by the looseness and wrinkling that the cutaneous covering shows. The subcutaneous tissue contains also the trunks of blood- and lymph-vessels which send their branches to the clumps of fat-cells and also upward into the corium. Nerves are also easily demonstrated in this layer, and it is here

that the Pacinian bodies are found. Coils of sweat-glands, and in places where the hair is well developed, as upon the scalp, hair-follicles also, have their seat in this layer. Warren discovered the presence of fat-columns, which project upward obliquely through the corium from the subcutaneous tissue to the bulb of the smaller hairs. These are found where the skin is thick, as upon the back, but are also found on the shoulders, arms, breasts, abdomen, and lower extremities.

Corium.—Next above the subcutaneous tissue, into which it merges without a sharp boundary-line, lies the corium, derma, or cutis proper. It is made up of masses of fibrous and elastic tissue closely intertwined with one another in the upper or papillary

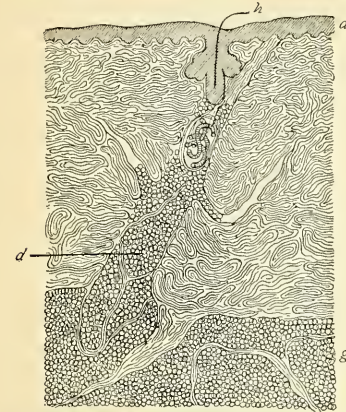


FIG. 224.—*a*, epidermis; *d*, columna adiposa; *g*, panniculus adiposus; *h*, hair (Warren).

portion, more loosely arranged in its lower part near the borders of the subcutaneous tissue, and containing here and there spindle-shaped cells, the so-called connective-tissue cells. These bundles of anastomosing fibrous connective tissue have a regular arrangement parallel to the surface of the skin.

The elastic fibers have been especially studied of late years, and new methods of staining them have thrown much light on their extent and distribution. By the ordinary methods of staining, with the carmines, etc., they are not seen. They surround the bundles of collagenous or fibrous connective tissue, and are especially numerous in the upper portion of the corium, accompanying the blood-vessels in great measure. They are especially numerous in people advanced in years.

The corium contains hairs, glands, blood- and lymph-vessels, nerves, and fat-cells. Some muscle-elements are also present, both of the striped variety, seen especially in the skin of the face, and unstriped muscles, such as are found in connection with the hairs and are called *arrectores pilorum*. The corium has been divided into two portions, the papillary and the reticular layer.

The papillary layer comprises that portion that lies in the upper part of the corium in and about the papillæ. The *papillæ* are the prolongations upward of the corium into the epidermis, the dipping down of the epidermis at the same time between the papillary prolongations causing the boundary between corium and epidermis to be represented by an irregular zig-zag line. The papillæ vary in size in different parts of the body, and are not of uniform size in the same place. Some of them contain blood-vessels, others terminal nerve-filaments.

The reticular layer is much greater in extent than the papillary layer. It is made up of larger and coarser bundles of fibrous tissue than the papillary part, and this feature has given it its name. The bundles become coarsest in the lowest parts of this layer, immediately above the subcutaneous tissue.

Epidermis.—The epidermis, also called the cuticle or scarf skin, is the outermost layer of the skin. It is composed, unlike the corium, almost exclusively of cells closely fitted together and without demonstrable vessels.

In the process of development the ectoderm, from which the epidermis is derived, is composed at first of one layer of cells, a second layer subsequently appearing below it. These outer cells form in very young embryos a distinct histological layer, analogous to the epitrichium of animals, and to which the name epitrichial layer has been given. Below the epitrichial layer successive rows of epithelial cells are developed. The epitrichial layer disappears in the sixth month of fetal life.

The thickness of the epidermis varies very much in different parts of the body, attaining its maximum upon the palms of the hands and soles of the feet. It is made up essentially of two layers—an outer horny layer, or stratum corneum, and an inner mucous layer, the rete Malpighii.

The *mucous layer*, or *rete Malpighii*, is made up of cells rich in protoplasm, with prominent nuclei distinctly stained by carmine and arranged in parallel rows. The lowest row of cells borders directly upon the corium, into which it sends projections from the individual cells. These lowest cells have a columnar form perpendicular to the surface of the corium, and possess elongated, deeply-stained nuclei. The next row of cells above is composed of elements more flattened, with nuclei less elongated, and in the next above that these features are still more pronounced. In these lower rows of cells is found the pigment of the skin, of small amount in the white race; in the negro so excessive as to give the appearance of a black line under the microscope. The rows of cells immediately above these are larger, more polygonal in shape, with a large round nucleus, and provided with a distinct cell-membrane. Still farther upward we come upon a layer of cells filled with small roundish granules, and these are often described as a separate layer, the *stratum granulosum* of Langerhans. The significance of these granules has been the subject of much study and speculation, and the question is not yet definitely settled. Their relation to the process of cornification that the cells immediately above undergo is admitted by most observers. Ranvier regarded them as of a partially fluid nature, and gave them the name *eleidin*, while Waldeyer, on account of their resemblance to hyalin, and in the belief that they were concerned in the process of cornification, called them *kerato-hyalin*. Buzzi has endeavored to show that *eleidin* and *kerato-hyalin* are two distinct substances, the former of a fluid nature and situated chiefly in the lowest layer of the stratum corneum, while *kerato-hyalin* represents granules found in the cells of the granular layer.

A peculiarity of the cells of the Malpighian layer is the presence of small spines or prickles which radiate from the individual cells and seem to connect them with the adjacent cells. Hence these cells have been called *prickle-cells*, and the Malpighian layer the “prickle-cell layer” or “thorny layer.” These prickles have been regarded as canals for the transference of fluids, but most observers now consider them to be outgrowths of protoplasm connecting with one another and joining the adjacent cells. They become less prominent in the upper layers of the rete, and are lost in the stratum granulosum. An intercellular substance called *cement-substance* separates

the cells of the Malpighian layer from one another. So-called "epithelial fibers" have been discovered by Herxheimer in the rete Malpighii—delicate fibrils that can be shown by special methods of staining to project upward perpendicularly from the basal layers and to anastomose with one another. They have been variously considered to be particles of fibrin, the projection of pigment-carrying wandering cells from the corium, and epithelial fibers. The latter view meets with most approval.

The *stratum corneum*, or *horny layer*, is the outer layer of epithelial cells which have undergone a more or less complete keratinization. Those nearest the surface have lost their cell-like appearance and are seen as flattened, dry scales. Immediately above the rete Malpighii, between that layer and the stratum corneum proper, lies a layer that has been named by Oehl the *stratum lucidum*. This layer is represented by a clear, translucent band under the microscope, in which separate cells are with difficulty or not at all distinguished, and which is deeply stained by certain reagents, especially those that have an affinity for horny tissue. In this layer there is no trace of the granules seen in the layer below, which are supposed to have been dissolved in the keratinizing process. Zander has described two types of horny cells—one (typus *A*) found only on the palms and soles and inner surfaces of the fingers and toes, consisting of cells characterized by a highly refractive, homogeneous-appearing edge. In the center a clear round or oval spot, looking like a hole in the tissue, which Zander considers to be the empty nuclear space, can usually be seen. Everywhere else on the body the stratum corneum belongs to his typus *B*, having a lamellated structure made up of horny flat cells. The stratum lucidum is present chiefly (according to Zander *only*) where his typus *A* is found. It has seemed probable to the writer that Zander's typus *A*, which is developed upon palms and soles, is homologous to the epitrichial layer which has been described above as present in young embryos, and that it represents a persistence of that layer in adult life.

Blood-vessels and Lymph-vessels.—All parts of the skin except the epidermis are liberally supplied with blood-vessels and lymph-vessels. The blood-vessels are arranged in two principal layers parallel to one another, one of them composed of pretty large arterial and venous channels lying in the subcutaneous connective tissue and sending branches to the coil-glands and fat-cells. This lower system of blood-vessels is connected by branches with an upper or papillary system of vessels which runs along just beneath the papillæ and parallel to the surface of the skin and to the subcutaneous system. From this upper system branches are given off to the papillæ. The hair-follicles and sebaceous glands are abundantly supplied with vessels.

Lymph-channels are present in all parts of the skin, which pour their contents into the large vessels of the subcutaneous tissue. Among them we distinguish lymph-vessels proper which have a direct communication with the blood-vessels, and lymph-spaces, found especially in the interstices of the fibrous tissue of the corium. It is probable also that similar lymph-spaces exist between the epithelial cells of the epidermis. The lymph-vessels proper are found for the most part accompanying the upper and lower systems of blood-vessels.

Nerves.—Both medullated and non-medullated fibers are found in the skin, arising from nerve-bundles in the subcutaneous tissue, spreading out horizontally to follow the blood-vessels in their upper and lower system, and becoming finer as they ascend upward to the papillæ. The nerve-fibers in some instances end in the Pacinian or Vater's corpuscles of the subcutaneous tissue, and in the tactile or Meissner's corpuscles of the papillæ. According

to Robinson, some of the medullated fibers lose their medullary sheath in the corium and continue upward as non-medullated fibers, and some fibers before

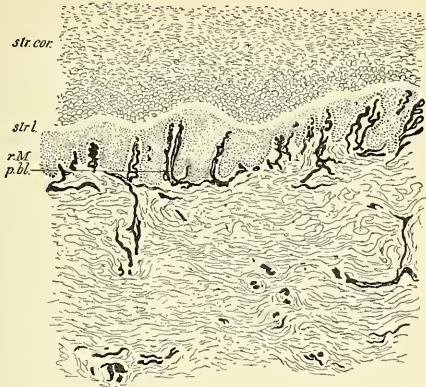


FIG. 225.—Section of skin of the palm of the hand, injected: *str.cor.*, stratum corneum; *str.l.*, stratum lucidum; *p.bl.*, papillary blood-vessels, injected; *r.M.*, rete Malpighii; *c.*, corium.

reaching the subpapillary region return to the lower part of the corium and then reascend to the papillæ. The capillaries of the papillæ are surrounded by a dense network of fine nerve-fibers with many nuclei. Hence it is seen that the blood-supply of the papillæ is in connection with an abundant nerve-supply.

It has also been shown of late years that non-medullated nerve-fibers penetrate into the papillary layer into the epidermis, where they anastomose, according to Langerhans, between the epithelial cells and end in club-shaped extremities. Others, as Unna, believe that each cell contains within its body a pair of nerve-endings.

The *tactile corpuscles*, or *corpuscles of Meissner* or of *Wagner*, are roundish oval bodies which have their seat in the papillæ, occupying its whole extent. They show under the microscope broader or narrower bands or lines running transversely, with small nuclei. The nerve-fiber ascending from the corium enters the corpuscle at different points of its periphery, winds itself about it, and ends in a number of terminal fibrils within its substance.

Robinson, however, considers that each corpuscle has an afferent and an efferent nerve, the afferent nerve entering its substance near the base, passing in a spiral direction toward the apex, and

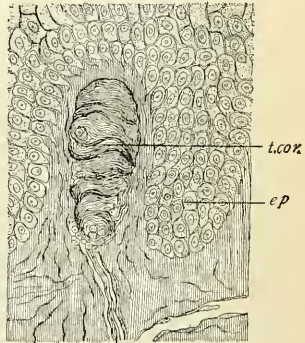


FIG. 226.—Tactile corpuscle in a papilla: *l.cor.*, tactile corpuscle; *n.*, nerve-fiber; *e.p.*, epithelia of the rete.

finally leaving the corpuscle. The fiber when in the substance of the corpuscle frequently divides, so that there may be two or more efferent fibers. Around the corpuscles there is a sort of connective-tissue capsule, which has been regarded by Wolff as a continuation of the perineurium. These tactile bodies are most numerous on the last phalanx of the fingers, the palms and soles, the nipples, and the lip. It has been estimated that they are present in about one out of four papillæ (Fig. 226).

Pacinian or Vater's Corpuscles.—The Pacinian corpuscles are oval or elliptical bodies found especially in the subcutaneous tissue of the palm of the hand and sole of the foot. A medullated nerve-fiber enters each corpuscle, and, with its sheath, forms a sort of stalk. The corpuscle is made up of a series of capsules enclosed within one another like the coats of an onion, and composed of connective-tissue fibers containing in their meshes serum, with an endothelial layer on either side. The medullary sheath ceases where the nerve-fiber enters the central part of the corpuscle, which is a clear space filled with serum or a transparent substance. The function of the Pacinian corpuscles is not well understood. Their situation in parts especially sensitive points to their connection with the tactile sense, although their deep position is with difficulty explained on this supposition.

Sweat-glands.—The sweat-, sudoriparous, or coil-glands lie in the subcutaneous tissue or deepest layers of the corium, in all parts of the body, except on the glans penis, inner surface of the prepuce, and the edges of the lips. They are most numerous on the palms and soles, and largest in the axillæ and about the anns. They consist of a single tube coiled upon itself so as to form a ball or globular mass. The blind end of the tube lies in the middle of the tubular coil. The gland proper, or secreting part, is made up of polygonal epithelial cells, somewhat granular in appearance, seated upon a basement membrane composed of flattened epithelial cells. Some unstriped muscular fibers exist between the basement membrane and the epithelial cells. Between the opposite rows of cells there is a well-marked lumen, and in this, as well as in the epithelial cells, oil-globules are frequently seen. Surrounding the glands there is much loose connective tissue, which is also continued between the coils of tubes. Blood-vessels from the deep plexus surround the coil-glands like a network, so that an analogy with the Malpighian bodies of the kidney has been pointed out.

The excretory duct starting from the coils in the subcutaneous tissue pursues a more or less straight course upward through the corium. Where it penetrates the epidermis its course becomes more irregular, and in passing through the corneous layer it has a spiral or corkscrew-like direction. The spirals are most numerous where the horny layer is thickest, as upon the palms of the hands. The ducts emerge on the surface of the skin with a funnel-shaped opening. The structure of the excretory duct is somewhat different from that of the gland proper. As the duct pursues its course upward toward the rete, the epithelial cells increase in number, and a transparent membrane lining the epithelia and bounding the lumen makes its appearance. The basement membrane disappears in the rete and the muscle-fibers are lost. It enters the epidermis at the lowest portion of an inter-papillary prolongation. The sweat-glands begin to form in the fifth month of fetal life, and show themselves first as an ingrowing or budding of the rete-cells. The canal is not formed until the seventh month.

Sebaceous Glands.—The sebaceous glands are acinous glands, the number of lobules varying from two to twenty in a gland, which have their seat in the corium and are closely connected with the hairs. Where the hairs

are large the sebaceous gland is an appendage to the hair-follicle, into which its duct empties, but small lanugo hairs may be said, on the contrary, to open into the duct, as the duct is much larger than the follicle. A secreting portion or gland proper and a duct may be distinguished in the sebaceous glands.



FIG. 227.—Sweat-glands.

The gland proper consists of lobules or clusters of epithelial cells seated upon a basement membrane. The outer cells near the basement membrane are cylindrical and of much the same form as those of the rete, while farther inward they become larger and polyhedral, and are more or less filled with fat, which increases the nearer the center is approached. The cavities of the acini empty into a common gland-cavity filled with remnants of epithelial

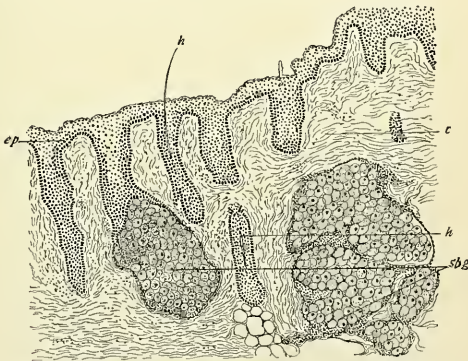


FIG. 228.—*sb.g.*, sebaceous glands; *ep*, epidermis; *h*, hair; *c*, corium.

cells and fat-globules, and this in turn has its outlet in the duct, which is also lined with epithelial cells and contains fat-cells and epithelial débris. The duct communicates with the hair-follicle. In the case where there are lanugo hairs the sebaceous gland emerges upon the free surface of the skin,

and may often be seen by the naked eye, as in the nose, cheeks, etc., where these structures are especially large. There are no sebaceous glands on the palms and soles and on the dorsal surface of the third phalanges. The first development of the sebaceous glands is in the third fetal month, and begins by a budding from the external root-sheath.

Hairs.—The hairs are cylindrical formations derived from the epidermis and enclosed in pouches called hair-follicles situated in the corium. They are found in all parts of the body except the palms and soles, the dorsal surface of the last phalanges of fingers and toes, and the penis. We distinguish two parts of each hair—the root, or part that is beneath the surface of the skin, and the shaft, or free portion that projects above the surface of the skin.

The *hair-follicle* is a pouch-like depression in the corium in which the hair is enclosed. Its direction is not straight, as it is always set obliquely to the surface of the skin, and the adjoining hairs are also placed at the same angle. The hair-follicle properly includes only that part of the pouch below the point where the sebaceous gland joins the follicle. This latter point is the narrowest part of the follicle, the upper portion or orifice of the follicle being of a funnel shape, and the lower part gradually increasing in size down to the papilla. Three layers of the follicle-sheath have been described—an outer, consisting of connective-tissue fibers, running parallel to the direction of the follicle, and containing vessels and nerves; a middle layer, with oblique fibers and long nuclei; and an inner layer, composed of a structureless basement.

The *hair-papilla* is made up of the follicle-sheaths, and upon this the hair rests. It contains, as do the follicle-sheaths, blood-vessels and nerves.

We find within the hair-follicle the external and internal root-sheaths and the hair proper.

The *external root-sheath* is next to the homogeneous basement membrane of the follicle-sheath. It is made up of the cells of the rete Malpighii, the entire hair-follicle being simply a pouch-like infolding of the epidermis. The cells of the outer root-sheath are immediately continuous with those of the rete. At the upper part all the layers of the rete are represented, but at the lower part it is thinned down to a single row.

The *inner root-sheath* is immediately adjacent to the outer. It has been divided into an outer and inner layer—Henle's and Huxley's layer, which is a division of no importance. The inner root-sheath is the part chiefly concerned in the production of the hair, and contains granules of keratohyalin.

In the hair proper are distinguished, both in its shaft and its root, two substances, the cortical substance and the medullary substance.

The *cortical substance*, or main body of the hair, is made up of nucleated, flat, epidermal cells containing pigment. This is covered in the shaft, and partially in the root, by the cuticle, a membrane composed of thin cells or scales overlapping one another. Within lies the *medullary substance*, not present in all hairs, composed of epidermal elements arranged parallel to the long axis, and containing more or less pigment. It is owing to the varying amount of pigment and granules present in the cells that the hair is of different color in different individuals. An absence of pigment is found in gray hair and a diminution of pigment in blond hair. Air-spaces are found in the medullary and also in the cortical substance. When studied in transverse sections the hair has an elliptical or ovoid form, the elliptical form being the more pronounced the more curly the hair, while the straight hairs are more circular in shape.

The development of the hairs takes place in the third fetal month, and the first thing seen is a projection downward of the rete mucosum in the form of a sort of cone. This cone is surrounded by degrees with connective-tissue cells, and later the papilla is formed from below by indentation of the cone. After a time the end of the hair perforates the cone and the hair becomes exposed. The hairs that are first formed are always lanugo hairs, fine hairs with a small follicle and usually a large sebaceous gland. When the hair has lived its proper period of existence it falls, and a new one grows from the same papilla. The term bed-hairs has been used to designate hairs without papillæ, which push out from the sides of the follicles from epithelial offshoots. The bed-hairs are replaced by papillary hairs at birth or later.

In the process of growth the young hair forming pushes out the old hair, that has become loosened from the follicle-walls, before it. The interpretation of the manner of growth of the hair is not the same with all observers. Some think that Henle's layer is formed from the rete-cells that make up the outer root-sheath of the follicle. Huxley's layer, however, they think, is formed from the epidermal structure that is produced directly from the papilla. Others, as Unna and Kaposi, think that the stratum granulosum does not extend beyond the neck or narrow part of the hair-follicle, but only the lower layers of the rete. These cells do not produce any horny matter, but, on the contrary, all the inner layers, Henle's and Huxley's layers, hair, and cuticula are formed at the same time from the original bed of the hair. Huxley's and Henle's layers are then broken through by the growing hair, as well as the epidermal masses at the orifice of the follicle,

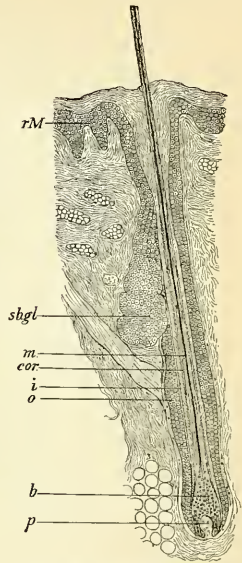


FIG. 229.—Section through hair and follicle: *sb.gl.*, sebaceous gland; *m.*, medullary substance of hair-shaft; *cor.*, cortical substance of hair-shaft; *p.*, hair-papilla; *b.*, hair-bulb; *i.*, inner root-sheath; *o.*, outer root-sheath; *r.M.*, rete Malpighii.

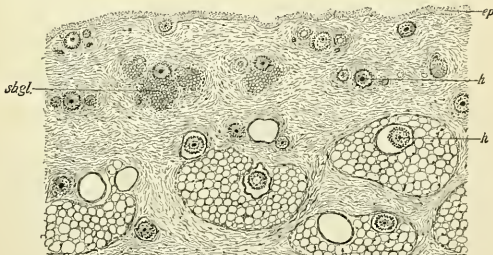


FIG. 230.—Transverse section of skin from scalp, showing hairs cut transversely: *ep.*, epidermis; *h.*, hairs; *sb.gl.*, sebaceous glands.

and the hair makes its appearance on the surface. As a rule, only one hair is found in a follicle, but occasionally there may be two.

Muscles.—Muscles are present in the skin in the form both of striated and non-striated fibers. *Striated muscles* arise in the subcutaneous tissue and extend upward into the corium. They are formed chiefly on the face and neck, and in the former locality, by producing movements of the skin, are concerned in the production of expression. *Non-striated muscles* are abundant, and they may run either obliquely or parallel to the surface of the skin. They are very numerous on the scrotum and prepuce, where they run in a straight direction and anastomose with one another. In other instances, as in the areola of the nipple, they have a circular arrangement. Those that run obliquely are, as a rule, connected with the hair-follicles and sebaceous glands. They are called the *arrectores* or *erectores pilorum*, and have their origin in the inner sheath of the follicle, running thence obliquely upward to their insertion in the papillary layer of the corium. Fibers are sometimes sent to the sebaceous gland. They may separate during their course into several different bundles, which may unite with other muscles. Sometimes two muscles may be seen arising from opposite sides of the same follicle, and occasionally fibers are seen without connection with the follicle running straight upward to the papillæ. It is by the contraction of these muscles that the condition called *cutis anserina* is produced, the follicular structures being raised up through their agency. The muscles have an abundant vascular supply. They are met with in varying numbers in different portions of the body, and are most frequent on the scrotum, penis, and scalp. They are found more extensively on the extensor than on the flexor surfaces, and their size and number vary considerably according to the individual. The elastic tissue, according to Unna, is intimately connected with these muscles, and these two factors, working together, play an important part in regulating the circulation and secretions.

Nails.—The nails are modified portions of the stratum lucidum of the epidermis, and are made up of hard, transparent, horny material, denser and more resistant than the horny layer of the skin proper. They are situated on the extensor surface of the terminal phalanges of the fingers and toes, are slightly curved in their long diameter, and are convex on their upper surface, concave on their lower. Three sides of the nail are inserted into a fold of the skin, while the anterior free border projects somewhat beyond the end of the finger or toe.

The fold of the skin into which the posterior and lateral borders of the nail are inserted is called the *nail-fold*, while the portion of integument upon which the lower surface of the nail rests has been called the *nail-bed*.

The nail is divided into two portions—the part covered by the posterior nail-fold, called the *nail-root*, and the part anterior to this, the *nail-body*. Again, the nail-bed is divided into two portions—the part beneath the nail-root being called the *matrix*, and the anterior portion the *nail-bed proper*.

The nail-bed is formed of the rete Malpighii and corium, and, beneath these layers, of subcutaneous tissue which contains no fat. It is richly supplied with blood-vessels and nerves. In the neighborhood of the matrix the papillæ are shorter and broader than in the nail-bed proper, as well as more closely set together, and are inclined obliquely forward. The papillæ are all well provided with blood-vessels, and those of the papillæ of the matrix are especially large and intertwined with one another. The *lunula* is the part of the nail of a whitish color that extends from the posterior border of the nail-fold to an anterior convex line sharply defined from the transparent portion

of the body of the nail. It is that part of the matrix that does not lie beneath the nail-fold, and its color, as shown by Ranvier, is caused by an increase in the opacity of the nail-tissue in this place, so that the vessels are not seen through its substance. It is not, as has been sometimes thought, due to a diminished vascularity in the bed of the nail at this point.

The formation of the nail begins during the third fetal month as a fold in the epidermis. The writer's investigations have led him to the belief that the nail represents a modified portion of the stratum lucidum. Between the third and fourth month of intra-uterine life a continuous layer of granular and bladder-cells is seen to cover the entire finger or toe, and beneath this layer the nail makes its appearance, formed from peculiar cells in the upper part of the rete, containing deeply-stained granules of kerato-hyalin. The granular and bladder-cells represent the epitrichial layer, which in young embryos covers the whole surface of the skin, and is thicker and more persistent in the region of the nail, where it has been called by Unna the eponychium. A distinct connection can be traced between the embryonic nail-formation and the stratum lucidum of the palms and soles. In the fifth month the epitrichial covering of the nail, or the eponychium, is cast off, and the free surface of the nail is exposed. At the edge of the nail, however, where the bladder- and granular cells of the epitrichium are heaped up in great numbers, forming a prominent ridge, these cells are not cast off, but undergo a process of keratosis, and form a part of the normal stratum corneum. Apparently also the epitrichial layer persists to a lesser degree over the whole palm and sole, and, becoming keratinized, gives rise to the peculiar type of horny cells described by Zander as occurring chiefly in these regions. In the adult the nail is formed chiefly by the cells of the matrix.

Nails are said to grow more rapidly in children than in adults, more

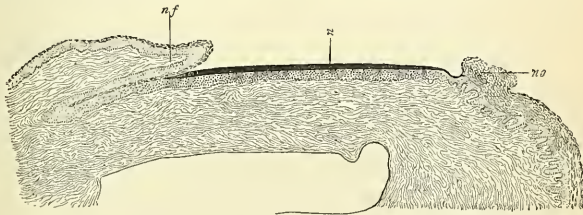


FIG. 231.—Section of fetal nail after the fifth month: *n*, nail; *ne*, nail-edge; *nf*, nail-fold.

rapidly in summer than in winter. Their rate of growth has been estimated as, on an average, one thirty-second of an inch a week.

PHYSIOLOGY.

The physiological functions of the skin are the respiratory, the secretory, the protective, the heat-regulative, and the sensory.

The Respiratory Function of the Skin.—This is supplementary to that of the lungs and is of the same nature. Water and carbonic acid are given off by the skin, and there is some absorption of oxygen, but the amount of carbonic acid and oxygen transferred is very small compared to that dealt with by the lungs. The exact way in which gases and water are transferred

is not known, but without doubt the sweat-glands play at least a prominent part in the process.

The Secretory Function of the Skin.—This is performed through two agencies, the sweat-glands and the sebaceous glands. The sweat is secreted from the coil-glands chiefly, although the possibility that some part of it is poured out directly through the pores without the participation of the glandular structures cannot be excluded. It is a clear, watery fluid, of a saltish taste, and a peculiar odor dependent upon the individual or upon the locality where it is produced. It contains about 99 per cent. of water, together with fat, volatile fatty acids, neutral fat, cholesterin, and urea. Its reaction has been considered to be acid under normal conditions, but when profusely excreted through the action of diaphoretics it is found to be neutral or alkaline. Luchsinger and Trümper have found that after the skin is carefully freed from sebaceous matter the reaction of the sweat is alkaline, and that it has an alkalike reaction on the palms, where there are no sebaceous glands. The question of its reaction must therefore be considered as in some sense an open one. It is probable that the sweat contributes in some degree to the oiling of the skin, and that a certain amount of fatty matter is excreted by the coil-glands, especially in certain portions of the body. This theory was first advanced by Meissner, and has been vigorously pushed by Unna, who claims for the sweat-gland apparatus the exclusive rôle in the production of seborrhea. As a rule, the perspiration is "insensible," the water evaporating as soon as it reaches the surface of the skin. When the sweat-glands are very active, however, it collects upon the surface in the form of drops or beads.

The secretion of the sweat is not a continuous process, but is affected by many different factors. It is especially dependent upon the influence of the nerves. The centers of the nerves that control the sweat-secretion are considered to lie in the spinal cord, extending upward to the medulla oblongata. The peripheral distribution of these nerves has not been accurately determined, although nerve-fibers have been demonstrated as entering the coil-glands.

The secretion of the sweat is accompanied, like that of other glandular structures, by a dilatation of the blood-vessels of the part. It is increased by changes in the temperature and constituents of the blood, and by the poisonous action of various drugs. According to Ziemssen, a simple venous stasis or an active hyperemia pushed to the point of inflammation does not increase the amount of sweat unless there is an abnormal character of the blood; and a simple increase of blood-pressure in the aortic system from the ingestion of large amounts of water is also not capable of exciting the secretion, unless the temperature of the blood is raised either by the heat of the fluid taken, by the warmth of the surrounding air, or by limiting the amount of heat and of water given off by the skin through muscular exertion. Causes that hinder or annul the activity of the sweat-glands are sudden cooling of the skin, cutting off of the arterial blood, or separation of the glands from the central nervous system. Atropia has a similar action by paralyzing the nerves of the glands.

The *sebaceous secretion* is produced by means of the sebaceous glands, and consists of free fat, the remains of epidermic cells more or less filled with fat, and crystals of cholesterin. It is of a semi-fluid, oily consistency, and is called sebum. Chemically, sebum has been found to contain water, fats, soap, palmitic and oleic acids, cholesterin, inorganic salts, and an albuminoid substance resembling casein. The secretion of the external auditory canal is

a mixture of the products of the sweat- and of the sebaceous glands found in the place, and shows microscopically the elements of each. The amount of secretion varies much according to the individual and also according to the locality, the sebaceous glands of the nose being proverbially large and active. These glands are especially active at the period of puberty.

It is probable that, unlike the sweat, the secretion of the sebaceous glands is a continuous one. The exact mechanism is not well understood. It is probably increased by dilatation of the blood-vessels and by an increase in the temperature of the skin. The secretion is formed by a fatty degeneration of the cells of the gland, the cells at the periphery containing but few fat-globules, while at the center the whole cell is filled with fat. The cells then become ruptured, and the fat is expelled through the duct to the free surface of the skin. It is not known whether the nerves have any part in the process of sebaceous secretion.

The Protective Function of the Skin.—The horny layer by its denseness and impermeability prevents evaporation from the surface, and, on the other hand, offers a barrier to the entrance of poisonous fluids and gases, of bacteria, electricity, and caustic substances. The sebaceous secretion by forming an oily coating adds to this impermeability. The skin by its elasticity and firmness is a great protector of the internal organs against injury from without, the loosely-meshed subcutaneous tissue aiding materially in this function. Large arterial and venous trunks, together with nerves, are imbedded in dense masses of subcutaneous fat-tissue, with the overlying skin correspondingly thick, so that they are well protected from injury. The hair, especially that of the head, is well adapted for the protection of the cranium, not only from excessive grades of temperature, but from mechanical injury.

The Heat-regulative Function of the Skin.—The skin plays an important part in regulating and controlling the heat of the blood. This function is performed by radiation, conduction, and evaporation of moisture from the surface. The vaso-motor nerves are prominent agents in this process, and their continuity must be perfect for the proper discharge of their functions. Through reflex action they cause either a dilatation or a contraction of the cutaneous blood-vessels, and at the same time exert a corresponding influence on the muscles of the skin. When cold acts upon the surface of the skin a contraction of the blood-vessels and of the muscle-fibers is produced by reflex action, and the amount of blood distributed to the surface is greatly diminished, and the temperature of the blood thereby much reduced. Conversely, when the surface of the skin is exposed to heat the vessels become distended and the muscle-fibers relaxed, so that an increased amount of blood is poured into the cutaneous vessels, and a great amount of heat is given off by radiation and conduction. This natural principle of heat-regulation is supplemented by man by the adoption of thicker or thinner clothing.

The secretion of the sweat is another factor of great importance in regulating the heat of the blood, the evaporation of the water poured out upon the surface of the skin under exposure to high temperature causing a great loss of heat and preventing an abnormally high temperature of the blood. The outer horny layer of the epidermis is a poor conductor, and obstructs the loss of too much heat from the body.

The Sensory Function of the Skin.—The sensory function is an important one, as by this means we are enabled to judge of heat and cold, pressure, etc. For its proper performance there must be no break in con-

tinuity of the terminal nerve-filaments nor of their connection with the nervous centers.

Absorption.—The thick envelope formed by the horny layer is the means of preventing to a great extent the absorption of fluids by the skin. The degree to which the horny layer is permeable is a point that is still a matter of much doubt and diversity of opinion. Very exact experiments upon this subject are difficult to carry out, and many of the results are questionable on account of the frequent sources of error. It is generally conceded that gases are absorbed by the epidermis with comparative ease, and also that volatile substances may penetrate the intact outer skin to a certain degree. Water is not absorbed, the experiments that show an increase in the bodily weight after long immersion in a bath being explained by an imbibition of the epidermis with water, and not by its absorption. Substances dissolved in water or alcohol are with very great difficulty, if at all, absorbed by the skin. The evidence as to the absorption of solutions of substances applied to the skin in the form of a spray is conflicting.

The greater part of the absorption that is possible is effected by rubbing into the skin substances dissolved or suspended in fats and oils, and in this case it is most probable that the sweat-glands and hair-follicles are the points of entrance—at any rate, to a great extent. There is much diversity of opinion among experimenters as to the substances that may be thus absorbed. Mercury is still the best proof that there is an absorption by the skin, as there is no difference of opinion as to the penetration of this drug. The manner in which it is absorbed is still unsettled, some believing that it is absorbed in the form of vapor, others that the globules are introduced through the follicles or sebaceous glands or only penetrate the outer epidermal layers.

GENERAL SYMPTOMATOLOGY.

BY CHARLES W. ALLEN, M. D.

THE subject of semeiology is especially important to the beginner in the realm of dermatology, since the whole question of diagnosis depends very largely upon the thoroughness of the knowledge one has of the elementary alterations which may occur in the skin, and the subsequent changes which these undergo to produce the characteristic features by which the one or the other disease is recognized.

The symptoms which the patient can tell one of, from his own sensations (subjective), are not nearly so important, nor indeed so trustworthy, as those which the physician can himself discover by the aid of his special senses—touch, sight, and, in some instances, smell (objective). One must, then, learn to rely more upon what he can take cognizance of than upon any statements he hears concerning a given eruption. Efflorescences are almost numberless in their variety; the sensations they cause are very few.

Subjective symptoms may arise from systemic affections, of which the skin-lesions are to be considered but as the outward manifestations; or they may result from the local irritation and perhaps reaction upon the general economy which the cutaneous eruptions have occasioned. As an instance of the first class may be mentioned syphilis, and of the second a severe attack of scabies. Here the constant pruritus may have occasioned loss of sleep, and this, in turn, exercised a baleful influence upon the general health.

Many skin-affections have no subjective symptoms. Among such may be named the anomalies of pigmentation, benign neoplasms, hypertrophic and atrophic conditions, etc. A blind man could not properly be said to "suffer" from one of these affections, since, unless told, he would be unconscious even of its existence. In many diseases, on the other hand, notably the neuroses, the sensations of formication, burning, itching, tingling, pricking, and pain which accompany the outbreaks are pronounced and sometimes intense.

Objective symptoms, like the illustrations of a book, often convey to the mind at a glance a clearer comprehension than one would get from a lengthy description.

The time the eruption has existed, the manner of spreading, the character of the original lesion, and its subsequent changes are often manifest at first inspection. Lesions which go to make up objective symptoms are primary or elementary and secondary or consecutive. Upon the way they develop, change in form and color, become distributed, form groups and combinations, hangs the whole question of their diagnostic significance.

The elementary are—1. Macula; 2. Papula; 3. Tuberculum; 4. Tumor or Phyma; 5. Pomphus or Urtica; 6. Vesicula; 7. Bulla; 8. Pustula.

The consecutive are—1. Excoriatio; 2. Infiltratio; 3. Squama; 4. Crusta; 5. Pigmentatio; 6. Ulcus; 7. Rhagas; 8. Cicatrix.

There are eight of each. Their arrangement is arbitrary. Indeed, the whole scheme is more or less arbitrary. Almost any primary lesion may follow or be secondary to some other primary or elementary lesion. Thus a papule may become vesicular; a vesicle become pustular, etc. The macule of erythema develops into the bulla of erythema exudativum. The syphilitic papule enlarges till it must be called a tuberele. A vesicle extends its dimensions until the term bulla more appropriately fits it. While elementary lesions may at times be consecutive in this sense, those termed consecutive can never be elementary, if we except, perhaps, infiltration and pigmentation. An infiltrated condition of the skin may occur primarily in certain diseases or develop from the diffusion of nodular cell-infiltration; and in that rare affection mycosis fungoides it is said at times to precede the tumor-formation. Pigment-stains may be looked upon as primary when they result from accidental or intentional tattooing or such penetration of coloring matter as follows gunpowder-explosions and injuries permitting coal-dust, etc. to enter the skin.

Elementary Lesions.—*Maculae*.—Macules are spots, stains, or circumscribed alterations in the color of the skin without appreciable change in the surface-level, unless accompanied by exudation. They are acquired or congenital, transient or permanent, of various color, form, and size. They often precede other lesions or accompany them, as in maculo-papular syphilide. Familiar macular eruptions are furnished by measles, copaiba and other drug-eruptions, purpura, lentigo, and maculae caeruleae. When diffuse, the redness is called erythema. Macules may be due to hyperemia, extravasation, or to pigment-changes. If vessels are to be seen in the hyperemic spot, the condition is one of telangiectasis.

Papule.—Papules or pimples are small, firm elevations of the skin. They may be white, black, of the natural color of the skin, or any other color. Generally speaking, the term is limited to the description of lesions not exceeding a French pea in size, though the form may be irregular. Instances are afforded by the various papular syphilides, the lichens, acne, milium, urticaria papulosa, and prurigo.

In diagnosis much depends upon the exact tissue-origin of the papule,

whether it arises from epidermis, corium, gland, or follicle. Many affections, instead of remaining strictly papular, are described as presenting papulo-squamous, papulo-vesicular, or papulo-pustular lesions. Some lesions, like those of milium, remain permanently papular.

Tubercula.—Tubercles are nodular, firm elevations, larger than papules, but essentially of the same nature. The size may equal that of a large hazelnut, when they are often referred to as nodular or tuberous lesions.

It is the preponderance of these large elements, or the evidence that a diffuse infiltration, such as is seen in lepra, syphilis, and lupus, has originated in such nodules, which gives the name "tubercular" to a given eruption, though scattered papules may coexist.

Tumores.—Tumors may be of any size, but the term should be restricted to neoplasms, and usually to those of large dimensions. They may be superficial or they may spring from the subcutaneous tissues, bound down or movable, projecting, pedunculated or sessile, solid or with fluid contents. The origin, rapidity of growth, and presence or absence of pain are important points to be determined.

Pomphi.—Urticæ, or wheals, might be considered as acute and usually evanescent, soft, flat nodules. They are due to a local edema of the corium, which is determined by an external or internal irritant resulting in angeio-neurotic spasm. The size varies from a mustard-grain to a small orange. It is not unusual to observe the coalescence of a number of wheals, so as to form extensive raised patches. The subjective sensations, itching, tingling, pricking, burning, are often intense, and may precede the actual outbreak, which develops rapidly upon scratching. In some subjects a slight irritation of the surface at any time suffices to raise a wheal, which takes on a form corresponding to the lines of irritation. Though usually characteristic of a definite urticaria, wheals may result from bites and stings of insects, from contact with certain fishes and nettle-bearing plants, and from the injection of fluids into the skin, etc.

Vesicula.—Vesicles are small water-blebs or blisters, from millet-seed to hemp-seed in size, and having non-purulent fluid contents. They are formed within or beneath the epidermis, and are more or less raised above the surface. The fluid may be turbid or blood-stained, but, once suppurative changes are added, the vesicle becomes a pustule. It may arise from a seemingly healthy surface, as in miliaria crystallina, or it may develop upon the summit of a pre-existing papule, as in varicella. Vesicles also spring up upon infiltrated surfaces, as seen in eczema, etc. In the latter the bleb-wall is usually very delicate, and it ruptures from the slightest cause. In herpes, rhus-poisoning, and other conditions the wall is so firm and tough that it may dry into a crust without external loss of the fluid contents.

Vesicles are located in the mucous layer, between the mucous and the horny layers, or in the latter alone. They are discrete or confluent, and have one chamber or several.

Bulle.—Blebs are larger water-blisters, varying from the diameter of a split pea to that of an orange. They may result from the enlargement of vesicles or they may arise *de novo* either from an erythematous area or from an apparently unchanged skin-surface. The fluid contained is clear, yellowish, greenish-pink, bluish, or almost black from hemorrhage from the floor of the bulla. They are seen especially in pemphigus, impetigo, exudative erythemas, scabies, and drug-eruptions, or they may be artificially produced.

Pustule.—Pustules may be regarded as vesicles or bullæ whose contents have become purulent, if they were not so from the first. They are yellow,

yellowish-, or brownish-green. If the connective tissue is implicated in the suppurative process and papillæ are destroyed, pitting or scar-formation is the result.

Consecutive Lesions.—*Excoriationes.*—Excoriations or scratch-marks follow conditions of hyperemia and inflammation, vesicular and bullous lesions when the surface epithelium has been violently removed. The common cause is the act of scratching in pruriginous affections. Here the location and form of the excoriations will often point to the causes which have led up to them, and often to the means employed in their production.

Infiltrationes.—Infiltrated areas arise, secondarily, when long-continued surface irritation has led to friction of the part, or when persistent lesions of an inflammatory nature have produced, as it were, a low organization of the lymph in the deeper layers of the skin, leaving a condition which Jamieson has well described as "leathery." Such patches are frequently seen upon the extremities after chronic eczema which has been apparently cured, or in association with fissures, notably in syphilis, elephantiasis, and lichen planus.

Squamæ.—Scales are the product of dried-up and cast-off epithelium. They follow erythematous or hyperemic conditions, but especially inflammatory processes characterized by proliferation, and occur in naturally dry states of the skin. In pityriasis capitis, or dandruff, they seem almost to occur as elementary lesions, so evanescent is the hyperemia which precedes their appearance. The scales are bran-like, flake-like, or the whole skin of a given region may exfoliate, as seen in the epidermic cast of the whole hand in quinine eruption, etc.

Scales appear dull and greasy-looking, as in syphilis, or opalescent and silvery, as in psoriasis. They prevail notably in squamous eczema, psoriasis, pityriasis rubra, dermatitis exfoliativa, xeroderma, and scarlatina.

Crustæ.—Crusts are thicker, dirtier, and more irregular than scales, because of admixture with epithelium and with various exudations, secretions, serum, pus, blood, fungous elements, and detritus, according to the lesion which they cover. Usually soft at first, they soon dry into hard plates loosely attached or firmly adherent. They are friable or greasy, rough or smooth, thick or thin, light or dark-yellowish as in favus, greenish, brownish, or black as in the rupial crusts of syphilis, or varnish-like as in impetigo. While usually convex, some, as in acne varioliformis, variola, and varicella, show a depressed center. Concentric, heaped-up crusts, always growing larger, result from certain ulcerations which extend at the periphery.

Pigmentationes.—Pigment-stains follow prolonged states of hyperemia, neoplastic formations, pronounced irritation from the presence of pediculi, lasting pruritic affections, syphilis, and occasionally psoriasis, lichen planus, etc. The size, form, and location of the stain may point to the nature of the process which has gone before.

Ulceræ.—Ulcers are secondary to states of infiltration, and are characterized by loss of tissue extending into the corium. They are shallow or deep, round or irregular, have straight, sloping, or undermined borders, and present a smooth, irregular, sloughing, pus-covered, or granulating base. The chief features to be noted are their location, size, shape, border, base, and manner of extension. The outline is usually round, but may be serpiginous or crescentic. Ulcers are very common in the later stages of syphilis, following tuberculous and gumulous processes, also in the more advanced stages of lupus, lepra, epithelioma, and tuberculosis. In eczema they are found particularly in association with varicose veins, and especially in advanced life.

Rhagades.—Fissures, cracks, or clefts are also secondary to infiltrations,

as seen in syphilis about the mouth, in eczema of the palms, and in lesions about the anus, the nares, etc. Familiar examples are the chaps of lips and hands caused by exposure in cold weather. They result from loss of elasticity in the skin, whose epidermis is perhaps thickened and rendered harsh, dry, and brittle, while the corium is infiltrated. If deep, much pain may be occasioned.

Cicatrices.—Scars follow all ulcerative processes which extend to the corium. A cicatrix, though pink or red at first, becomes usually glistening white unless pigmented. In some the redness remains for a long time. They are depressed or hypertrophic, and at times keloidal, as after burns and deep ulcerations. Usually insensitive, they may be tender. The form, size, location, and color will often give a clue to the affection responsible for them.

Cicatrices occur in the diseases mentioned as ulcerative and attended with suppuration, besides so-called struma, carbuncle, etc. They are produced by connective-tissue new growth following the process of cicatrization.

General Symptoms.—Besides studying the form of an elementary lesion, we must pay due regard to its deportment in passing through its transition stages. We must observe the distribution, localization, symmetry, formation of groups and patches, and the size, color, shape, and outline of the latter. The eruption may be *universal*, leaving no intervening healthy skin, or it is spoken of as being *general*, when the entire surface is involved, but healthy skin exists between the spots or patches. Lesions may be *aggregate*, *disseminate*, *discrete*, or *confluent*. If the eruption is confluent over the entire surface, it is said to be *universal*. If disposed in rings, it is *annular* or *annulate*; if in more or less circular patches, it is *circinate*; or if rings or circles, fused into extensive wavy outlines, we designate it as *gyrate*. Patches which clear up in the center as they extend at the periphery are called *serpiginous*. If the border of a patch meets the healthy skin abruptly, it is called *marginate*. All sharply-defined patches are *circumscribed*.

The age of the patient, of the disease, and of the individual lesion which goes to constitute the latter is each one of importance, not only in fixing the nature of the affection, but in fixing to it an appropriate name.

The natural direction taken by the fibers of the skin, the distribution of the follicular openings, the course of the cutaneous vessels and nerves, the natural furrows and lines, all follow a more or less definite course in the various regions of the body's surface; and these, taken together with what Langer has described as the "lines of cleavage" of the skin, have much to do with the distribution, localization, and at times the configuration, of eruptions.

GENERAL ETIOLOGY.

By DOUGLASS W. MONTGOMERY, M. D.

SALISBURY, in an address before the British Association at Oxford, referred to life as "that mysterious impulse which is able to strike across the ordinary laws of matter and twist them for a moment from their path." One can almost in the same words define etiology as the study of those phenomena that strike across the ordinary laws of life, twisting them from their path.

The advances made in the direction of etiology during the past few years

have been greater than in any of the other medical sciences. The discoveries touch not alone the life and happiness of the individual, but of the whole community, for the present robust growth of that once puny child Hygeia is for the most part owing to the increase in knowledge of the origin of disease. Homo sapiens has thought himself more acute than all the other mammalia, and has surrounded himself with a most intricate machinery; but instead of running the machine, the machine has begun to run him, and he is spun around in a system he does not more than half comprehend, although the whole of it is of his own making. This machine is called the social system, and his very life in it depends to a great extent on obedience to the laws of hygiene. This intricate social life gives rise in many instances, to what we call a predisposition to a disease which is often enough a disease in itself, furnishing a soil on which another more obvious disease is easily planted. Man has made shoes for his feet, and from them we have the etiology of ingrowing toe-nail. The abrasion by the down-growing edge of the nail in its turn gives occasion for infection by pyogenic bacteria, which, besides complicating the wound, may set up an impetiginous eczema, ecthyma. Dishwasher's eczema is another instance of the requirements of civilization causing disease. The growth of our cities demands increased facilities for transportation, such as street-cars, and the street-car driver with his varicose veins and eczema of the legs becomes a frequenter of our clinics.

Different ages also present an etiology peculiar to them. Tinea tonsurans is principally a disease of childhood, eczema an affection of childhood and of old age, leucoplasia of old age and of adult life.

Maladies and their frequency in the sexes differ, for, in addition to plica of the hair, intertrigo under the breasts, kraurosis of the vulva, which of course must appear in the female, there are other diseases where the reason for their predominating attachment to one sex or the other is not quite clear, as lupus erythematosus in females.

The influence of climate in producing or predisposing to disease is well recognized. Man, however, like the dog, can live almost anywhere, and a large number of the diseases usually attributed to climate are really instances of parasitism due to the parasites that live in that particular climate. It is clear that one would not expect to find pyogenic diseases at an altitude where pyogenic bacteria do not exist. The more we know about parasitism, the fewer are the diseases we can attribute to the influence of climate *per se*.

The influence of heredity as a cause, predisposing or direct, of disease of the skin is shown, on the one hand, by gout, and, on the other, by ichthyosis—gout predisposing to eczema, and ichthyosis being an instance of the transmission of congenital deformity. Syphilis and tuberculosis are not examples of heredity in the true sense of the term, but of inherited parasitism or parasitism acquired *in utero*.

Some diseases of the skin are limited to the skin, and no other organ is affected; they are what are called local diseases.

Other affections of the skin are dependent on a disease localized in some distant part of the body: herpes zoster, for instance, is merely a symptom of disturbance in the ganglia on the posterior spinal nerve-roots. Still other maladies of the skin are the expression on the skin of the action of a generalized virus, such as measles, scarlet fever, or syphilis.

The great number of diseases of the integument that are dependent on disease of some internal organ or on some generalized affection requires that a skin-disease specialist be well up in internal medicine. In fact, the affinity between diseases of the skin and those of internal medicine is much closer,

and much more profitable for medical culture, than that between the diseases of the skin and those of the genito-urinary system, although it is so customary to throw the diseases of the skin and those of the genito-urinary organs together.

One need not insist on the importance of etiology in the study of medicine. Much of the advice we give our patients, much of the treatment, must necessarily depend on our personal ideas of the cause of disease. For instance, no matter what may be said against the overshadowing proportions that the study of bacteriology has taken during the past few years, it has given an objectivity to therapeutics that we never possessed before.

GENERAL PATHOLOGY.

BY DOUGLASS W. MONTGOMERY, M. D.

PATHOLOGY is the study of disease in its broadest signification. It includes not only facts that can be acquired by the unaided senses with the patient before us, but those that can be elicited by microscopical research, by chemicals, or by staining reagents; in fact, by anything that may elucidate the phenomena under consideration. By general consent, however, pathology is restricted to the facts obtained from an examination of the diseased tissues. These tissues may be those secured either by biopsy or necropsy.

The importance of microscopical investigation in diseases of the skin has only to be considered to be appreciated. In epithelioma, in tuberculosis, and in leprosy the positive facts that it is capable of giving us are alone sufficient to secure a dignified position for pathology.

Pathology rests in its finer details on correct anatomy, and no great advance can be made without previously preparing the way by investigations in normal histology. In 1848, Gustav Simon wrote the first pathologic anatomy of the skin, the road for which had been already broken by the elder Krause's researches in the normal histology of the integument.

The facts obtained in diseases of the skin are of great importance to the study of pathology in general. One has only to consider the matter for a moment. In the internal organs one can only see the results of inflammation after the process has ceased, while in an inflammation of the skin, an identical process, the whole panorama of disease passes on under the eye; and at any time a piece of the tissue may be removed for examination. No organ in the body, with the exception of the eye, is so well fitted for the study of pathology as the skin and the neighboring mucous membranes. Its study, therefore, ought not to claim the attention of the skin-disease specialist only, but of all who take an interest in observing disease-processes. What Unna says may come perfectly true: "that the time must come when in the study of every internal disease a better known and clinically more accurately observed affection of the skin will be used for the purposes of explanation and illustration."

The increased interest in the pathology of the skin of late can be seen by the larger space devoted to it in the leading special journals. The day when a man can boast that he is all the better clinician because of not wasting his time on useless microscopical work is almost past, even in the most backward countries. There was some excuse for this. The monotonous repetition of

the discovery of round-celled infiltration, and nothing more, in diseases that were clinically entirely distinct, was enough to dampen the ardor of the most enthusiastic student. In its general features the pathology of the skin is the same as that of any other organ of the body, but it most closely resembles that of the mucous membranes covered with stratified epithelium. This resemblance is so close that many diseases of stratified epithelial surfaces are now discussed in treatises on diseases of the skin. This is particularly the case with diseases of the tongue.

GENERAL DIAGNOSIS.

BY DOUGLASS W. MONTGOMERY, M. D.

ONE must always listen to the patient's story, not only because he usually thinks it the most weighty part of the examination, but also because if due attention is paid to separating the facts from the theories many useful points may be gained. Also, while listening to the recital time need not be lost, as many useful facts may be noted from the general aspect of the patient, his attitude, and his demeanor. But the subordination of the history to the actual facts gathered from a direct examination of the skin must never be lost sight of, as the diagnosis must be made from what the skin itself reveals. The history and the concomitant circumstances may modify one's opinion, but the diagnosis must either be made or omitted by what is found or by what fails to be found on the skin.

One cannot insist on examining the entire skin of every patient that comes into the office, but neither indolence nor ideas of modesty ought to prevent seeing all or any part of the skin that may be necessary.

In inspecting the lesion itself the primary efflorescence of which the rash is composed should be looked for. This may be entirely obscured, either by coalescence, by scratching, or by applications. The following is an instance of obscurance of the primary lesion by coalescence: A woman came to me with an even, dark-red, slightly elevated desquamating patch on the side of the nose near the eye. I took it to be a patch of eczema, and ordered a salve composed of white-precipitate and oxide-of-zinc ointments. A few days afterward what had been an even redness had resolved itself into a circle of fairly large, rounded, projecting papules, offering no difficulty to the diagnosis of a syphilide—a diagnosis that was abundantly confirmed both by the course of the lesion under consideration and by others that developed subsequently.

Usually, however, the primary efflorescence may be easily made out, especially if sought for in the right place. In a patch, for example, which may be formed by an aggregation of lesions separate individuals may be found at the periphery. Then, again, there may be several kinds of efflorescence in the same disease, as in eczema, where there can be erythemas, papules, vesicles, and pustules.

The age of the patient has much to do with the kind of lesion one expects to meet. In the eczemas of childhood pustules are frequently found, and excite no comment, while if seen in eczema in adults a parasitic cause is instantly thought of. As a matter of fact, an extensively distributed pustular eczema in an adult ought to lead to a persistent search for the itch-mite.

The consistence and prominence of a rash are sometimes valuable. I remember while a student being struck by the remark of a well-known teacher of diseases of the skin, that if deprived of his eyesight he believed he could still make his living diagnosing syphilis by the prominence and firmness of the rash.

The clustering and the configuration of a rash often furnish valuable data. This is especially true of parasitic affections that, taking their point of inoculation as a center, spread peripherally—as ringworm, for instance. The circinate arrangement of the syphilides is also well known.

The situation of a rash is often of more importance than its configuration—for example, psoriasis on the scalp, tip of the elbows, and over the ligamentum patellæ.

CLASSIFICATION.

By W. A. HARDAWAY, M. D.

THE desire to classify the acquisitions of human knowledge is both rational and necessary, since it is an effort to arrange in some logical order the facts in our possession, and to show their relationships to each other; moreover, a judicious system of classification is a most important aid to the memory.

That these obligations have been fully appreciated in the special field of dermatology is shown in the numerous attempts that have been made to construct a scheme of classification that would be at once scientific and practical. They have necessarily been of different degrees of merit, and as a matter of course have reflected the state of general and special knowledge of the time at which they were written. The writer, in common with many others, still thinks that Hebra's system—the application of the principles of general pathology to cutaneous diseases—remains in its broad outlines the best suited for practical purposes, notwithstanding its imperfections and inconsistencies. Therefore it has been adopted in this work, with the modifications proposed by Crocker and with certain additions and changes suggested by Morrow.

It has not been thought necessary to retain the second column of the classification as arranged by Crocker, in which the more prominent lesional and other features of the several diseases appear.

CLASS I.—INFLAMMATIONS.

Erythema simplex.	Pellagra.
Erythema traumaticum.	Acrodynia.
Erythema caloricum.	Furuncle.
Erythema venenatum.	Carbuncle.
Erythema intertrigo.	Malignant pustule.
Symptomatic erythema simplex.	Equinia.
Erythema medicamentosum.	Dissection-wounds.
Erythema scarlatiniforme.	Impetigo.
Passive hyperemia.	Impetigo contagiosa.
Symptomatic passive hyperemia.	Ecthyma.
Erythema exudativum multiforme.	Pompholyx.
Erythema nodosum.	Herpes simplex.
Erythema induratum.	Herpes facialis.
Erysipelas.	Herpes progenitalis.
Erysipeloid.	Herpes zoster.

Pemphigus vulgaris.
 Pemphigus foliaceus.
 Pemphigus vegetans.
 Impetigo herpeticiformis.
 Dermatitis herpeticiformis.
 Eczema.
 Dermatitis repens.
 Prurigo.
 Psoriasis.
 Pityriasis maculata et circinata.
 Dermatitis exfoliativa.
 Pityriasis rubra.
 Epidemic exfoliative dermatitis.
 Dermatitis exfoliativa neonatorum.
 Parakeratosis variegata.
 Urticaria.
 Urticaria pigmentosa.
 Angioneurotic edema.

Lichen ruber.
 Lichen planus.
 Lichen scrofulosorum.
 Lichen pilaris.
 Pityriasis rubra pilaris.
 Dermatitis factitia.
 Sphaceloderma.
 Dermatitis gangrenosa infantum.
 Multiple gangrene in adults.
 Symmetrical gangrene.
 Diabetic gangrene.
 Dermatitis medicamentosa.
 Dermatitis venenata.
 Dermatitis calorica.
 X-ray dermatitis.
 Dermatitis congelationis.
 Dermatitis traumatica.
 Vaccinal eruptions.

CLASS II.—HEMORRHAGES.

Purpura simplex.
 Purpura rheumatica.

Purpura hæmorrhagica.

CLASS III.—HYPERTROPHIES.

Lentigo.
 Chloasma.
 Anomalous discolorations of the skin.
 Acanthosis nigricans.
 Tattooing.
 Argyria.
 Keratosis pilaris.
 Keratosis senilis.
 Keratosis palmaris et plantaris.
 Angiokeratoma.
 Callositas.
 Clavus.
 Cornu cutaneum.

Verruca.
 Porokeratosis.
 Papilloma cutis.
 Nævus pigmentosus.
 Ichthyosis.
 Sclerema neonatorum.
 Edema neonatorum.
 Scleroderma.
 Morphea.
 Elephantiasis.
 Acromegaly.
 Myxedema.

CLASS IV.—ATROPHIES.

Albinism.
 Leukoderma.
 Atrophia cutis.
 Perforating ulcer of the foot.

Striæ et maculæ atrophicæ.
 Glossy skin.
 Ainhum.

CLASS V.—NEW GROWTHS.

Cicatrix.
 Keloid.
 Fibroma.
 Lipoma.
 Myoma.
 Neuroma.
 Osteoma.
 Xanthoma.
 Xanthoma diabeticorum.
 Angioma.
 Nævus vasculosus.
 Telangiectases.
 Angioma serpiginosum.
 Lymphangioma.
 Lymphangioma, simple.
 Lymphangioma, cavernous.
 Lymphangioma, cystic.
 Xeroderma pigmentosum.

Rhinoscleroma.
 Tuberculosis cutis.
 Lupus vulgaris.
 Scrofuloderma.
 Paratuberculoses.
 Lupus erythematosus.
 Mycosis fungoides.
 Sarcoma.
 Leprosy.
 Morvan's disease.
 Colloid degeneration of the skin.
 Adenoma sebaceum.
 Adenoma of sweat-glands.
 Multiple benign cystic epithelioma.
 Leukokeratosis buccalis.
 Keratosis follicularis.
 Psorospermosis cutis.
 Molluscum contagiosum.

Carcinoma cutis.
Epithelioma.
Paget's disease.
Frambesia.

Verruga.
Aleppo boil.
Tropical ulcer.

CLASS VI.—NEUROSES.

Hyperesthesia.
Pruritus.

Dermatalgia.
Anesthesia.

CLASS VII.—DISEASES OF THE APPENDAGES OF THE SKIN.

A. SWEAT-GLANDS:

1. *Functional disorders.*
Hyperidrosis.
Anidrosis.
Bromidrosis.
Chromidrosis.
Uridrosis.
Hematidrosis.
Phosphorescent sweat.
2. *Organic affections.*
Hidradenitis suppurativa.
Sudamina.
Miliaria rubra.
Miliaria crystallina.
Chronic miliaria.
Hidrocystoma.
Miliary fever.

B. SEBACEOUS GLANDS:

Seborrhea.
Seborrhœa oleosa.
Seborrhœa sicca.
Eczema seborrhoicum.
Asteatosis.
Comedo.
Miliium.
Steatoma.
Aene disseminata.
Aene rosacea.
Aene varioliformis.

C. HAIR-FOLLICLES:

Canities.
Discolorations of the hair.
Hypertrichosis.
Atrophia pilorum propria.
Fragilitas crinium.
Trichorrhæxis nodosa.
Aplasia pilorum propria.
Plica polonica.
Piedra.
Beigel's disease.
Tinea nodosa.
Lepothrix.
Alopecia.
Alopecia areata.
Folliculitis decalvans.
Dermatitis papillaris capillitii.
Conglomerate suppurative perifolliculitis.
Sycosis.

D. NAILS:

Onychauxis.
Atrophia unguium.
Onychia.
Onychomycosis.
Leukopathia unguium.
Scleronychia.
Spoon-nail.
Reedy-nail.
Pterygium.

CLASS VIII.—PARASITIC DISEASES.

A. VEGETABLE:

Tinea favosa.
Tinea trichophytina.
a. Tinea circinata.
b. Tinea tonsurans.
c. Tinea barbæ.
Tinea imbricata.
Fungous foot of India.
Actinomycosis of the skin.
Tinea versicolor.
Erythrasma.
Pinta disease.

B. ANIMAL:

Scabies.

Demodex folliculorum.
Phtheiriasis capitis.
Phtheiriasis pubis.
Phtheiriasis corporis.
Filaria Medinensis.
Pulex irritans.
Pulex penetrans.
Cimex lectularius.
Culex pipiens.
Ixodes ricinus.
Leptus autumnalis.
Dermanyssus avium.
Cysticercus cellulose cutis.
Echinococcus hydatid.

PART II.—SPECIAL.

CLASS I.—INFLAMMATIONS.

ERYTHEMA. (I. E. ATKINSON, M. D.)

ERYTHEMA SIMPLEX (E. CONGESTIVUM).

ERYTHEMA SIMPLEX is characterized by an eruption of bright-red or dark-red patches or macules, varying indefinitely in size and shape, and fading to pressure. They are due to intravascular hyperemia of the capillaries and minute arterioles and venules of the most superficial layers of the derma without exudation, and are excited by a variety of causes often widely different, both external and internal. It is impossible to define sharply the limitations of this affection. From the physiological flushing of the skin under the reflex vaso-motor irritation of emotions of shame, anger, joy, etc., to the essentially pathological though transitory cutaneous hyperemia caused by alcohol and other drugs and by slight and momentary trauma, to the more persistent and more clearly defined lesions of erythema simplex, the gradations offer no line of demarcation. Perhaps the term erythema is most appropriately applied to those cutaneous hyperemias which persist, even though briefly, after the withdrawal of their immediately exciting causes, though such limitation would not exclude the quickly-fading redness following a blow, the friction of badly-fitting clothing, or the irritation of a mustard plaster. Sometimes the erythema constitutes the only morbid condition, and is then to be regarded as an essential disorder, or it may prove but one of a number of symptoms, and is only the expression of morbid action exerted reflexly. Thus erythema simplex may be idiopathic or symptomatic.

Symptomatology.—Erythema may invade any portion of the surface. It is less common, however, upon the palms, the soles, the scalp, and the flexures of the joints. Idiopathic erythema simplex is limited largely to the focus of irritation, but symptomatic erythema simplex tends to observe an imperfect symmetry, and may be widely distributed. The lesions vary in size from that of a pin-point to large areas, sometimes involving nearly the whole surface. When recent they are of a bright rose-red, sometimes scarlet, color. As they grow older they assume a darker, often livid, color. They are not at all, or at least very little, elevated above the general surface, yield no sensation of resistance to the finger, and fade to pressure, their color rapidly reappearing upon its removal. A very slight degree of edema may accompany the patches. They vary in duration with the persistence of their exciting cause, sometimes vanishing within a few hours, sometimes persisting for days. In the former event they leave no trace, but when they last longer branny exfoliation of the epidermis and slight pigmentation may follow. Subjective symptoms are often absent. Itching is unusual, but mild burning and tingling may be felt. Very rarely slight elevation of the general tem-

perature accompanies the eruption of erythema simplex idiopathicum (*e. g. e. caloricum*, var. *solare*). Higher temperature may be encountered in symptomatic erythema. In erythema medicamentosa it may reach from 103°-104° F.

Erythema simplex idiopathicum :

1. Erythema traumaticum ;
2. Erythema caloricum ;
3. Erythema venenatum.

1. **Erythema simplex traumaticum** may follow almost any kind of slight and transitory external violence. In higher grades it passes into acute dermatitis. Its usual causes are badly-fitting or badly-made clothing, the pressure of straps, trusses, bands, garters, and shoes, and friction with hard and rough substances. If the irritation has been severe and sustained, erythema may be converted into eczema or dermatitis. This form of erythema rapidly subsides upon the removal of its exciting cause.

2. **Erythema caloricum** may follow exposure to either unduly high or low temperature. Prolonged exposure to the rays of the sun induces a bright erythematous redness, accompanied by burning heat. If the exposure be brief, the erythema subsides in a few days, but is often followed by lamellar desquamation. The redness is uniformly distributed over the exposed surfaces. Protracted exposure to a very hot sun will result, especially in those of fair complexion, in acute inflammation, with exudate and formation of vesicles and even blebs. If the exposure be moderate and continued for a number of successive days, the brilliantly red erythema deepens into a brownish-red. Finally, the blood-vessels of the skin accommodate themselves to the solar irritation ; the active hyperemia diminishes and becomes associated with secondary pigmentation. Erythema may also be excited by artificial heat. Thus cooks, firemen, and others exposed to intense heat are sometimes subject to the eruption upon the parts most exposed. Under prolonged excitation the patches darken into brownish pigmentations. Conversely, the effects of exposure to a temperature near the freezing-point and lower, if brief, may be a parietic condition of the capillaries, which results in transitory redness. In higher grades this may become a dermatitis (*dermatitis congelationis, pernio*). A decided erythema often follows the local application of ice, ice-bags, and ice-poultices in inflammatory and febrile affections.

3. **Erythema venenatum** results from local contact with certain poisonous or irritating substances. A large number of drugs are capable of exciting this form of erythema. Among others may be mentioned mustard flour, turpentine, ammonia, volatile oils, capsicum, dilute acids, and alkalies. Various vegetable substances, contact with some coleopterous insects, with the hairs of caterpillars, etc. may evoke it. The hyperemia usually corresponds to the area of irritation, and quickly disappears, usually upon withdrawal of the irritant. Protracted contact may cause exudation and dermatitis.

Erythema Intertrigo.—Erythema intertrigo is an idiopathic eruption that merits some especial attention. It is an erythema at points where two layers of skin are in contact and retain their sweat and secretions. Such localities are the groins, the arm-pits, the buttocks, the folds between pendulous breasts and the chest-wall of women and of fat persons, the skin-folds of the neck and other parts. The heat and moisture of decomposing secretions excite an active hyperemia which may rapidly pass into exudation, inflammation, and eczema. The chafing of the thighs in hot weather or the pressure of clothing or bandages and similar influences favor its development.

The skin becomes reddened and tingles and burns, so that motion may be seriously interfered with. If properly treated, it subsides within a few hours, but under continued irritation the superficial epidermis becomes stripped off and an abundant mucoid secretion appears, accompanied by itching, swelling, and all the features of *eczema rubrum*. In fat persons, and in infants in whom cleanliness has been neglected, it often becomes an extreme annoyance, and may persist for a long time. It is more readily excited in infants and those persons who have delicate skin. Erythema intertrigo may become the source of a widespread *eczema*.

SYMPTOMATIC ERYTHEMA SIMPLEX.

Symptomatic erythema is a secondary expression of morbid action in other parts of the body, acting principally through the central nervous system. It occurs quite irrespective of local irritation, and may depend upon conditions of the most varied character. These erythemata are usually unimportant except as indicating the existence of morbid action elsewhere. A physiological type of symptomatic erythema is the flush that is called forth by an emotion of joy or shame or anger. The most frequent causes of pathological symptomatic erythema are reflex irritations following disturbances of the digestive system, the blood-changes produced by various febrile states, especially the specific fevers, and the untoward action of drugs acting through the digestive, vascular, or nervous systems.

Erythema infantile (red-gum, tooth-rash, stomach-rash, *roseola infantilis*) is a characteristic symptomatic erythema. It may be caused by disordered stomach-digestion, by the reflex irritation of teething, and in other ways. It consists in scattered rose-red maculations, rarely exceeding the size of the thumb-nail, not elevated or but slightly so, sometimes a little infiltrated, hot to the touch, not painful, itching little or not at all, distributed over the extremities as well as the face and trunk, and disappearing within a few days, leaving no trace. Freshly-appearing lesions may protract the course of the affection.

A similar and equally transitory eruption is often seen upon older persons following the ingestion of certain articles of diet, as strawberries, fish, shellfish, etc., readily distinguishable from the urticaria that often follows more severe reflex irritation from similar causes. The symptomatic erythemata that constitute essential features of various specific fevers, such as scarlatina, rubeola, rubella, syphilis, typhoid fever, etc., need only be mentioned here, as they may be studied more profitably in connection with the disorders of which they form part. Erythema occurs sometimes, however, as an occasional but unessential feature of several specific fevers, and, if only for diagnostic purposes (for lamentable mistakes have often occurred), a brief description of them is introduced here. In the prodromal period of small-pox erythematous macules sometimes develop upon parts usually spared by the specific variolous eruption, the groins, the inner and upper surfaces of the thighs, the pubic and hypogastric regions, the extensor surfaces of the knees and elbows, the phalanges, the dorsum of the foot, the axillary folds and clavicular regions, and the lateral aspect of the loins (Kaposi). This eruption rarely lasts more than twenty-four hours, and sheds no light upon prognosis. An eruption (*roseola vaccinica*) is often observed accompanying the fever of maturation of the vaccine vesicle. This is scattered more or less abundantly over the trunk and extremities. It is an erythema, often accompanied by considerable infiltration and by urticarial

wheals, vesicles, and even blebs. As the fever subsides the erythema disappears. Rarely, also, a pale-red erythema, which has been mistaken for scarlatina, has been observed upon the trunk and even the extremities during the first week of typhoid fever. During convalescence from cholera a disseminated erythematous rash is occasionally encountered. Scattered erythematous patches often occur during the course of septicemia and pyemia. They usually present an insignificant appearance, but they have been known to be so intense and widespread that they have simulated and been mistaken for the eruption of scarlatina.

ERYTHEMA SCARLATINIFORME.

This is probably always a symptomatic erythema. Its most common cause is reflex irritation following the ingestion of certain drugs, notably Peruvian bark; at other times it may be attributed to idiosyncratic reaction to certain articles of diet—berries, fish, shellfish, etc. Often no cause can be assigned for it. It usually appears without warning, though a short prodromal period of headache, anorexia, malaise, and fever may be observed. The entire surface of the body may be invaded, though the eruption is commonly confined to the face, neck, trunk, and proximal surfaces of the extremities. The skin of the wrists and ankles, knuckles, and palms and soles is often implicated. It consists of bright-red or scarlet macules or punctiform papules, which may coalesce to form a continuous sheet of scarlatiniform eruption. During the first twenty-four hours it may prove indistinguishable from the eruption of scarlet fever, but, unless its exciting cause continues in action, during the second and third days it fades into a pale-red or brownish-red color which destroys this resemblance. A high grade of burning and itching may be experienced. Though intense and widespread, the eruption may be afebrile or almost afebrile, thus contrasting at once and definitely with scarlatina. Upon the other hand, fever may be intense, and the resemblance may be heightened by the appearance of the "strawberry tongue" on the second or third day, and the subsequent desquamation of the area of the eruption. This may be lamellar, and upon the hands and feet even glove-like or slipper-like. Scarlatiniform erythema may begin upon any part of the cutaneous surface, and may attain its maximum intensity almost at once. It sometimes begins in the vicinity of a recent wound. Under such circumstances it has been attributed to medicamentous, septic, and other influences. Often upon awakening in the morning the patient finds it freely developed. Recurrent attacks, probably due to idiosyncrasy, are often observed.

ERYTHEMA MEDICAMENTOSA.

This is a symptomatic erythema following the ingestion of certain drugs, such as cinchona-bark, belladonna, opium, copaiba, cubeb, turpentine, phenacetine, acetanilid, etc. As shown above, this eruption may rarely be scarlatiniform. Usually it is macular and disseminated over the head, trunk, and extremities, sometimes as only a few scattered maculations, varying in size from a mere point to that of the palm or larger. In more severe cases the eruption is accompanied by papular and even vesicular and pustular lesions, and may be almost universal, the erythematous element proving often insignificant. It is accompanied by slight burning and itching. Upon withholding the peccant drug the erythema subsides, often within a few hours, leaving no trace or a slight bran-like desquamation.

PASSIVE HYPEREMIA.

The symptomatic differences between active and passive hyperemia of the skin are chiefly shown in the coloration of the lesions. In the latter this varies from a dull red to a light or dark bluish hue. Under the pressure of the finger the color fades, and upon its withdrawal reappears, though sluggishly. The structure of the skin remains unaltered or, after a while, becomes edematous, and the temperature is but little elevated or may be distinctly depressed. If the influences that bring about active idiopathic hyperemia of the skin be long continued, passive hyperemia may be induced. Under the name *livedo* two principal varieties are recognized—*livedo mechanica* and *livedo calorica*.

Livedo Mechanica.—This is an extremely common form, and is caused by any pressure that may retard the circulation in the superficial capillaries or in any way induce a parietic condition of their walls. The pressure of tight shoes, bands, garters, if long continued, the internal pressure of growths, diseased conditions of the veins, as in varicosity, suffice to produce it. The extent of the livid discoloration will usually correspond with the distribution of the irritation.

Livedo Calorica.—Many persons show discolorations of the surface as a result of exposure to cold. These are usually observed upon the extremities, but may be seen upon almost any exposed surface, except possibly the scalp, the soles, and the palms. They are more often observed in young persons. They occur frequently in those who have tarried too long in the cold bath, especially at the seaside. After exposure to extremely low temperature they are seen upon the cheeks, nose, ears, and digits. When the body becomes warm they disappear, giving place to intense redness or active hyperemia. Under such circumstances they are to be distinguished from *dermatitis congelationis* (pernio, chilblain). This passive hyperemia speedily disappears upon the withdrawal of the exciting cause.

SYMPTOMATIC PASSIVE HYPEREMIA.

This form of hyperemia depends upon internal obstruction of venous circulation (cyanosis) or upon central vaso-motor nerve-disorder (Reynaud's disease, etc.) Its consideration more properly belongs to works on internal medicine.

Pathology.—Hyperemia is a phase of many diseases of the skin. With the persistence of its exciting cause it passes into exudation and inflammation. Erythema simplex, in its strictest sense, is an active hyperemia of the smallest arterioles and capillaries of the superficial layers of the skin. Strictly speaking, we are no longer justified in designating as erythema simplex any condition in which demonstrable alteration in the tissues within the area of these vessels is present. Yet it is impossible to imagine a continued hyperemia without increased exudation. The limitation, therefore, is quite conventional. A transitory hyperemia leaves no trace behind it. As longer-lived hyperemia fades it is replaced by slight pigmentation and sometimes by desquamation. In higher grades exudation and inflammation occur. In active hyperemia there is increased supply of blood to the parts through increased force of the cardiac and arterial contractions, or through local irritation, which results in relaxation and overfilling of the arterioles and capillaries; while in passive hyperemia the vessels become distended either through obstruction to their outflow or through relaxation of their walls, without increased blood-supply. The circulation in the affected area becomes retarded, the blood more carbon-

ized, and consequently darker in color. In active hyperemia the coloration is brighter, the local irritation greater, the temperature higher. The two conditions often coexist, and an active is often converted into a passive hyperemia.

The anatomical conditions are identical whether the etiological factors are local or remote. The stimulus to hyperemia acts through the vaso-motor nervous system, either by paralysis of the vaso-constrictor or by stimulation of the vaso-dilator nerves.

Treatment.—Erythema simplex requires little or no treatment. Upon the withdrawal of its exciting cause it will disappear almost at once. Should this be an internal one, such as an error in diet, this should be corrected. To allay the slight tingling or burning dusting-powders or simple lotions may be employed. Any ordinary dusting-powder will prove efficient. A good one is the following :

Ry. Pulv. camphoræ,	ʒj ;
Pulv. talci,	ʒss ;
Pulv. zinci oxidi,	ʒij ;
Pulv. amyli,	ʒij.—M.

Sig. Use as a dusting-powder.

Or the following lotion :

Ry. Acid. carbolici,	ʒss ;
Zinci oxidi,	ʒij ;
Glycerini,	f ʒj ;
Aq. rosæ <i>vel</i> liquor. calcis, q. s. ad	f ʒvij.—M.

Sig. Use as a lotion.

More care will be required in the management of erythema intertrigo, lest acute eczema be induced. Prophylactic treatment will consist in the maintenance of absolute cleanliness and the avoidance of ill-fitting and irritating under-garments. Whether in infants or adults, the daily bath is the best safeguard, but the utmost attention should be paid to thorough drying of all contiguous areas of skin. This is the more essential with fat people. With infants, after drying the parts with a soft towel, they should be freely dusted with infant powder. Napkins should be changed as soon as soiled, and the surface cleaned and dried. This will suffice in nearly all cases of erythema intertrigo. In more severe cases powders and washes will fail to give relief. A bland ointment may then be used. One of the best is zinc-oxide ointment, or, better,

Ry. Zinc. oxidi,	ʒj ;
Unguent. aq. rosæ,	ʒj.—M.

The skin of some persons is irritated by any kind of fatty ointment. The substitution of the glycerole of starch will often prove very satisfactory. Whatever ointment be used, it should be applied so as to separate the folds of skin. This may be done by putting the skin upon the stretch, covering it with a soft cloth spread with the salve. The relaxed skin will throw the cloth into such folds as will fit neatly into the crease.

ERYTHEMA EXUDATIVUM MULTIFORME.

Erythema exudativum multiforme is an affection, probably angioneurotic in origin, characterized by multiform cutaneous lesions accompanied by exudation and symmetrical in development. Unlike erythema simplex, it is distinctly inflammatory, and is often characterized by constitutional manifestations. It is encountered mostly in young persons of either sex, and lasts usually from two to six weeks, sometimes longer. Its lesions are erythematous and papular, but at times they become tubercular, and even vesicular and bullous. Following their configuration, we have—

1. Erythema multiforme papulatum.
2. Erythema multiforme vesiculosum.
3. Erythema multiforme bullosum.

A number of sub-varieties are also recognized :

4. Erythema multiforme annulare.
5. Erythema multiforme iris.
6. Erythema multiforme vesiculosum circinatum (herpes circinatus).
7. Erythema multiforme vesiculosum iris (herpes iris).

Sometimes the patches assume the appearance of urticarial wheals and are accompanied by unusually violent burning and itching. This variety is known as—

8. Erythema urticatum (lichen urticatus).

Some authors describe also an *erythema gyratum seu figuratum*. This, however, is a secondary condition from the confluence of annular lesions, and does not merit the dignity of a separate variety, though the designation is sometimes useful as descriptive. There are no essential differences between the varieties.

The favorite locations for these eruptions is "first the extensor surfaces of the forearm and leg, especially the back of the hand, wrist, and ulnar sides of the forearm, the dorsum of the foot and tibial side of the shin; secondly, the face, cheeks, and neck; thirdly, the chest and abdomen. The back of the trunk, the buttocks, thighs, and upper arms are much less frequently affected, while the scalp, the flexures of the joints, the palms, and the soles are scarcely ever attacked by any form of true erythema" (Pye-Smith).

Erythema Multiforme Papulatum.—This begins symmetrically, with or without prodromal symptoms, as bright-red maculations or papules, usually upon the dorsal surfaces of the hands and feet, and quickly spreads to the corresponding surfaces of the forearms and legs. These spots, at first hardly larger than pin-heads, rapidly increase in size, until within a day or two they sometimes acquire the size of a finger-nail or even of a silver quarter-dollar. In the milder forms they are but slightly elevated above the surrounding surface. At first they fade entirely on pressure. When they enlarge their central portions grow darker or violaceous in color, and may become depressed. This appearance will often have been acquired within thirty-six hours, their peripheral portions remaining bright red. While this development of the original lesions is occurring new lesions are constantly forming beyond and between them, and gradually other parts of the body may become invaded (predominantly extensor surfaces). Thus the arms, thighs, trunk, and face may become involved. As the patches become older and livid they may no longer fade completely on pressure, but may have a brownish or yellowish pigmentation—an effect of the extravasation of red blood-corpuscles and blood-pigment. With the enlargement of old lesions

and the successive development of new ones the patches often coalesce and a parti-colored appearance is presented. This will be especially notable upon the extremities, which will be irregularly livid. They may also be cooler than normal. If the eruption prove intense and slow in involution, an ecchymosis-like appearance may be presented. If the disorder be not intense and the lesions undergo rapid involution, all traces of them will be speedily obliterated. When the inflammatory action is more severe exudation occurs in a higher degree. The papules rapidly acquire the size of a shirt-button, a dime, or a quarter-dollar, often within twenty-four hours. They may remain bright red, quite elevated, and hard to the touch. Often, however, as they enlarge their central portions become depressed and acquire a bluish color, and with their sharply-defined peripheries present a peculiar and characteristic appearance. At times a distinctly annular distribution is shown (*erythema annulare seu circinatum*), and the coalescence of a number of these erythematous rings, with obliteration of their points of contact, may give a figured embroidery-like aspect to the patches (*erythema figurata seu gyratum*); or a new lesion may develop in the fading center of an original one, and, again, a third one in the center of this, and form two or more consecutive erythematous rings (*erythema iris*).

At times the papules show a marked urticarial tendency. They then offer a close resemblance to urticarial wheals, often with considerable surrounding edema (*erythema urticatum, lichen urticatus*). The papules, however, are less transitory than are the lesions of urticaria, preserve their predilection for the extensor surfaces of the extremities, and take on the characteristic phases of *erythema multiforme*. The violent itching causes the patient to scratch, so that they are frequently denuded of their epidermis in their centers and covered with black blood-crusts. Their further phases are those of uncomplicated erythema papulatum.

Erythema tuberculatum differs from the preceding variety only in the size of its lesions. Apart from the element of size, it follows the same course. Its lesions, however, are fewer, though they may attain the size of a pigeon's egg. It may coexist with the smaller eruption. The term is rather an embarrassment to nomenclature than otherwise, but is perhaps useful in describing those cases in which sometimes a few gigantic papules are alone present.

Erythema Vesiculosum and Erythema Bullosum.—The vesicular and bullous forms of erythema are less common. They are due to a high grade of inflammation in which the exudation is free enough to collect under and raise the epidermis into vesicles and blebs. Rarely, a single small vesicle may form upon the center of the papule, and after a few hours rupture and form a thin scab. Subsequently, the lesion pursues an ordinary course.

A very interesting condition is observed when the spreading periphery of the papules becomes surmounted by a ring of small vesicles. This gives a central livid depression to the lesions and surrounding vesicular ring which is known as *herpes circinatus*. It corresponds to an erythema circinatum of intense grade. In the same manner, corresponding to an erythema iris in a spreading lesion, a series of two or more concentric rings of agminated vesicles (*herpes iris*) may appear. These two latter varieties are never very abundant, and often one, two, or more patches upon the dorsum of the hand or elsewhere may constitute the entire eruption, or this may be composed of a single patch of elevated erythema covered with a closely-arranged distribution of small vesicles. These vesicles show but little tendency to rupture and discharge.

Erythema bullosum is quite rare also. Here the exudation is collected

into a large central or peripheral bleb, sometimes as large as the thumb-nail. In severe cases the contents of the bleb may become sanguinolent. This variety rarely presents more than a few lesions, and usually coexists with another variety. Occasionally, however, a copious eruption of bullous erythema is observed, and may be mistaken for *pemphigus acutus*. Associated with other forms, especially with *erythema urticatum*, it is sometimes seen in young female immigrants (usually Irish) shortly after landing. The same pigmentary changes follow the evolution of the vesicular and bullous as of the erythematous and papular lesions.

When erythema multiforme completes its course, within twelve or fifteen days as a rule, no new lesions develop after the first few days. The patches each endure from ten days to three weeks, rarely longer, though the pigmentation may be long in disappearing. Even when confined to the extremities, the affection may last four, five, or six weeks, but usually these cases only have this duration when the general surface is more extensively invaded. Occasionally erythema multiforme is protracted almost indefinitely by rapidly-succeeding outbreaks of the efflorescences. Thus, one may have constantly recurring attacks for months and even years. Long intervals may separate recurrences. Usually erythema papulatum is not complicated by other lesions, but during an attack, especially in severe cases, all may be shown. In severe cases, also, the mucous membrane of the mouth and throat, the vulva, vagina, and urethra, may participate in the eruption. The epithelium becomes raised and opaque, and is stripped off, leaving irregular erosions that may become deep ulcerations, which give rise to much discomfort, and, if about the epiglottis or larynx, even to danger from edema.

As a rule, constitutional symptoms are absent in this disorder. In severe forms there may be malaise, anorexia, headache, and even fever; the latter, however, is not intense. Slight burning and itching are nearly always present, and in *erythema urticatum* may be violent. The connection between *erythema multiforme* and certain rheumatic conditions is well known, and, though not so pronounced as in the related affection, *erythema nodosum* is at times very striking. Pains, and even swelling and tenderness of joints, are not very infrequent concomitants. Sometimes the symptoms of *erythema multiforme* are engrafted upon other and much more serious affections. Of these, rheumatism, acute and subacute, is the most frequent, but sometimes the nature of the essential disorder is very obscure. It is probable that sepsis is the usual influence in these obscure, dangerous, and even fatal cases. Thus, there may be rigors, high fever, internal hemorrhages, intense inflammation, and ulceration of the buccal and faucial mucous membrane, endo- and pericarditis, delirium, coma, and death. In such cases, and in all other severe and dangerous morbid conditions in which erythema multiforme is a factor, it can only be regarded as symptomatic. It is interesting that eruptions quite indistinguishable from those of erythema multiforme are frequently evoked as a result of untoward action of drugs (*dermatitis medicamentosa*).

Etiology.—Very little is known of the causes of *erythema multiforme*. It is more often observed in young persons and during the spring and autumn months. This seasonal occurrence has been thought by some to point toward a malarial origin, and there is but little doubt that the eruption is an occasional expression of this influence. Unquestionably, also, it often shows affiliations with rheumatism, both occurring with other rheumatic symptoms and alone in rheumatic subjects. In older persons the gouty diathesis appears to evoke it at times, and its dependence upon this diathesis

is sometimes made evident by the disappearance of obstinate erythema multiforme under treatment for gout. As a purely reflex disorder it may form a symptom of grave and even fatal general disease, as sepsis, tuberculosis, etc. The varying conditions under which erythema multiforme may arise make it probable that its lesions and symptoms do not constitute an essential disorder, but that they are due to a primary and central trophic or nutritive disturbance of the nervous system, which in its turn may have its awakening influence in a variety of morbid conditions. Landois's teaching that erythema multiforme is to be regarded as an angio-neurosis is at present generally accepted. Beyond this we cannot go.

Pathology.—Beginning with active hyperemia and subsequent paresis of cutaneous arterioles and capillaries, and, later, of the venous capillaries, erythema is to be classified as an exudative inflammatory disorder. These characteristics are all that histological examination of the lesions will reveal.

Diagnosis.—The disorders with which erythema multiforme is most apt to be confounded are *tinea circinata*, *psoriasis gyrata*, the erythematous and papular syphiloderms. *Tinea circinata* has not developed symmetrically; its course is slower and more obstinate; the margins of the lesions are paler in color, less elevated, narrower, and surmounted by fine scales in which the microscope will reveal the parasite. The patches of psoriasis are slower in development; they are covered with thick, imbricated silvery scales, and pursue a course quite unlike that of erythema. The erythematous syphiloderm can only occasion doubt upon superficial examination. The location, course, and concomitants are different; the lesions do not present the central bluish discoloration. The papular, and especially the circinate papular, syphiloderm, which is so often seen upon the faces and necks of mulattoes, may at times closely resemble erythema papulatum. The history, the concomitant lesions, the chronicity of the patches will usually serve to distinguish it, but care will be necessary, as the one lesion may closely simulate the other. The vesicular and bullous forms present features that make it difficult to confound them with other disorders. *Erythema bullosum*, which may simulate pemphigus acutus, can readily be distinguished by considering the course of the eruption. *Erythema urticatum* (*lichen urticatus*) may readily be mistaken, at first, for *urticaria*, which, in fact, will be present; but the erythematous lesion will persist after the subsidence of its urticarial element.

Prognosis.—Erythema multiforme runs a favorable course, though relapses may be frequent and annoying. In serious or fatal disease in which it is present as a reflex symptom the prognosis will never depend upon it or have reference to it.

Treatment.—In most cases erythema multiforme runs a favorable course, uninfluenced by treatment, yet in more protracted cases arsenic often appears to exert a beneficial influence. From three to six minims of one of the arsenical solutions, given after meals, well diluted with water, will at times cause a rapid disappearance of the eruption. In distinctly rheumatic cases salicylic acid and the salicylates will be indicated. These agents are also useful in gouty subjects. For gouty patients the following prescription often answers admirably—viz. :

℞. Potass. acetat.,	ʒvj;
Vin colchici rad.,	fʒij;
Syrup. rub. idæi,	fʒj;
℞q.,	q. s. ut ft. fʒvj.—M.

Sig. Take a tablespoonful in water four times daily.

Quinine should be given in full doses if a malarial element be present. Apart from these agents, there are none that are specifically useful. In anemic and debilitated subjects iron, cod-liver oil, cinchona-bark, phosphorus, and tonic remedies generally should be given. Benefit will occasionally follow the administration of a saline purgative.

External treatment will hardly ever prove very useful. If itching be severe, soothing dusting-powders and lotions may be applied :

R̄. Gum. camphor. pulv.,	ʒj ;
Talei pulv.,	ʒv ;
Amyli pulv.,	ʒiij.—M.

Sig. Use as a dusting-powder.

R̄. Acid. carbolic.,	ʒj ;
Zinci oxidi,	ʒij ;
Glycerini,	f ʒij ;
Liquor. caleis,	ad Oj.—M.

Sig. Use as a lotion.

In *erythema multiforme urticatum* a more powerful lotion will be needed. One of the best is as follows :

R̄. Acid. hydrocyanic. dil.,	f ʒij ;
Chloral. hydrat.,	ʒj ;
Spts. myrciæ,	f ʒxiv ;
Emuls. amygdal. amar.,	f ʒvj.—M.

Sig. Use as a lotion freely.

In the severe disorders in which *erythema multiforme* is only symptomatic no treatment of the latter affection will be indicated.

ERYTHEMA NODOSUM.

(*Dermatitis contusiformis* ; *Erythème noueux*, *French*.)

Erythema nodosum is closely allied to, and sometimes coexistent with, *erythema multiforme*. It affects, preferably, young females about the time of puberty. It may occur in infants, and is rarely seen in adults. It appears symmetrically, usually upon the tibial surface of the legs and the dorsum of the feet, the backs of the forearm and hand, less frequently the back of the neck and the face, still more rarely the thighs and other parts of the body. The palms and soles are very rarely affected. The characteristic lesions are inflammatory nodules varying from the size of a pea to that of a pigeon's egg. They appear abruptly, with their long axes corresponding to those of the limbs and body. They vary in number from two or three to a dozen or more. At first they are bright rosy red, fading to purple, painful spontaneously, and often exquisitely so on pressure. They form elevations above the surrounding integument, and are infiltrated and hard, but in some cases soft and elastic, giving a deceptive simulation of fluctuation. They never suppurate, however. They burn rather than itch. After two or three days the lesions lose the bright-red color in their centers, which become bluish. This blueness gradually extends peripherally, and the nodules fade less readily to purple. The lesions now gradually become effaced, hyperemia slowly disappears, and in from ten to fourteen days only an ecchymosis-like discoloration

remains. Should no fresh lesions appear, the disorder is completed in about two weeks. Usually, however, fresh lesions do appear, either between the original ones or in different parts of the body. In severe cases the lesions may be connected by their hyperemic peripheral areas and form reddened or mottled patches interspersed with the tender nodules. At times a hemorrhagic element is very pronounced, and a decided purpuric tendency manifested. The occurrence of fresh lesions may prolong the attack for weeks and even months. Concurrently with the cutaneous nodules infiltrated areas may appear upon the tongue and the mucous membrane of the mouth and throat. It is said that these may undergo ulceration and necrosis.

General symptoms may precede, and nearly always accompany, the attack. These are malaise, nausea, and vomiting, anorexia, and fever, which latter is usually moderate. The painfulness of the lesions is often supplemented by painfulness of joints, distinctly rheumatoid in character, with redness and swelling.

The attack may be preceded by rigors, and in severe cases acute gastric and intestinal catarrh may be a complication. If the attack prove protracted, with accompanying fever, patients may become considerably reduced. It is even claimed that death may result. This can only be from dangerous complications or where the erythema arises as a symptom of organic or general disease.

The relationship between *erythema nodosum* and *erythema multiforme* is shown in the occasional concurrence of the two affections. The different lesions may be intermingled, or those of *erythema nodosum* may show upon the tibial surface of the legs, while those of *erythema multiforme* may appear in other parts. Similarly, a relationship with *purpura* or *peliosis rheumatica* is often very clearly indicated; indeed, it is not at all uncommon to find unequivocal symptoms of the two disorders coexisting.

Etiology.—No more is known of the etiology of *erythema nodosum* than of that of *erythema multiforme*. It is more unequivocally a disorder of early female life. It has the same tendency to prevail during the spring and autumn. The same etiological influences have been claimed for it. It is more apt to attack those whose general health has been reduced.

Pathology.—The changes are those due, first, to active and later to passive hyperemia, extending through the entire derma, with an overcrowding of blood- and lymph-vascular spaces and exudation of blood-cells, both white and red. According to Kaposi, "with regard to the suddenness of its development, its complete involution, and the anatomical findings the erythema nodule simply forms a more fully-developed and stable urticarial wheal."

Diagnosis.—The nodules of *erythema nodosum* are more symmetrically arranged than the wheals of urticaria. They are also more regular in configuration, more stable; they never present a pallid surface, and are painful, not only spontaneously, but to pressure. The resemblance to *erythema urticatum* may be closer, but the lesions of the latter affection are not painful. Confusion with *purpura* is to be apprehended when the erythematous and nodular stage has given place to pigmentation. The history and remains of active lesions will prevent error. When nodules assume a deeply purpuric character and rheumatoid symptoms are present, *purpura rheumatica* may be simulated. The lesions of the latter affection are not nodular; however, the close relationship between the two may render a definite diagnosis impossible. A hemorrhagic condition of lesions may excite suspicions of traumatism.

Careful examination of the whole body should be made in such cases, and will always reveal their true nature. Sometimes the stings of insects—bees, wasps, spiders, mosquitoes, etc.—will excite erythematous nodules much like those of erythema nodosum. The history and course of these will remove doubt. Gummy tumors of the extremities have been confounded with the disorder under discussion. Here, again, the history, the slow development, the ultimate breaking down, or the results of specific treatment will serve to distinguish. Finally, it is only necessary to direct attention to the localized periphlebitis often seen in varicosity of the veins of the lower extremity, which may present some elements of resemblance.

Prognosis.—This is always favorable. Sometimes a remarkable tendency toward recurrence will be observed. Such cases, however, have the same favorable outlook. Cases said to have terminated fatally may reasonably be attributed to other pathological conditions of which the erythema nodosum was simply an epiphenomenon.

Treatment.—Erythema nodosum is even less amenable to treatment than erythema multiforme. Fortunately, its tendency is almost invariably toward recovery within a few weeks. In debilitated subjects iron, quinine, cod-liver oil, arsenic, phosphorus, and wholesome food will be indicated. In rheumatic and malarial patients remedies appropriate to their special conditions should be given. If a hemorrhagic tendency be pronounced, ergot, turpentine, gallic acid, and other agents useful in purpuric conditions will be useful here. Local treatment may be restricted to evaporating and mildly astringent lotions. A weak lead lotion or washes of witch hazel, mild solutions of carbolic acid or of ammonia chloride, will remove the burning pain and tingling.

ERYTHEMA INDURATUM.

Although this affection was first described by Bazin, in 1861, as *erythème induré des scrofuleux*, and was stated by him to be not uncommon, it has only attracted the attention of writers within a recent period. Crocker, Jonathan Hutchinson, Colcott Fox, Patterson, and, more recently, Whitehouse, have supplemented the description of Bazin. The subjects of this affection are mostly young women of lymphatic or so-called scrofulous tendency, who are compelled to be much upon their feet. It invades the legs, usually below the calves, upon their posterior surfaces. Bazin has seen it upon the face. It appears as red patches which are indurated, the induration extending to the subcutaneous cellular tissue. The redness fades on pressure, which excites no pain. The patches become darker in color, even livid or violaceous, and gradually merge into the normal skin at their peripheries. They do not itch. Quite extensive areas of erythematous induration may result from the coalescence of a number of neighboring patches. Recent writers have noted a pronounced tendency toward ulceration. The ulcers are shallow, indolent, and irregular. Hutchinson insists upon this ulceration as a characteristic symptom. This appears, however, to be by no means the case. Erythema induratum is often seen in debilitated persons who present tuberculous lesions in other parts of the body; often, again, however, no concurrent form of tuberculosis is present. The course of the affection is very chronic, the patches slowly undergoing resolution under improved hygienic conditions or breaking down into ulceration.

Erythema induratum differs from erythema nodosum in its freedom from pain, its distribution, its more chronic course, its tendency to ulcerate, the

absence of the ecchymotic changes of color and of the rheumatoid symptoms of the latter affection. From late syphilitic lesions it may be distinguished by the history, by the absence of pain, its distribution, the absence of other lesions and of constitutional symptoms, and the failure of antisyphilitic treatment to modify its course.

Under favorable conditions the prognosis is good.

As the subjects of this affection are usually debilitated and out of health, restorative agents are indicated in the treatment. Good food and clothing and improved hygienic surroundings should be supplemented by cod-liver oil, iron, and arsenic. Local medicinal applications are of but little use in non-ulcerating cases, but when ulceration has taken place mild antiseptic and stimulating washes and ointments prove very useful. Hutchinson recommends an ointment containing four grains of bisulphuret of mercury to the ounce. Carbolated washes and ointments are always useful. The support afforded by a good bandage forms a very important element of treatment. Under proper constitutional treatment and the application of a bandage, especially if of solid rubber, ulceration may be averted and the cure greatly expedited.

ERYSIPELAS. (C. W. ALLEN, M. D.)

(St. Anthony's Fire; *Ger.* Rothlauf; *Fr.* La Rose.)

Definition.—Erysipelas is an infectious inflammatory infiltration of the skin characterized by marked redness, swelling, and tenderness of the patch, which tends to spread at the periphery. It develops with constitutional symptoms, runs an acute course, and terminates by resolution, usually within a fortnight.

Symptoms.—A chill or rigors, gastric symptoms, frontal headache, and malaise usually precede the appearance of the reddened patch by twenty-four hours or less. There is often soreness of the throat also, especially in facial cases. An inflamed area of moderate size, rarely exceeding the short diameter of a lemon, is now discovered. The swelling is bright red, changing to dusky red or reddish brown, either painful or tender, tense, possibly pitting on pressure, and giving rise to a serous infiltration which may produce bullæ or vesicles over the surface. The patch spreads for three to five days, always with an abrupt margin, and may involve only a limited area of integument or the whole surface of the body. Desquamation follows, and is proportionate to the intensity of the inflammation. Unless recrudescences occur—and they are not uncommon—the process is now at an end, save perhaps a slight amount of remaining low-grade, firm edema (*c. œdematodes*). In less favorable cases the process is prolonged perhaps for several weeks by the involvement of new areas or extension for a second or even third time over regions previously affected. I wish to emphasize this, because it has been stated that a territory once invaded becomes immune for a time to further invasion. This has been called *c. migrans*. In some instances an erysipelas may spread rapidly by sending out processes which shoot off just like streaks of lymphangitis beyond the more slowly advancing margin of the patch. The lines of cleavage seem to be generally followed in this mode of spread. Repeated attacks, especially upon the extremities, result in a permanent thickening of the skin, due to persistent edema, with abundance of exudation-cells, which become converted into connective-tissue corpuscles. In this way a condition of elephantiasis may be established. During the course of an attack of erysipelas there is fever of moderate intensity, or there may be morning fall and evening exacerbation, carrying the temperature to a high point. I have

personally observed it above 107° F. The temperature curve is usually indicative of the extent and intensity of the inflammatory process.

After the temperature has once fallen to near the normal a sudden rise indicates a new area of involvement, and should lead to a search for a bright patch either at a distant point from the old one or in the midst of territory already once swept over. At the height of the process, and even quite early in head cases, especially where the scalp is involved, delirium occurs and may be of pronounced type. The tongue, at first dry and furred, subsequently becomes glazed, raw, and perhaps fissured.

The urine is scanty, of high color and strong odor. Analysis shows a diminution in the chlorides, and not uncommonly the presence of albumin.

Etiology.—Within comparatively recent times the causes of erysipelas have come to be better understood. In 1883, Fehleisen described a micrococcus which he regarded as specific, and which he called the streptococcus erysipelatis. The following year Rosenbach found in pus the streptococcus pyogenes, which was morphologically identical, but behaved differently under cultivation. Since then many observers, including Fränkel and Knorr, have considered the organisms identical, and it has been found (Hajek) that the streptococcus pyogenes may produce erysipelas as well as suppurative processes, and that the streptococcus erysipelatis occasions the latter at times, instead of erysipelas. These bacteriological findings agree with clinical experience, which teaches that erysipelas often starts from a focus of pus, as, for example, from a pustule of ordinary nature upon the skin, and that, after an attack of erysipelas, the surface involved and the neighboring parts not infrequently become the site of pustules, furuncles, or abscesses.

The dermatitis of erysipelas can be excited, it would appear, by more than a single agent, and thus we are forced back to the position held by many pathologists before the days of bacteriology. The presence of various skin-diseases, solutions of continuity of surface, as in traumatism, the existence of acute or chronic disease of the throat and nose, lymphatic disease, such as is seen in elephantiasis, all favor the entrance of erysipelas-producing organisms. I have, for example, seen repeated attacks of facial erysipelas in an old subject of chronic suppurative disease of the lachrymal duct. In like manner, one often observes the facial form in those whose nasal mucous membranes are in a pathological condition, and it is especially frequent where a naso-labial fissure exists. In 100 consecutive cases of my own just one-half showed some skin-lesion. Undoubtedly, many cases originate from the throat. The tonsil has long seemed to me to furnish favorable conditions for the penetration of micro-organisms, and I have a number of times been convinced that here was to be found the real *porte d'entrée* in cases of doubtful origin. This would in a measure explain the preponderance of facial over other cases—a preponderance which is marked, considering that no region of the body is exempt.

Fifty per cent. of the patients I have treated have been face-cases, while hospital statistics, both those compiled by myself and those of the Vienna Hospital, give a percentage of over 63. It is unquestionably the proximity of the various mucous membranes which makes erysipelas faciei so comparatively frequent. Sometimes the process begins upon the mucous surface. In some women an erysipelas of the face or other region will show itself as a recurrent affection at the time of the menstrual epoch. In the new-born the umbilicus is a frequent starting-point, while not a few cases have their origin in ritual circumcision. The most frequent etiological factor

in infancy I have found to be the vaccination ulcer, and next to this comes the pock of varicella.

Pathology.—Erysipelas must be classed as an infectious dermatitis closely allied to lymphangitis. It is a wandering inflammation of the skin, starting in some broken surface or pent-up pus-collection. The tense, brawny, or edematous condition of the skin is due to serous exudation, swelling of connective-tissue fibers, and fibrin deposit. Leukocytes are abundant about the blood-vessels, while in severe cases the streptococci infiltrate the lymph-spaces, which are dilated, and where, under appropriate staining, they may be seen in abundance. The blood-vessels usually escape, though Billroth, Recklinghausen, and others have found masses of cocci within the vessels of internal organs. The subcutaneous areolar and fatty tissues may be invaded by the cocci, but never to such an extent as is the corium.

In proportion to the amount of serous exudate, and the rapidity with which it is poured out, vesicles or bullæ develop, a local separation of the horny layer of the epidermis being effected and pressed up by the fluid. Upon the scalp the hair-sheaths become swollen from the same cause, and separated from the roots, resulting in the *defluvium capillorum* often observed. In some cases, where more or less permanent thickening of the skin remains, especially after recurrences in the same area, there would appear to have been a proliferation of wandering cells, which become fixed cells and serve to form connective tissue. Thus conditions of pachydermia or pseudo-elephantiasis are produced, not to be confounded with true elephantiasis, in which latter condition, however, recurrent attacks of erysipelas are to be observed.

The streptococci appear as short, wavy, sometimes rosary-like chains. They grow on almost all media, but are readily destroyed by germicides and by heat.

Diagnosis.—This is not attended with difficulty. Erythema, acute eczema, and dermatitis phlegmonosa are the only diseases likely to cause error. Dermatitis due to thapsia, poison-ivy eruption, abscess, especially alveolar and dacryocystitis, are conditions which might be mistaken on superficial examination.

In erythema there is absence of pain and constitutional symptoms, and the border of the patch is not so abrupt, but fades into the surrounding skin. In eczema there is much more itching, but fever and other symptoms are lacking. So, too, with facial urticaria, which occasionally simulates erysipelas. Taken by themselves, the bullæ might suggest pemphigus or drug-eruption. More difficult is an early diagnosis from the evidences of systemic derangement before the erysipelatous blush makes its appearance. The chill, headache, and furred tongue may lead to a shrewd guess, especially in those predisposed by former attacks.

Prognosis.—An uncomplicated attack of erysipelas may terminate spontaneously within a fortnight. In the very young and very old, and especially in the presence of marasmus and chronic processes (Bright's, diabetes), the prognosis is unfavorable, and must be very guarded in the puerperal state and in drunkards. My hospital statistics show a mortality of 5 per cent. In 100 cases in city practice which I have recently reported, only 3 per cent. proved fatal. Of these 50 per cent. were facial cases, in which the mortality is usually to be reckoned at from 1 to 2 per cent. In vaccinal erysipelas and that starting from the umbilicus in infancy the percentage of deaths is often very large, especially in institutions. Relapses and recurrences are frequent.



FIG. 232.—Micrococcus erysipelatis.

Some patients suffer repeatedly, and often at about the same season, perhaps for several years in succession.

Treatment.—This embraces constitutional and local measures and the management of complications. Therapeutic methods have changed somewhat in recent times, and bacteriology has undoubtedly had an influence upon prevailing practice. The explanation of the numerous vaunted "cures" lies partly in the fact that no internal remedy exerts any decided influence, and partly in the affection being in the majority of instances self-limited and tending to spontaneous resolution after a period variously estimated at from eight to sixteen days in uncomplicated cases. The claim of any remedy must therefore be based upon its powers to jugulate the process or confine it to a period of a few days. It is too grave a disease, and too likely to present serious complications, for any expectant plan to be justifiable. The aim should be to abort it, and, failing in this, to bring it to the most speedy termination.

Constitutional measures embrace a diet made as concentrated and nutritious as can be given; alcoholic stimulation for asthenic cases, especially in elderly subjects; sufficient quinine to keep down the temperature, and subsequently administered in tonic doses, or, if the temperature is very high, one of the newer antipyretics. No reliance can be placed upon any internal drug-treatment to cut short the course of the disease, but it is to be employed mainly as a means of meeting the indications as they arise. At times ichthyol, salicylate of sodium, camphor, iron, bichloride of mercury, and other drugs seem to act beneficially, but one must look upon internal treatment as mainly symptomatic. The natural functions of the system are to be carefully supervised and any irregularity promptly corrected. In constipation calomel and the salines are best given; in concentrated and scanty urine, diuretics. Debility is to be met with tonics, heart weakness with strychnine, digitalis, camphor, caffeine, etc.

Local measures are required to relieve the distressing symptoms, and, besides, they are, in many instances, capable of arresting the onward march of the inflammatory process. Out of the mass of those which have been recommended few deserve special consideration. Following the discovery of a streptococcus, thought to be essential to the existence of erysipelas, the germicidal remedies took a leading place. Pre-eminent among these stands ichthyol, which, either from its antibacterial or reduction properties, or both combined, has proven beneficial, and has steadily gained favor as an external application. It can be applied in watery solution or may be combined with glycerine, vaseline, lanoline, or other fatty substance, in 10 to 50 per cent. strength, wherever possible. I have found it best applied in combination with collodion. By this means we secure the additional advantage of compression and exclusion of the air. The streptococci, being aërobic, would naturally lose their virulence the sooner if the oxygen could be entirely shut off.

Among other recently advised applications is that suggested by Besnier of compresses soaked in 5 per cent. salicylate of sodium; that proposed by Tassi of a saturated solution of picric acid in water; and Barwell's recommendation to cover over the affected area with white-lead paint, which makes an occlusive dressing, but one hard to remove after its object is accomplished. At the New York City Hospital for a number of years compresses of bichloride, 1:5000, applied hot, were in favor; but more recently it has been customary to wash the region affected with 1:1000 bichloride solution, and then to apply a 50 per cent. ichthyol ointment. Here, too, benzoated collodion, containing about 50 per cent. of compound tincture of benzoin, has

been a favorite application. In Vienna the continuous bath has been employed with good results in severe cases.

Injections of carbolic acid of 1 or 2 per cent. strength have been made surrounding the patch. The disadvantages are that it must be repeated daily, and it is likely to occasion abscess. Salinger and others, following DaCosta, have used pilocarpine in the same manner, about one-sixth grain being injected every four hours until pronounced physiological effects are produced. Creoline solution (1 in 15), a spray of corrosive sublimate in ether (1 in 100), guaiacol pure or diluted, thiol in 20 to 40 per cent. solution, are other recently advocated measures.

Surgical and mechanical treatment came into vogue about 1886, when Kraske introduced scarification, which, since modified by Riedel, has been known as the Kraske-Riedel method. It consists in making criss-cross incisions, $\frac{1}{3}$ inch in length and fifteen to twenty to the square inch, a short distance from the margin of the patch or including the margin, so as completely to surround the diseased area with these superficial cuts just deep enough to penetrate the corium. Over this is placed a compress wet with a 5 per cent. carbolic or a 1:1000 bichloride solution, the operation field having first been thoroughly irrigated with the same solution. The objections to the method for general use are that it is painful, sometimes necessitating an anesthetic; that it cannot be used in face-cases for fear of scar-production; and that it does not prove more successful than another method of which I shall now speak. My personal experience with scarification has not been very favorable; still, when practised, I believe the quadrilateral incisions are best made at the distance of an inch from the apparent border of the erysipelatous patch.

I think the method proposed by Wölfler in 1890, of applying tightly about the parts surrounding the patch a band of adhesive plaster is equally efficacious, and for other reasons to be preferred. The band can be applied when the face or scalp is implicated. A simple adhesive strip an inch wide and sufficiently long to completely surround the part is applied at the distance of an inch or more from the advancing border, so as to make firm pressure upon the underlying bony or muscular tissues. The firmer the parts upon which pressure can be exerted, the greater are the chances of success. I have now employed the strap in over 30 instances, and have repeatedly observed the spread of the disease abruptly stopped at the plaster barrier.

If the erysipelas spreads beyond the strap, a second one should be applied a little farther away, but it is better to leave the original strap *in situ*, unless too much tension has been caused. Another important point is to leave the strap upon the skin for several days after all sign of the disease has disappeared and the temperature has fallen. Recurrences are observed if the band is too early removed.

The theory of its action is that by compressing the lymphatic channels and spaces in which the germs are supposed to circulate, their advance is hindered. It has been my custom for several years to apply the bands, if possible, on both sides or so as entirely to surround the patch, and to paint the whole area thus included with a 25-50 per cent. mixture of ichthyol and collodion, varying the strength and number of coats according to the amount of inflammation, edema, bullous formation, etc. The results of this combined method have surely been, in my hands at least, superior to those obtained by other plans of treatment. By it several important indications are met—*i. e.* the prevention of spread, the exclusion of atmospheric air, antisepsis, and reduction.

It may be that the adhesive band, excluding in a measure the air from the parts it covers, exerts a beneficial action in this way also.

Various prepared tissues—thin rubber, oiled silk, etc.—have been employed in the attempt to exclude the air, and Kraell has recommended an elastic band to replace the adhesive strip, especially about the head.

ERYSIPELOID. (C. W. ALLEN, M. D.)

Definition.—Erysipeloid is the name given by Rosenbach to an inflammatory process developing in the skin as a result of special infection. It has likewise been called erysipelas chronicum, erythema migrans, etc. It is supposed to depend upon certain micro-organisms found in decomposed or decomposing animal matter.

Symptoms.—Usually a livid red or possibly a violaceous, itching, burning, or tingling circumscribed patch surrounds a point at which infection has occurred. This enlarges by a zone-like extension, while the center of the patch fades. There is some ulceration at the slowly extending margin, which may take on a wavy or serpiginous outline. The hands are the parts principally involved, and one frequently sees several zones starting from different points, and perhaps intersecting each other. The subjective symptoms persist until the redness disappears.

Etiology.—Usually a solution of continuity is readily found which has given ingress to the infectious organisms. Sometimes no wound of the surface can be made out. Occupation has an important bearing, since those who handle fish, meat, poultry, etc. are those who are mostly affected, and the hands are for obvious reasons the parts mostly involved.

Pathology.—Rosenbach's early researches led him to believe the micro-organism was a coccus, but subsequently he thought it was of the cladothrix family. From cultivations he was enabled to inoculate the disease, with the development of symptoms in about forty-eight hours.

Diagnosis.—The appearance of slowly-extending rings upon the fingers, palms, and backs of hands, or perhaps the feet in those who go bare-footed, clearing in the center and fading into a yellowish color without desquamation, points to this affection. Erysipelas is excluded by absence of severe constitutional symptoms; ringworm, by the absence of vesicular elements at the periphery and the non-desquamating end-stages; erythema multiforme and erythema iris, by the local subjective symptoms and lack of concentric rings, and particularly, in many instances, by the presence of a visible point of infection.

Prognosis as to duration depends upon the avoidance of reinfection, and upon whether or not an appropriate local treatment is instituted. The average case lasts from one to three weeks before spontaneous cure sets in. Under treatment it may be cut short inside of a week.

Treatment.—No other drug has given such general good results as ichthyol. It may be applied as an ointment of 10 to 20 per cent. strength, preferably made with lanolin and lard. A collodion or traumaticine paint may likewise be used, and it has the advantage of making a more cleanly application for such exposed parts. The various antiseptics have also been employed with benefit.

PELLAGRA. (C. W. ALLEN, M. D.)

Definition.—Pellagra, likewise called Lombardy leprosy, is a systemic disease due to a toxine generated in unwholesome maize, which when eaten

produces, besides trophoneurotic changes, peculiar skin-manifestations in the parts most exposed to the sun. It was first observed in Spain (1735), where it is still found in the northern districts, as well as in North and Central Italy.

Symptoms.—The early symptoms are referable mainly to the cerebro-spinal and digestive systems, and those implicating the skin appear later. Headache and articular pains are prominent; there are weakness, lassitude, vertigo, burning pain in the back and extending from it into the extremities, along with gastro-intestinal derangements.

The exposed regions of the surface, such as face, hands, the antero-lateral surfaces of the neck, and in some the dorsum of the feet, the back and the chest, suddenly manifest a diffuse bright or dusky erythema with swelling, burning, and itching which persist for a fortnight. Petechiæ and bullæ may appear. As the redness subsides a dirty-brown discoloration replaces it, and desquamation follows, but the parts are left thickened. After several years atrophy begins in the parts which have perhaps each spring been the seat of renewed activity of the congestive process. The skin then becomes lax and wrinkled. In the winter-time there is remission of the symptoms. Finally, the head-symptoms become alarming; there are emaciation, great weakness, and perhaps the redness extends to other than the exposed parts. Delirium may now set in or the patient may become insane, with maniacal and suicidal symptoms; a typhoid state may develop, and death from asthenia ensue.

Etiology.—Faulty hygiene and poisonous cereal food, like that produced by the presence of ergot, are the etiological factors in the vast majority of cases. (Lombroso has extracted from fermented maize, besides a fatty oil, the substance termed *pellagrozein*, which when administered produces the symptoms.)

Pathology.—The sympathetic and vagus are believed by this investigator to be affected by a toxine.

The anatomical changes found in the brain, kidney, spleen, liver, etc. are due to inflammatory processes.

Besides the atrophy of the skin, atrophic changes are found in the organs mentioned, as well as in heart and lungs, and there may be fatty degeneration, while pigmentary changes are quite frequent.

Diagnosis.—There is a pseudo-pellagra, occurring sporadically, having somewhat similar, but not so decided, symptoms. The region in which the affection is observed would at the present time serve best to prevent error.

Prognosis.—The average duration is five years.

Treatment.—Improve the hygiene and sustain with tonics. Arsenic is the only drug which seems to offer much in a curative way.

ACRODYNIA. (C. W. ALLEN, M. D.)

Definition.—An epidemic erythema having close relationship to pellagra. Alibert gives an account of an epidemic in France in 1828. It is now observed at rare intervals in prisons and in soldiers' quarters.

Symptoms.—At first various digestive irregularities are present, followed by nervous symptoms and edema of the hands and feet as well as of the face. Pricking, burning, and hyperesthesia of the extremities are succeeded by anesthesia, and this in turn by erythematous patches, mostly upon the palms and soles. These may be accompanied by papules, bullæ, boil-like lesions, and such painful sensations that the term *cheiropodalgia* has been ap-

plied to the condition. Desquamation occurs in large flakes, and deep pigmentation follows, especially in warmly-clad parts.

Etiology and pathology are obscure. Inflammation of the spinal arachnoid has been found several times. It seems to be related to pellagra, and, like it, caused by the use of spoiled grain.

Prognosis.—Recovery is the rule inside of a few months. In severe cases atrophy of the limbs, paresis, or ataxic symptoms may result. In advanced life it is often fatal.

Treatment is symptomatic. Counter-irritation over the spine has been employed.

FURUNCLE. (C. W. ALLEN, M. D.)

Definition.—Furuncle, or boil, is an acute circumscribed inflammation of the skin, and usually of the subcutaneous tissues, beginning as a small induration, which gradually assumes a conical elevation. It is attended with throbbing pain and the formation of a central necrosis of tissue, usually called the "core," which is extruded with suppuration, leaving a round and deep volcano-like opening which quickly heals.

Symptoms.—Usually upon the day after the hardness and tenderness have appeared in the skin there is found to be localized heat and redness, while pain and tenderness are increased and swelling of variable degree occurs. The evidences of suppuration become manifest in different ways, according to the origin and location of the process. If of follicular origin and superficial, a yellowish apex or the formation of a vesicle may be already apparent. If the process implicates the connective tissue, signs of suppuration may be delayed for several days, and then show rather as a thinning and bluish hue of the skin over the central portion or as fluctuation. Such diffuse, abscess-like furuncles may open at several points, like a carbuncle. Such compound furuncles are usually attended with considerable suppuration, and a necrosed plug can be extracted from each opening of the honeycombed surface.

A week or more is required for the plug, be it single or multiple, to become detached by suppuration. As soon as this has occurred and the contents are thrown off, there is a marked sense of relief, not only from the acute throbbing pain, but from the sense of stiffness and soreness in the surrounding parts. Small furuncles may run their course quickly, at times without pronounced subjective symptoms.

The term furunculosis is applied to that condition in which a diathesis would seem to exist and boils continue to develop for a long time—months or even years—perhaps implicating, coincidently or successively, various regions of the body. Patients suffering from this chronic state are usually debilitated from some cause, or become so from the constantly recurring pain and attending suppuration.

Etiology.—In speaking of the cause of furuncles we must distinguish in a measure between those which arise spontaneously in otherwise healthy individuals, and are termed idiopathic, and those which accompany diabetes, the debility of advanced years, malnutrition, etc., and are spoken of as symptomatic.

In the former the lesions are usually single, or at least those following the first to appear can usually be traced to infection from it, while in the latter multiplicity is the rule, and the term "furunculosis" can be more justly applied.

Irritation of the skin is an important etiological factor whose influence is

manifest in various pruriginous dermatoses in which the skin is injured by scratching, as well as in certain regions subjected to friction, such as the back of the neck, the buttocks, the inner surface of the thigh, etc. A sporadic furuncle may lead to the development of others in its neighborhood by the faulty application of poultices, ointments, and moist dressings, which in themselves cause maceration of the skin and favor the penetration of pyogenic and other organisms.

That a micro-organism peculiar to the affection exists would seem probable, but till now none has been isolated nor experimentally proven to be such. The staphylococcus pyogenes aureus et albus is usually present, and Bockhart, Voituriez, and others have succeeded in producing the disease with pure cultures. An individual predisposition or a cutaneous surface rendered fertile for the germs by disease or change in the secretions seems indispensable.

Pathology.—No one, so far as I am aware, has made an anatomical study of the early stages of furuncle. Billroth believed that the process usually originates in the follicle of a hair- or sebaceous gland, while Wertheim has advanced the plausible theory that the prolongations of the core, which can at times be extracted in long shreds, arise from implication of the trabeculae which pass into the connective tissue from the base of the follicle. It is highly probable that the tissues adjacent to the follicle become early involved, even if the process always has an intrafollicular origin. The necrosis of tissue has been thought by some observers to be due to a thrombosis in the follicle's vascular supply.

Diagnosis.—This presents no difficulties except in the very onset, when a solitary boil may be mistaken for an inflamed aene-papule or other mildly inflammatory lesion. In the case of multiple furuncle (Vespajo) the condition is to be differentiated from common anthrax or carbuncle and from Verneuil's hydrosadenitis phlegmonosa.

Prognosis is usually favorable, but in diabetes and states of debility the probability of recurrences and of the chronic condition furunculosis is to be kept in mind.

Treatment.—Constitutional treatment is here of very great importance; for, while believing the direct cause is to be attributed to the action of micro-organisms introduced from without, still the soil must be rendered unsuitable for their development in order to prevent constant recurrences. This becomes the more important in diathetic disorders and enfeebled states of the system. In diabetes the amount of sugar excretion must be lessened by diet, exercise, and appropriate medicinal measures. In anemic states iron, mercury, or other so-called blood-tonic may be useful, and mineral springs are recommended, while in marasmus, malnutrition, and allied disorders cod-liver oil, forced nutrition, and hygienic regulations may do good.

The important drug, however, in the furuncular diathesis, if we may speak of such a condition, is sulphur. Now, given in small quantities, the sulphides are rapidly converted into sulphates, which are not excreted by way of the skin, and hence fall short of accomplishing our purpose. Sulphuret of calcium has been thought by many to prevent fresh boils from cropping out, while others have failed to observe any good effects from its use. Properly administered, it undoubtedly hastens maturation, but other preparations are probably more efficacious in preventing new lesions. A pill containing $\frac{1}{10}$ grain can be given every hour; 8 gr. daily have been recommended to be given in divided doses. Better results have been secured by the writer, and others have had the same experience, from the use of hyposulphite of sodium in doses ranging from 10 gr. to a dram, given in a sufficient quan-

tity of water, either in the smaller dose several times daily between meals, or in one maximum early-morning portion, the indication being to secure an elimination of the drug through the cutaneous glandular apparatus, and thus to attack the supposed causative agent from within.

Some authors recommend intestinal antiseptics, such as the salicylate of bismuth, beta-naphthol, etc. If sulphocarbonated water is employed, as has been recommended, the benefit of cutaneous elimination is secured at the same time. This may be prepared by shaking in a bottle 25 gm. of purified sulphide of carbon with 500 gm. of boiled water, to which $\frac{1}{2}$ a dram of essence of peppermint can be added. Of this a dessert-spoonful can be given six or eight times daily in milk or weak wine and water.

Local treatment is to be directed first toward the abortion of the individual boil, and, this failing, as it often does, toward the hastening of the process of elimination of the necrosed tissue, so that granulation and cicatrization may occur, and, thirdly, toward the prevention of subsequent lesions. The first object may be attempted by the early and oft-repeated application of a strong tincture of iodine. Carbolic acid, which has been frequently tried, is not to be recommended. Indeed, the iodine has not given very favorable results in the writer's hands, but appears to offer greater chances of success than other abortive measures. To produce good results it must be introduced as far as possible within the follicular opening or made to penetrate deeply into the center of the lesion by means of a pointed probe, glass applicator, or wooden toothpick; a very good applicator is the sharp-pointed glass pen used for marking linen with indelible ink. If a hair perforates the center of the incipient boil, it is to be first removed; but pressure made in the hope that the core will be expelled is likely to do harm rather than good. After the iodine has been well worked into the central opening, and in instances in which there is no such opening to be found, the exterior of the lesion, and especially the summit, should receive one or more coats of the iodine several times daily.

Poultices and fomentations, unless prepared with antiseptics, are too apt to favor the penetration of germs into new follicles, and thus to perpetuate the trouble. Still, applications should be made to hasten the natural process of elimination of the plug by suppuration. Having failed in the attempted abortion, the actual lesion may be covered with salicylated soap plaster, 5 or 10 per cent., or with a salicylic mercurial or carbolic plaster mull; and over this any moist dressing made with an antiseptic solution, and applied hot or cold according to the feelings of the patient.

To prevent renewed outbreaks the surrounding parts should be carefully bathed with an antiseptic wash, such as 1:1000 bichloride, several times daily, all undue irritation being avoided. The patient's surroundings, especially in reference to purity of air and water, should be carefully investigated.

CARBUNCLE. (C. W. ALLEN, M. D.)

Definition.—Common anthrax has been defined as a diffuse furuncle presenting multiple openings. This definition applies more properly, however, to the agglomerate or compound boil mentioned in the chapter on Furunculosis, from which at times an anthrax seems to spring; but that they are distinct processes seems quite certain. The carbuncle is much larger, flatter, more painful, and much more likely to have disastrous consequences, especially in the aged.

Symptoms.—In carbuncle there is at first, just as in furuncle, a cellular-

tissue infiltration; but, unlike the latter, it may have an area equal to that of the palm of the hand or at least as large in circumference as a silver dollar. This infiltrated area is tense, hard, tender, and perhaps spontaneously painful. It occurs principally in the regions of the nucha, lower portions of the back, buttocks, and the face, especially on the lip. Instead of a single central opening, as in the boil, numerous small perforations of the gradually thinning skin take place, and a colander-like appearance is presented. After a time the whole skin-covering is apt to be involved in a process of necrosis, and with or without surgical aid the whole extent of dead and sloughing tissue is cast off. During the process the constitutional symptoms are pronounced, there being fever, and other symptoms may be so severe as to cause death, while in other instances I have seen even extensive carbuncular lesions produce scarcely any effect upon the patient's well-being.

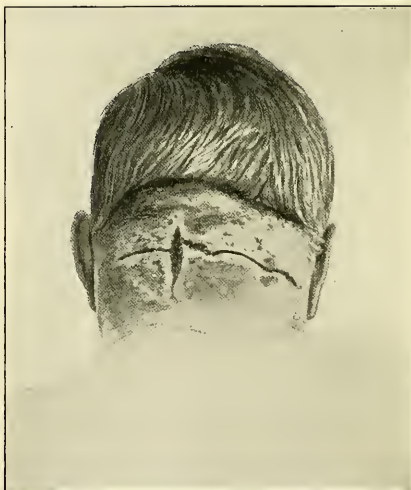


FIG. 233.—Carbuncle, showing vertical and transverse incisions, the latter nine inches in length (from a case recently under the author's observation).

It must be remembered that this variety of anthrax may be an indication of diabetes or some vitiated state of the system, as in the case of furuncle.

Etiology.—This has not been fully and definitely established, but there is little doubt that specific micro-organisms will be found, as they have been for anthrax vera. Symptomatic and idiopathic divisions may be made, just as for furuncle, the former implying the existence of a nutritive derangement of the body acting in a causative manner. Diabetes and, possibly, alcoholism are the two most active factors. Repeated attacks of boils and the various causes which favor their recurrence undoubtedly predispose to carbuncular anthrax. The two conditions are most closely allied.

Pathology.—Little study has been made of the varied stages of carbuncle-development, and little is known about it. It is thought by some that a thrombosis occurs in the vessels supplying the point of origin, whence

the tissue-necrosis. The anatomical conditions are much the same as in furuncle, but more extensive and correspondingly more complicated.

Diagnosis.—The location of an acute, rather diffuse, boggy inflammation in the situations most common to carbuncle, especially in diabetics or following crops of furuncles, will point at once to the right diagnosis. Instances, however, occur in which the border-line between a compound furuncle and true carbuncle is not distinctly drawn, and in lesions which remain small and give rise to little constitutional disturbance the question of diagnosis may remain for a time in doubt. The necrotic tissue of carbuncle, however, comes away in long grayish tape-like shreds; while in furuncle there are greenish pus-covered plugs corresponding to each surface opening, the intervening tissue remaining intact.

Treatment.—In carbuncle, as in boil, early efforts to jugulate the process are advisable, though not always successful. Probably most reliance is to be placed upon early and constant applications of strong camphor in alcoholic solution by means of cotton covering the part, or by the energetic use of strong iodine solutions. Early incision or attempts at excision are not to be recommended, nor are poultices of much avail, though these are of use to assuage pain where found to be more grateful than ice-cold applications. After suppuration is well established the throwing off of necrosed tissue is encouraged by hot fomentations and flaxseed cataplasms. Though incision as a means of aborting carbuncle is rarely of much value, in lesions upon the lip or other portions of the face it is considered by many imperative at an early stage, since for some reason this situation is attended with great gravity and places the patient's life in jeopardy. In other locations the incisions may be made at a stage when pus-formation is present. They may be made so as completely to cross the inflamed area in two or more directions, and so as to extend through the whole depth of the tissue-necrosis. Antiseptic washes may then be freely used, and a 5 per cent. carbolic or a 1:2000 bichloride solution may be constantly applied. If a flaxseed hot poultice is employed, a piece of lint covered with a 5 per cent. salicylic soap plaster or a 2 per cent. resorcin ointment can be first spread over the lesion.

Peroxide-of-hydrogen solution injected carefully into the surface openings aids in removing the pus, hastens the elimination of the dead tissues, and adds to the comfort of the patient.

The acid nitrate of mercury finds favor with some as a local application, but its application may prove quite painful. Others have advised the use of potassa fusa after incision to convert the slough into an eschar, which is said to be rapidly separated and cast off, leaving a granulating surface. Any stimulating antiseptic dressing can be applied for the after-cure to secure cicatrization. Aristol in powder or ointment usually answers well. The oxyiodide of bismuth furnishes an admirable dusting-powder to hasten the process of repair.

Constitutional treatment may be ordered on general lines. If there is much debility, quinine may be of decided benefit. If anemic symptoms are present, iron will usually be beneficial. If intestinal antiseptics seem to be called for, beta-naphthol, salicylate of bismuth, salol, etc. can be given until their effect is produced.

MALIGNANT PUSTULE. (DOUGLASS W. MONTGOMERY, M. D.)

Definition.—Malignant pustule is the primary lesion caused by the inoculation of the bacillus anthracis (Fig. 234) in the skin or in any of the exposed mucous membranes in man.

Synonyms.—The synonyms of this disease have given rise to much confusion. The name "coal" was a favorite with the early writers on medicine in describing lesions as either red or black as a coal, and when one of the lesions called anthrax, or a coal, was found to be caused by a special bacillus, this bacillus was called the anthrax or charbon bacillus. The micro-organism being named the anthrax bacillus, it would have been well to have named the disease caused by it anthracosis. But the name anthracosis had already been pre-empted as a proper designation for impregnation of the tissues with coal-dust or carbon; for instance, anthracosis of the lungs. With characteristic indifference to the literal meaning of terms we have called the bacillus the anthrax bacillus, and the lesion found at the point of inoculation malignant pustule if the primary lesion is on the skin or on any of the exposed mucous membranes. If the primary lesion is situated in the bowels, we call it mycosis intestinalis. The disease caused by the generalization of the bacillus anthracis throughout the system is not anthracosis, but splenic



FIG. 234.—Anthrax bacilli; $\times 800$ (cover-glass specimen from mouse's spleen).

fever. The terms carbuncle, a little coal, and anthrax, a coal, are applied to a totally different affection caused by the inoculation with staphylococci of a bunch of sebaceous or possibly in some cases sweat-glands. Many writers, however, call the primary lesion caused by the bacillus anthracis anthrax, while some call it carbuncle; others adopt the French term, charbon, a coal; and yet others adopt the name carbuncle for the staphylococcic affection above referred to, and carbunculus malignus for the infection by the bacillus anthracis.

Symptoms.—The first symptom is a small, red, slightly itchy spot, usually situated on some exposed surface, such as the face, neck, or back of the hands. It resembles an insect-bite, and is frequently thought by the

patient to be such. It is rarely, however, seen by the physician at this early stage, as the patient does not attach enough importance to it to seek advice until the lesion has assumed the characteristic appearance of a malignant pustule. There is then a central necrosis that looks like a depressed black scab. The surrounding skin is highly inflamed, swollen, and of a livid-red color. Presently little vesicles form in the skin around the central necrosis. There is now the central black, necrosed area surrounded by a wreath of vesicles lying on a bed of intensely inflamed skin. The next step is lymphangitis and involvement of the neighboring lymphatic glands, accompanied by extensive inflammation of the subcutaneous connective tissue, which causes brawny indurations, vesiculation, and sloughing of the skin. At this stage the general symptoms become grave. There is a dry, hard tongue, insatiable thirst, a burning skin, and an elevation of temperature. The pulse is small, feeble, and irregular, and the patient is afflicted with a horrible anxiety. Before death there are colliquative sweatings, syncope, delirium, and the temperature falls below normal. Fortunately, man is relatively little susceptible to this virus, and therefore it frequently does not cause a general infection, but merely a local lesion, in which, after a time, the bacilli die out and the sore heals by granulation. Goldschmidt, for instance, has reported 3 deaths in 30 cases of malignant pustule.¹

When the infection takes place in tissue that is very loose, such as the web of the fingers, the lips, or the eyelid, the part may swell up enormously and become brawny and hard, presenting a picture entirely different from that described above.

Etiology.—Malignant pustule rarely occurs except among those who handle animals or the products of animals infected with splenic fever. Shepherders, wool-sorters, dressers of raw horse-hair, etc. are all subject to this affection. Those eating the flesh of animals dead of this malady for the most part escape, as cooking usually kills the germ, and the juices of the stomach are also fatal to it.

Malignant pustule is usually situated on the uncovered portions of the integument, as the face and head, the upper extremities, and the neck. There is rarely more than one lesion present at once, but two, and even three, have been observed.

The great majority of cases are in men, simply because men are more exposed to the malady than women.

Pathology.—After inoculation there is an interval of two or three days before the bacilli are numerous enough to cause sufficient inflammatory reaction to give rise to the small red spot, the first symptom of the disease. At first the inflammatory exudation is principally serum, and some of the serum collecting under the horny layer of the epidermis, over the point of most intense reaction, causes a vesicle. This vesicle is at first filled with serum or serum tinged with blood, and afterward may become thinly purulent. In a short time the tissue under the vesicle dies from the effect of the virus, presenting the central black necrosis which is such a characteristic part of the picture of the fully-developed malignant pustule.

The above-described symptoms are interesting both from a diagnostic and pathologic standpoint, for different bacteria differ in the character of the exudation they cause to flow from the blood-vessels. For instance, the pyogenic bacteria give a rich creamy pus, the good and laudable pus of old authors, who taught that such a discharge from a wound was normal and desirable.

¹ Congress at Nurnberg; *Annales de Dermatologie et de Syphiligraphie*, p. 250, 1894.

Then, again, the diphtheria bacilli cause a tough, fibrinous exudation. The power of a substance to cause a flow or exudation from the blood-vessels toward itself is called its chemotactic power. One can therefore say of the anthrax bacillus that its chemotactic power is principally exerted in the direction of causing a flow of serum from the blood-vessels.

Many of the symptoms, especially the general ones, are due, not to the direct action of the bacilli, but to the ptomaines they produce.

The resistance of the human body to the anthrax bacilli is very great—indeed, so great that in a few days they die out completely, and cannot be found in the malignant pustule itself, no matter how carefully looked for.

In a disease in which the ptomainic poisoning is such a prominent feature, and in which the bacilli can even be found floating in the blood, one would expect, from the efficiency of the means that the human organism evidently has for combating the virus, that one attack would immunize an individual against future attacks, but this is not so. A person may have many malignant pustules following in quick succession, without their having the least effect either in lowering his susceptibility to acquiring the disease or in mitigating its severity.

Diagnosis.—The first symptom following the inoculation of the anthrax bacillus, the red spot, looks like the sting of an insect. As it develops it resembles a severe furuncle. One on the alert upon seeing the vesicle filled with serum, instead of the usual head of yellow pus at the apex of the inflammatory induration, would suspect its cause. A little later on, when the vesicle dries down or is scratched off, and the central dark, gangrenous spot appears surrounded by a circle of vesicles, the recognition of the disease becomes easy.

If a microscopical examination is made and the characteristic bacilli found, it is decisive, as a person at all familiar with this bacillus would hardly make a mistake in its identification. It is erroneous, however, to suppose that the bacilli are always to be found. During the first few days they are easily demonstrable; then broken ones and involution forms appear, and in a short time no trace of them can be seen. It is evident, therefore, that the sooner a microscopical examination is made the better. A little of the exudation may be spread on any piece of broken window-glass, dried over a lamp, and carried home for staining. A staining fluid may easily be improvised by dissolving a piece of aniline-blue pencil in water, and the bacilli are so large that they may be easily seen with an ordinary high-power lens.

Prognosis.—Being let alone, the prognosis is generally good even after the general symptoms have set in.

Treatment.—As to treatment, the point to be impressed on the mind is the necessity of doing almost nothing. Blue ointment should be put on the malignant pustule itself to prevent complications from pyogenic bacteria, and also for its effect on the anthrax bacilli. Whiskey should be given in fair quantity as a stimulant, and the patient should be kept in bed. Not the least surgical interference should be undertaken. The patient has, according to the observations of Kurt Müller,¹ better means within himself of combating the disease than any that can be furnished to him.

¹ *Deut. med. Wochenschrift*, 1894, Nos. 24 et seq.

EQUINIA. (DOUGLASS W. MONTGOMERY, M. D.)

Derivation.—*Equus*, a horse.

Synonyms.—Glanders; Farcy; Malleus.

Definition.—A virulent, contagious, and inoculable disease caused by the bacillus mallei (Fig. 235).

Equinia, though in its nature always the same, has a great variety of symptoms and forms. In the present article we have principally to do with those symptoms that affect the skin. These manifestations may not be very pronounced, or they may be so marked that all other symptoms sink into insignificance beside them.

There are two forms of the disease—an acute and a chronic. It may be chronic from the start and through its whole course, or the acute frequently develops out of the chronic form. The reverse, however, never seems to take place—the chronic does not supervene on the acute.

In the **inoculated** form the disease may commence as a local disease, and remain so, healing completely after a time, or it may become generalized. The first symptoms observed, however, may be those of generalized glanders, and this is especially seen when the malady is acquired by infection.

The point of inoculation is frequently in the skin, principally in that of the hands or face, where the virus enters through some wound. This wound may at first heal entirely, but, the time of incubation being short, in from three to eight days it swells and becomes painful; vesicles having sero-purulent contents develop, the tissues break down, and a ragged ulcer forms.

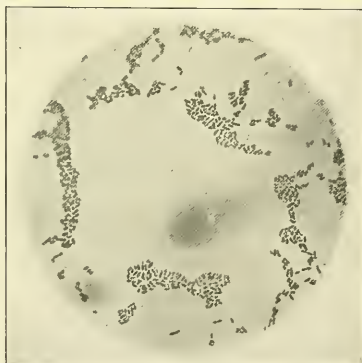


FIG. 235.—*Bacillus mallei*; $\times 7000$ (from potato-culture).

This ulcer, as above indicated, may run a local course, healing in time and having no general effect, or, as the virus has an especial preference for the lymphatics, it may spread around in the connective-tissue interspaces of the skin, which are the radicals of the lymphatic vessels, and cause a widespread redness and edema of the integument resembling erysipelas. The virus, having entered the lymphatic radicals, may next run along the lymphatic vessels, causing cord-like swelling of them, and afterward may reach the lymphatic glands, which then become enormous. The affection of the lymphatic glands is so constant as to have given rise to one of the names of the

disease—glanders. The generalized toxic effects of the malady now appear, with elevation of temperature and sometimes chills. The dominant symptom, however, is usually extreme weakness, accompanied with headache, nausea, anorexia, and diarrhea. If these symptoms appear in a patient where the malady has been acquired by infection, they may be mistaken for typhoid fever. Sometimes there are pains in the muscles or joints of such severity as to simulate acute articular rheumatism.

The mucous membrane of the nose is generally, but by no means always, affected. When affected it usually occurs early in the course of the disease, and when present is an important diagnostic feature. There is at first an uneasy sensation in the nose and pharynx, accompanied by a glairy discharge and sometimes epistaxis. Soon the discharge becomes muco-purulent, and either streaked with blood or of an even brown color. It is viscous and sticks to the nostrils and to the lips, thereby excoriating them. The mucous membrane of the nose is red, excoriated, and sometimes even ulcerated, and the ulcerations may go on to the destruction of cartilage and bone.

Erysipeloid Malleoderma.—There is first the diffuse erysipeloid inflammation, which follows shortly after the inoculation of the virus. But, besides the erysipeloid inflammation that occurs under such circumstances, there is another form of diffuse dermatitis in acute glanders, which also resembles erysipelas. This dermatitis occurs on the face and is accompanied by a hard edema. It is not well limited, and it has not the advancing border so characteristic of erysipelas. The nose becomes deformed, the cheeks tumefied, and the eyelids swollen, closing the eyes. A purulent fluid escapes through the eyeslits. The inflammation may run up on the forehead, and even into the scalp. Vesicles, bullæ, and even gangrenous patches soon appear.

Pustular Malleoderma.—This eruption usually appears early, from the ninth to the twenty-fourth day in acute equinia. There are at first red macules that develop into whitish, acuminate, firm papulæ, that in turn become pustules. These pustules are not umbilicated; they are generally discrete, but may become confluent and form large purulent patches. The favorite situations for this rash are the extremities and the face, particularly the cheeks, the eyelids, the nose, and the forehead. It may also break out on the conjunctivæ, the mucous membrane of the nose, the tongue, the palate, and the tonsils.

Furuncular Malleoderma.—These furuncles may appear on the sixth or seventh day of acute equinia. Sometimes they look like indolent tumefactions covered with a pasty, soft skin of normal color; at other times the skin is hard and violet red. The tumefaction itself is painful, and contains blood or a red gummy substance. The furuncles may open up and form ugly ulcers, with a necrotic floor. They comport themselves very much like the deeper and larger abscesses of chronic equinia.

Chronic Equinia.—Chronic equinia is characterized in the first place by the formation of abscesses. Three to five abscesses will appear; then there will be an interval in which none are formed, then another attack, and so on. Some of these abscesses form rapidly, while others grow with exceeding slowness. Their favorite situation is on the limbs, especially near the joints. They may also appear on the face, and sometimes show themselves, though infrequently, on the trunk. The abscesses on the face vary from the size of a pea to that of a hazelnut, but on the limbs they are often much larger. After they have ulcerated through the skin they discharge their contents,

which may be purulent or pus mixed with blood or a yellow viscid fluid, often called farcy oil. The ulcers formed by the opening of these abscesses—or nodules, as they are called when small—may heal, or they may grow larger, and, uniting with others, form circinate figures resembling those of syphilis. The edges of the ulcers are violet-colored, ragged, soft, and velvety and the floor dirty and gangrenous.

The affection may go on slowly and determinedly to the end, or there may be spells when the malady may seem to have come to a standstill, or even appear to be cured, only to break out again. It is even said on good authority¹ that the disease may remain latent, not only for months, but for years.

Toward the fatal termination the disease goes with a rush, ending up with acute glanders.

Etiology.—The disease is almost always acquired from horses; therefore it is most frequent in men who have charge of these animals, such as stablemen, jockeys, cavalrymen, and veterinary surgeons. Equinia is, however, not exclusively confined to people who have to work with horses, asses, or mules. Rösner² relates the case of a man who had had nothing to do with such animals, and whose association with those who had was both remote and trifling. Victor Babes³ says that out of 11 fatal cases in Bucharest only 5 could be traced to contagion from glandered animals.

Equinia is caused by the bacillus mallei, which is somewhat shorter and broader than the tubercle bacillus, and has rounded or slightly tapering ends (Fig. 236). It is a most delicate organism, being extremely sensitive either to changes of temperature or of environment. Man is quite susceptible to infection, and the rarity of the disease in the human race is owing to the delicate nature of the virus.

Equinia may be acquired either by inoculation or by infection, and G. H. Roger⁴ says that, like small-pox, the disease seems to be less grave when inoculated. Infection takes place with people who are usually more than ordinarily susceptible to the disease, and the bacillus finds a good soil in which to develop, while inoculation is more purely an accident, and may hit on a person who is eminently refractory.

Equinia belongs to the great group of infective granulation tumors: The other members are tuberculosis, syphilis, and leprosy. Actinomyces is sometimes included, but it differs in so many ways from the others that it is hardly fair to class it with them. The micro-organisms of tuberculosis, equinia, and leprosy have been discovered, and morphologically are much alike. They are all bacilli about the same size and shape, and it therefore seems probable that the micro-organism of syphilis is also a bacillus. Two of these diseases, tuberculosis and equinia, are inoculable into man and the lower animals; two, syphilis and leprosy, are confined solely to man. The tubercle bacillus is a tough, hardy fellow as compared with that of glanders. The virus of syphilis must also be very delicate, while that of leprosy is so sensitive that ordinary human cleanliness is, according to G. Armauer Hansen, enough to prevent the transmission of the disease.

Common drinking-troughs seem to be a source of contagion among animals, and the vestry of St. Pancras⁵ has recommended their abolition, and the

¹ Victor Babes: *La Semaine médicale*, Aug. 18, 1894.

² *Annales de Derm. et de Syphiligraphie*, p. 277, 1892.

⁴ *Traité de Médecine*, par Charcot, Bouchard, et Brissaud, vol. i. p. 572.

⁵ *Lancet*, Aug. 17, 1895.

³ *Vide supra*.

substitution of pipe-stands from which water may be drawn into pails and given to horses or cattle.

Pathological Anatomy.—The lesions are made up of round-celled granulation-tissue, forming tumors running from the size of a pea to that of a hazelnut, and much larger. Giant-cells are rarely found in the neoplasms. The tumors are soft and velvety, forming a contrast to syphilitic gummata, which are firm and resistant.

The new tissue, as in all the granulomata, is foreordained to speedy degeneration, and the cells in breaking down form a thick, mucilaginous substance like the gummy substance in syphilitic gummata.

It is very difficult to stain the bacilli in the tissues, but they do not appear to be present in nearly such great numbers as the lepra bacilli in the lepra tubercles.

The skin, the mucous membrane of the nose and throat, the lymphatics, and the muscles are the favorite locations for the tumors.

Diagnosis.—In acute glanders the rise of temperature, the headache, nausea, chills, and diarrhea may lead to a diagnosis of typhoid fever. If the muscular pains are very severe, as they are apt to be, it may be thought to be acute articular rheumatism. When the glandular swellings, the nasal symptoms, and the eruptions appear the nature of the disease is clear.

Erysipeloid malleoderma may be mistaken for erysipelas; pustular malleoderma for a pustular syphilide or for small-pox; and furuncular malleoderma for furunculosis. The chronic nodes, particularly when occurring on the face, are usually diagnosed either as a syphilide or as a peculiar form of tuberculosis. When suspicion is aroused the bacilli may be looked for, but the best test is to inject some of the discharge into a male guinea-pig, and then look for the characteristic enlargement of the testicle from orchitis. The pus from the guinea-pig's testicle may be examined for glanders bacilli by staining with Gram's method, and also by cultures on potatoes, on which they form honey-like, brownish colonies. Judging from the experiments on horses, the effects of mallein seem to be too uncertain to be useful as a means of diagnosis.

Prognosis.—It would appear that the lesion that develops at the point of inoculation may sometimes be thoroughly eradicated by the active use of the thermo-cautery.¹ Many of the instances where recovery has followed closely on inoculation were probably not glanders at all, but simply wounds infected with some other poison while handling or dissecting a glandered animal.

Acute generalized equinia is fatal.

The recovery from chronic generalized equinia, while possible, must be rare. The knowledge that the disease may remain latent for a long time prevents us from positively asserting a cure in any particular case.²

Treatment.—There is no specific treatment for equinia. The local manifestations are to be treated surgically by incision, the thermo-cautery, antiseptic douches, and dressings.

The general hygiene of the patient is to be looked after and tonics are to be given.

¹ "Ueber chronischen Rotz der menschlichen Haut von A. Buschke," *Arch. f. Derm. und Syphilis*, Bd. xxxvi. S. 323.

² Victor Babes: *vide supra*.

DISSECTION-WOUNDS. (DOUGLASS W. MONTGOMERY, M. D.)

There is no risk in dissecting a well-preserved cadaver. The chemicals used in injecting and preserving the body sometimes irritate the skin of susceptible persons; this, however, is not what is meant by the term "dissection-wound." By a dissection-wound is meant an infectious disease of a wound or an infectious folliculitis acquired in cutting up a dead body. Physicians and servants in pathological laboratories acquire dissection-wounds in making post-mortems, and butchers also contract them in the discharge of their vocation. The affection, therefore, is not due to any one disease-process, but may be caused either by pyogenic bacteria, the virus of erysipelas, anthrax bacilli, tetanus-poisoning, tubercle bacilli, or any other inoculable poison. In tuberculosis, malignant pustule, tetanus, and erysipelas the disease-process can be recognized and appropriately labelled, but in some other infections the diagnosis is more obscure.

In considering dissection-wounds certain chemical poisons, such as cadaverin and necrotoxin, the result of decomposing tissues, must be mentioned. These poisons may enter a wound either in performing a surgical operation or while making a post-mortem. They lower the vitality of tissues, and render them an easy prey to pyogenic bacteria.

Besides the affections above mentioned, another disease, called post-mortem pustule, has been described. It appears shortly after infection as a red itchy spot, usually situated on the back of the hand. A pustule soon forms that dries into a scab. Under this scab there develops an ulcer that shows a tendency to grow steadily larger. The affection heals quickly under antiseptic treatment.

There is also a form of tuberculosis of the skin, called post-mortem tubercle, as it is almost always acquired in making post-mortems on tuberculous subjects. This disease will be described under the head of Tuberculosis of the Skin in another part of this work.

IMPETIGO. (DOUGLASS W. MONTGOMERY, M. D.)

Under the name of impetigo Duhring has described a few cases of a disease that must be exceedingly rare. Some writers consider them examples of atypical impetigo contagiosa. Duhring's description, however, is very clear, and he is so good an observer that it is well to describe impetigo as an independent disease till it is definitely settled that it does not exist as such.

Definition.—Impetigo is an acute, self-limited, non-contagious dermatitis, manifesting itself by characteristic pustules occurring principally on the face and hands.

Symptoms.—An otherwise perfectly healthy child may present itself with thirty or forty pustules, most of them situated on the face and hands, the rest scattered over the body and limbs. Almost all of the pustules are the size of a split pea—some of them larger, even much larger. They are well distended with their contents, none of them being either flabby or umbilicated. Their color varies from a straw color to a deep yellow, and they are seated on a red base. The pustules stand well apart from one another and show no tendency to coalesce. They are firm and elastic, and have a thick top, which is very difficult to rupture. When the top is broken a straw-colored or deep-yellow fluid flows out and a bright-red base is exposed. These pustules do not show any disposition to spontaneous rupture, but dry down into scabs, which fall off in a short time, leaving a reddened surface, which gradually becomes paler, then scurfy, then normal. The whole pro-

cess, consisting of a succession of crops of pustules, lasts from two to three weeks, and is benign and superficial, not leaving any scars. The subjective symptoms are insignificant; there may be slight itching. The distinguishing mark of the disease, separating it sharply from impetigo contagiosa, is its non-contagiousness.

As the disease is described the **treatment** would be eminently simple. The affection not being contagious, segregation is not necessary. The constitutional symptoms are so slight as not to require attention. The lesions themselves undergo benign involution and do not require interference.

IMPETIGO CONTAGIOSA. (DOUGLASS W. MONTGOMERY, M. D.)

Definition.—Impetigo contagiosa is an acute contagious disease, characterized by the rapid formation of markedly superficial, auto-inoculable vesicopustules, principally on the scalp, face, or hands.

Symptoms.—In many cases there is at first a slight fever with accompanying malaise. It is followed by a few split-pea-sized vesicles on the face or scalp. The contents of these vesicles rapidly become purulent, and the pus is of a rich yellow color and of sticky consistency. Some of the lesions keep on enlarging, attaining at times the size of a nickel, while others simply maintain their original dimensions. During this time new pustules are constantly appearing, and these, with the enlargement of those already in existence, make by confluence patches of considerable extent. The pus both of the pustules that break and of those that do not rapidly dries down, forming bright-yellow, thick, friable superficial crusts that look as if stuck on the skin. When these crusts are lifted off a reddened surface level with the skin is exposed, from which oozes a clear sticky fluid that rapidly dries into a crust again.

After the crust falls a dark-red surface is left, that remains pigmented for some time. No scars result; in fact, the whole process from beginning to end impresses one with its superficiality. The patient may apparently get well, and suddenly a new crop of lesions may appear, or the rash may continue to come out for two or three weeks. Usually, however, the malady lasts about ten days, rarely running along for a month.

As before mentioned, the rash appears by preference on the head and face, and especially around the mouth. The fingers and backs of the hands often become inoculated from the face. The affection may, however, appear on any part of the integument or even in the mouth. The subjective symptoms are usually insignificant—sometimes a slight itchiness or a sensation of heat or even burning. Sometimes the pustules appear to be umbilicated, but it is not a true umbilication, like that of small-pox, but is simply the result of the center of the pustule drying down while the periphery is still active and filled with fluid pus.

Etiology.—The large majority of cases occur in children, and it is said to attack by preference blonds having a fine white skin. Frequently one of the children of a family gets the disease at school, and, carrying it home, communicates it to the others, for the great etiologic characteristic of the disease is its inoculability. In case after case none but the ordinary pyogenic bacteria have been found. In the highly virulent cases, however, it seems likely that some other bacterium constitutes the chief virus, and it may be that either it gives a clinical picture simulating closely that caused by the pyogenic bacteria, or that it causes a lesion on which the pyogenic bacteria easily thrives.

this scab falls, leaving a slightly reddened, pigmented area. If the inflammatory process has eroded the true skin, a cicatrix will be left. Usually the subjective symptoms are slight—some pruritus and a feeling of burning and heat. The disease can continue indefinitely, as it is auto-inoculable.

Under the name "ecthyma of infants" there has been described a rare disease confined to very young children. At first little red blotches, papulopustules, and pemphigus-like blebs appear. Deep ulcerations, having a steep edge and a dirty floor, develop under the blebs. These ulcers are surrounded by a thin red border and do not show much reaction. They granulate slowly and leave indelible cicatrices. The favorite situations for the lesions are the calves, thighs, groins, back, and abdomen. The prognosis is bad, but some of the patients do recover.

Etiology.—If ecthyma exists as an independent disease, it must be an excessively rare affection. It is seldom seen, excepting in those who are poorly fed, clad, and housed. It is therefore most frequently seen in the tramp. The direct cause of the pustulation is probably one of the common pyrogenic bacteria, which ordinarily cannot produce any such lesion, and does so only when planted in the exceedingly ill-kept "temple of the soul" of a hobo. In these people there are many points where superficial inoculation may occur, such as scratch-lesions and the bites of bed-bugs, lice, and fleas. It is also observed in those who are debilitated by excesses, by cachexia, or by old age. Alcoholism, syphilis, Bright's disease, diabetes are all predisposing factors. Unna believes in ecthyma as an independent disease, and in one case he discovered a peculiar micro-organism consisting of large cocci arranged in rows and groups. These, however, were found only in the crusts, and not in the ulcer.¹

If, however, the observations of Vidal and of J. H. McCormick² hold good, that it is not alone auto-inoculable, but that it can be transferred to other individuals by inoculation of the pus, then the search for a special micro-organism must be continued.

Ehlers has found the bacillus pyocyaneus in two cases of that variety of the disease called "ecthyma of infants," described above.

Diagnosis.—The diagnosis of ecthyma from an ulcerative, crusted syphilide is sometimes difficult. In the syphilide there is more frequently a true ulcerative process, and, as it usually occurs in the secondary stage of the malady, there are almost always other symptoms showing the nature of the affection.

A furuncle differs in being more conical; by the central pustule being less in extent and the surrounding redness greater; also by the more intense pain and tenderness of the furuncle. Then the central necrotic core of the furuncle differs entirely from the superficial extension of ecthyma.

Impetigo contagiosa resembles ecthyma very closely. Some observers believe that they are different manifestations of the same disease. Impetigo contagiosa is usually situated on the face and hands, and ecthyma on the lower limbs. The pus and also the crusts of the lesions in impetigo contagiosa are usually more yellow, and the lesions themselves are not so large, and are even more superficial than in ecthyma.

The diagnosis between pemphigus neonatorum, pemphigus syphiliticus, and the "ecthyma of infants" is difficult. Pemphigus neonatorum occurs in extensive epidemics in asylums. Pemphigus syphiliticus appears shortly after birth, and usually on the palms and soles, and there are other manifestations of syphilis.

¹ *Unna's Histopathologie d. Haut.*, p. 256.

² *Med. News*, 1894, vol. lxx. p. 151.

Treatment.—As far as constitutional treatment is concerned, general rules only can be laid down—good hygiene, tonics, and good food.

The local treatment consists, in the first place, of getting rid of the parasites, such as lice and itch-mites, when such are present, after which the lesions are to be treated on general surgical antiseptic principles. Compresses made of lint or cheese-cloth soaked in boracic-acid solution may be applied to the lesions themselves. These compresses are best covered with rubber tissue and held in place with a bandage. After the inflammation has calmed down and the crusts have come off, or even before, ointments may be used. A good antiseptic yet mild ointment is made of calomel, 1 dram, and simple ointment, 1 ounce.

POMPHOLYX. (A. R. ROBINSON, M. D.)

Synonyms.—Cheiro-pompholyx (Hutchinson); Dysidrosis (T. Fox).

Definition.—An acute inflammatory affection, characterized by the symmetrical development upon the palms of the hands, and usually also upon the soles of the feet, of clear vesicles or bullæ, usually grouped, which afterward become opaque and in a few days disappear, leaving a reddish, non-inflammatory skin behind.

Symptoms.—This disease is rare and statistics are somewhat unreliable, as cases of neuritic eczema have often been regarded and described as examples of it. The eruption is almost always symmetrical and rarely appears except on the hands and feet. The hands are always affected, but the feet sometimes escape. The eruption commences with burning and itching, quickly followed by the formation of deep-seated vesicles, usually in groups upon the palms and between the fingers, rarely upon the dorsal surface. When the feet are affected the lesions are upon corresponding situations. The vesicles are at first transparent, resembling closely lesions of neurotic eczema, and have been likened to boiled sago grains. The contents gradually become more and more opaque, and in a few days are pustular in character. When the vesicles are grouped they often coalesce and form variously sized bullæ. Sometimes the lesions are bullous when first formed. Whether vesicles or bullæ, they disappear without ulceration unless destroyed by traumatism. The life-duration of a lesion is usually from one to two weeks, and on disappearing the skin remains for a time more or less red, but never eczematous in character. If many lesions are present, the hands are stiff and painful, but in mild cases there is only a feeling of tenderness and slight pricking. Exaggerated perspiration of the hands is usually present. The lesions may be few in number or quite numerous. The lesions of a group are usually about the same age and size. They are never acuminated in form, but have a rounded or more or less flattened top.

Etiology.—The persons affected are usually of a nervous temperament, and their general condition is below the normal. It is more frequent in women than in men. It is rare before puberty and in old age. Anything causing great mental worry or nerve-fatigue is liable to produce it in those who have already had the disease.

Pathology.—On account of the symmetrical character of the eruption, the grouped arrangement of the lesions, and the marked disturbance of the nervous system the disease can be regarded as a neurosis. It is not an affection of the sweat-glands, as originally maintained by Tilbury Fox, who gave it the name of dysidrosis.

Anatomy.—In the earliest stage the vessels contain clear serum and a few, if any, leukocytes; afterward pus-corpules appear, and continue to

increase in number until the contents are yellowish in color. The fluid is never acid and contains a large amount of albumin and some fibrin. It comes from the papillary blood-vessels, collecting between the rete-cells to form the lesions. These are situated usually in the upper part of the rete. The liquid causes degeneration of some cells, and, collecting, presses the surrounding cells in different directions. The larger the vesicle, the more the rete-cells are flattened and drawn out, until some of them look like fibers. The stratum lucidum is pushed upward and occasionally ruptured, as in Fig. 236. The corneous layer often shows many small loculi from escaped

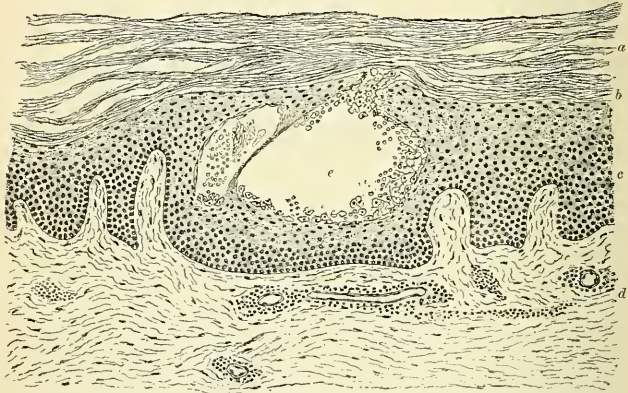


FIG. 236.—Vesicle in pompholyx: *a*, corneous layer; *b*, stratum lucidum; *c*, rete; *d*, corium; *e*, vesicle. The sweat-glands are normal and show no connection with the lesions.

sweat. The inflammatory changes in the corium are slight, consisting of perivascular leukocyte-collection and some edema from serum-transudation.

Diagnosis.—The only difficulty is to diagnose from acute neurotic eczema of the hands. Some authors regard pompholyx as an eczema, but in well-marked cases the symptoms are characteristic and stamp the affection as not a catarrhal dermatitis. From weeping eczema the diagnosis is easy, as in pompholyx the lesions are not acuminate, and there is no exudation on the free surface and but little inflammation present. In neurotic eczema the eruption is often symmetrical and the lesions grouped, as in pompholyx, but the inflammatory swelling is greater, the lesions soon become more acuminate, they are liable to exist upon the back and sides of the fingers more than upon the palm, and they usually rupture, leaving a more or less weeping surface. The presence of lesions like sago grains alone does not justify the diagnosis of pompholyx.

Prognosis.—The eruption usually disappears spontaneously in from ten to fourteen days, but may last several weeks. It is very liable to return after intervals of weeks, months, or years, depending upon the activity of the factors above described as influencing its production.

Treatment.—No local application will remove the lesions or shorten their life-duration. An alkaline solution, as bran-water or a solution of bicarbonate of potassium, or simply cold water, is of benefit in the acute

stage to relieve the feeling of tension and to reduce swelling. Internally tonics to tone the nervous system and improve the general condition are indicated. Proper food, good hygienic surroundings, and such tonics as iron, quinine, strychnine, etc. are of value in most cases. In my experience arsenic possesses special value in this disease. It must be given in doses to get the physiological effect, and then its action is almost as prompt as in pemphigus. Alcoholic stimulants, tobacco, tea and coffee are probably injurious. All causes of worry and nervous depression should be avoided if possible.

HERPES SIMPLEX. (JAMES M. WINFIELD, M. D.)

Definition.—An acute, non-contagious, inflammatory disease of the skin, characterized by the formation of vesicles grouped together upon an erythematous base, running a short and definite course.

Symptoms.—The outbreak of herpes is usually preceded by a burning or itching in the part to be attacked, which generally subsides after the eruption has existed for a day or two. The lesions make their appearance in groups of small vesicles, being from a millet-seed to a pea in size, at first filled with a clear fluid, which becomes lactescent after a day or so, finally desiccating into a yellow crust. If the vesicles are broken, healing takes place rapidly, no scar resulting. The skin about to be attacked is generally hot to the touch; in some instances it is slightly swollen. The disease is essentially an acute one, rarely lasting over a week. Recurrences are frequent.

The term herpes has been the cause of considerable confusion. In the works of earlier writers it was applied to many diseases that had a tendency to peripheral extension. Even some of the modern authors use the term herpes tonsurans to designate ringworm. This tends to make the distinction very confusing to students. I find that the term herpes applied to the simple variety, and zoster to the form situated over a nerve, will simplify and cause a clear comprehension of the whole matter. According to location, two divisions of the simple variety are made—viz. herpes facialis and herpes progenitalis.

HERPES FACIALIS.

Synonyms.—Herpes labialis; Herpes febrilis; Hydro-febrilis; Cold sore; Fever blister.

Symptoms.—The eruption is generally located on the lips just at the junction of the mucous and cutaneous surface (vermilion border). The great frequency of occurrence in this location suggests the term herpes labialis.

The subjective symptoms are not severe. The part to be attacked may burn, itch, or feel slightly tense. Itching is by far the most prominent symptom. Frequently chilliness may precede the cutaneous outbreak. The eruption consists, at first, of one or more clusters of papules situated upon an inflamed base. These change into vesicles, which are from a hempseed to a small pea in size; they are arranged in groups of six or more, which in a few days dry into small yellow or brownish scabs, and soon drop off, leaving transient reddish marks, but never any scars. The whole attack lasts a week or ten days.

Etiology.—The etiology of herpes facialis is still a subject of much controversy. Herpes facialis is a frequent symptom or accompaniment of many acute febrile diseases (herpes febrilis, fever blister), for instance, pneumonia, typhoid fever, tonsillitis, etc. It often accompanies simple

acute coryza (cold sore). In some individuals digestive disturbances will provoke an attack. Some women are subject to herpes at the menstrual period. Many persons seem to have a predisposition to the disease; the slightest local irritation appears sufficient to produce a group of vesicles—exposure to sun, sea-air, or cold. Irritation from various condiments, such as pepper, salt, or spice, are all productive of herpetic attacks.

In those cases where local irritation is a causative factor the belief is that the terminal nerve-fibers are in some way affected. If the disease is a symptom of febrile disturbance, it may be reflex, or, as some claim, direct irritation of the nerve may take place from compression by the congested blood-vessel. The writer has shown that the facial herpes so frequently accompanying malaria is undoubtedly due to some toxic effect on the facial nerves produced by the plasmodium malariae. Many other observers have endeavored to demonstrate the microbic origin of this disease, but thus far there has not been sufficient data to draw definite conclusions.

Diagnosis.—Contrary to the opinion of most writers, my experience shows that herpes facialis is nothing more than an abortive form of zoster; consequently, differentiation from this disease is unnecessary, except perhaps to say that the symptoms in a fully-developed case of zoster are more severe and continue longer.

Eczema may in rare instances be mistaken for herpes, but when we note the large size of the vesicles, absence of weeping or oozing, itching only in the onset of the disease, the typical course and quick recovery, the diagnosis will readily be determined.

When the herpetic patch is covered with a brown scab, it can easily be mistaken for impetigo; here the history of the case, the occurrence of an impetiginous eruption on other parts of the body, the isolated and irregularly distributed lesions on the face, and observation for a few days will aid in making the diagnosis.

Treatment.—Treatment is essentially protective—simple dusting with borated talcum powder, a lotion of 1 per cent. ichthylol or ichthyolated zinc ointment, painting with flexible collodion, to prevent friction and protect from the air. Camphor is useful in aborting the vesicles, used either in the spirits or as a powder composed of equal parts of camphor and biborate of soda, rubbed into the reddened spot before the papule has changed into a vesicle. In some incipient herpes, biborate of soda alone, as suggested by Hardaway, is sufficient to relieve discomfort and abort an attack. The treatment then is simply to prevent rupturing the vesicle and abort an attack if possible.

HERPES PROGENITALIS.

Synonym.—Herpes præputialis.

Symptoms.—The eruption is of frequent occurrence, and, if it were not for the tendency to recur, the cause of anxiety to the patient, and the danger of it being an inoculative point for infection, it would be a disease of little consequence.

In males it most frequently occurs in the sulcus behind the corona; it is less frequently found on the glans, rarely in the meatus or urethra.

In females the labia, both inner and outer surface, the hood of the clitoris, the vagina, and even the cervix uteri, may be the site of the eruption.

The first symptom to attract the patient's attention is itching and burning of the parts to be affected. The prepuce or labia may become edematous. The vesicle that happens to be on the mucous membrane soon

ruptures, leaving in its place a small superficial ulcer. If the true nature of the disease is recognized, the ulcers very soon dry up and give but little inconvenience, but if, through mistaken diagnosis, they are irritated by caustics or powders, the simple sores often become deep ulcers which may last for weeks.

Etiology.—Herpes progeneralis is apt to occur in people of a gouty habit or in neurotic individuals; any excess in eating, drinking, or venery is sufficient to provoke an attack. A tight prepuce, gonorrhœa, balanitis, or any local inflammation about the genito-urinary tract may serve as a predisposing cause. Contact with an acrid menstrual discharge, irritation from ill-fitting garments, may excite an attack.

Diagnosis.—Too much care cannot be given to this subject, for the occurrence of abrasions about the genital organs of either sex, especially in a male with a tight prepuce, may become the site of inoculation of chancre or chancroid; and the diagnostician should exercise the greatest caution in prognosis, never forgetting that what is now a simple herpetic vesicle may, from infection, develop other trouble.

Chancroid.—Herpes always appears as a vesicle or group of vesicles; chancroid never. Herpes is attended with little inflammation, discharge is slight, outline regular; chancroid is usually complicated with inguinal adenopathy. In herpes enlargement of the glands rarely occurs; when it does it is transitory. The discomfort in herpes is from itching and burning; in chancroid there is decided soreness. Chancroid auto-inoculable; herpes never.

Chancre.—In differentiating herpes from the initial syphilitic sore attention must be paid to history and duration and manner of attack. Chancre generally occurs singly; herpes in groups of vesicles. The edge and base of a chancre are hard, indurated, and elevated: those of herpes soft, pliable, and with little or no elevation. The color of an herpetic ulcer, light red: chancre, dark red or yellowish-brown. In herpes there is a serous exudate, making the ulcer appear moist; chancre has no secretion, the ulcer is glistening and dry.

Mucous Patches.—Herpes is readily differentiated by observing that it always appears as vesicles that are acuminate, while mucous patches are flat; herpetic ulcers are covered with a serous exudate; mucous patches by macerated epithelium.

Treatment.—If the patient is rheumatic or gouty, a full course of anti-rheumatics will prevent a recurrence of the herpes.

Neurotic individuals, when below par, should be given tonics. Indications of any trouble about the genital tract should be rectified. If the prepuce is tight, circumcise. Dusting the diseased surface with calomel powder or equal parts of calomel and bismuth, or, if there should be any contraindications to the use of powder, applications of *lotio nigra* or *liquor plumbi subacetatis*, dilute, will be found very useful.

ZOSTER. (JAMES M. WINFIELD, M. D.)

Synonyms.—Herpes zoster; *Zona*; *Ignes sacer*; *Feuer gurtel*; *Blaschenflechte*.

Definition.—An acute inflammatory disease of the skin characterized by groups of vesicles on an inflammatory base, distributed along the course of one or more of the cutaneous nerves, attended with prodromal neuralgia in the part about to be attacked.

Symptoms.—The cutaneous eruption of zoster is usually preceded by definite prodromal symptoms consisting of malaise and febrile disturbances of varying intensity. There is also considerable pain of a neuralgic character in the part about to be attacked, which usually precedes the eruption for from a few hours to two or three days, and, as a rule, subsides at the advent of the vesicles. Pressure along the course of the nerve-tract will elicit tenderness, especially marked where the cutaneous branches are given off. The eruption is generally unilateral, although cases of bilateral zoster are on record.

The first cutaneous manifestation is a number of macules which are rapidly changed into papules, and finally into vesicles; the latter are characteristic. The vesicles, from one to a dozen, are irregularly grouped on an erythematous base. The first crop generally appears nearest the nerve-center; there are, however, exceptions to this rule. In size the vesicles are from a pinhead to a pea. In extremely mild cases only one or two may appear at a point; if, however, the attack is severe, a number may form, and by coalescence the discrete blister may become an irregularly outlined bulla. At first the contents are clear; after a day or two they become lactescent or puriform. The vesicles seldom rupture spontaneously, but dry into a yellowish-brown scab, which soon drops off, leaving the skin normal except for a slight transient pigmentation. In a typical case the whole process, from the first eruption to the drying of the scabs, lasts from ten days to three or more weeks.

The gravest form of zoster is the hemorrhagic; in this type the vesicular contents, instead of being clear or slightly reddish, are dark, showing the admixture of red blood-corpuscles. Here the eruption may terminate by desiccation, but, as a rule, the roof-walls being thin, the blister is easily ruptured and ulceration takes place.

Zoster may abort at any period up to the formation of the vesicles. Sequelæ of zoster are occasionally met with; one of the commonest is persistent neuralgia, with anesthetic or hyperæsthetic areas corresponding to the previously affected skin. In rare instances there may be muscular atrophy and falling of the hair and teeth. Sequelæ are to be feared if the disease occurs in the old or debilitated.

Second attacks of zoster are rarely observed, although cases have been reported. The well-known one of Kaposi had no less than eleven recurrences. The writer recalls a patient who had two typical attacks within a year.

Although zoster is more commonly found in the intercostal region, any peripheral nerve may be affected.

After Hebra, seven classifications are made according to location—namely, zoster capillitii, zoster faciei, zoster nuclæ s. collaris, zoster brachialis, zoster pectoralis, zoster abdominalis, zoster femoralis.

The region most commonly affected is the dorso-pectoral; here the disease involves the intercostal nerves and extends from the vertebræ to the sternum. One or more nerves may be affected, so that the eruption appears as a narrow band or a broad area involving all the intercostals. The prodromal neuralgia is generally severe, and before the appearance of the eruption clears up the diagnosis is often mistaken for pleurisy.

Pectoral zoster, as all others, is, with rare exceptions, unilateral. This peculiarity has led to the popular belief that if the eruption should encircle the body death is the result. This idea is frequently the cause of much anxiety to nervous patients. Children are more apt to have intercostal zoster than any of the other forms.



Brachio-ular zoster (from original photograph).

Space will not permit a description of the other varieties. It is only necessary to remember that the clinical picture and symptoms are the same in all of them, the only difference being location. There is, however, a sub-variety of facial zoster (zoster ophthalmicus) that needs special mention; for the agonizing and persistent neuralgia coupled with the frequently serious sequelæ, such as panophthalmia, ulcerative keratitis, meningitis, and even death, makes this a dangerous manifestation of what is generally a mild disease.

Etiology.—Zoster may occur at any age. The majority of personally observed cases were between fourteen and thirty, the average about twenty-two years. Infants are, generally speaking, exempt; still cases have been reported in babies. Old age seems to offer a slight immunity from the disease. Sex has but little influence on the attacks, although American dermatologists claim a slight predominance for males. Some of the cases observed can be directly traced to nerve-traumatism, degenerative changes in the cord, as noted by Charcot and others. Just how changes in the cord produce the cutaneous eruption is difficult to explain, but it is probable that irritation in the ganglia is transmitted to the terminal nerves. Zoster has followed carbonic-acid and coal-gas poisoning. Exposure to cold or to sudden chilling of portions of the body from direct draft have been productive of attacks. It is one of the accompaniments of tuberculosis, especially in the beginning of the pulmonary disease.

Many observers, notably Kaposi, Pfeiffer, Landouzy, and Erb, are inclined to believe that true idiopathic zoster is of infectious origin. They argue from its appearance in the fall and spring, the pseudo-epidemic character of some outbreaks, and that it usually affects a person but once in a lifetime. Study of their observations, together with the fact that many of my cases came from malarial sections of the city, led me to make examinations of the blood in all cases of zoster. Care was taken to exclude traumatism, tuberculosis, or any other causes that might produce the disease. The result was that, in addition to the case elsewhere reported,¹ at least 75 per cent. of blood showed the malarial parasite. Reasoning from analogy, we find that malaria is capable of producing many neuropathic disturbances, as, for instance, persistent neuralgia, especially of the face, multiple neuritis, and reflex paresis.²

Placing these facts in evidence, it is proper to consider paludism an important etiological factor. Just how the plasmodium accomplishes its results cannot be definitely stated without autopsy. It may be by clogging the terminal arteries, as has been suggested, or the congested blood-vessels may produce pressure on the nerves at their bony exit. It is also probable that the parasite exerts some localized toxic effect on the ganglia, or it may produce a general nerve-toxemia. The fact that zoster occurs only once in a lifetime does not militate against this theory, for in a disease which in itself is uncommon recurrences would, in the same proportion, be exceedingly rare.

Many observers have endeavored to isolate germs from the vesicular fluid; some claim to have discovered distinctive organisms, but they probably have no etiological bearing on the disease. Pfeiffer and Wasielewski consider the bodies sometimes found in zoster vesicles to be protozoa, and claimed that these might be the cause of the disease. Hartzell has, however, found the same protozoa-like bodies in cases of traumatic herpes as well as in the idiopathic.

¹ Winfield: "Blood-examinations in Zoster," *Journal of Cut. and Gen.-ur. Dis.*

² Browning: "Bilateral Paresis and Pseudoplegias of Childhood, etc.," *Am. Journ. of the Med. Sci.*, Dec., 1891.

Finally, zoster is a disease essentially due to some change or irritation in or about the nerve-ganglia or terminals.

Pathology.—From its distribution along the course of the cutaneous nerves the older writers assumed that zoster was a nervous affection. This was first anatomically proven by Baerensprung, who found changes (interstitial neuritis) in the posterior ganglia and also in the nerve from it to the affected skin. In some examinations changes have been found in the posterior column of the cord, while the ganglia and nerves appear to be healthy. Hemorrhages, tubercular and inflammatory changes of the ganglia, have been found in some instances. Perineuritis and tumors pressing on the nerve, as well as suppurative processes in the neighboring parts, have a pathological significance.

Morbid Anatomy.—The pathological process begins in the papillary layer. The papillæ are enlarged and their blood-vessels dilated. The tissues are infiltrated with round-cells, which infiltration may extend to the subcutaneous layer. The cells of the rete are separated, and each undergoes a balloon-like degeneration. Many of them are heaped loosely upon each other at the base of the vesicle. The roof of the vesicle is formed by the horny layer; hanging down from it is a network of elongated epithelium cells, the meshes of which are filled with various-shaped leukocytes, fibrin-clots, and serum.

In hemorrhagic zoster the extravasated blood destroys the papillæ, causing a solution of continuity; healing takes place by granulation. It is claimed that this is the only form of zoster that leaves scars.

Diagnosis.—But little difficulty will be experienced in making a diagnosis, for the occurrence of crops of vesicles on an erythematous base situated along the course of a nerve is characteristic.

Acute eczema may be mistaken for zoster if the observer fails to remember that eczema has no prodromal neuralgia—that the vesicles are smaller, which soon rupture and exude serum.

Prognosis.—Zoster is usually a benign disease. Still, in the debilitated or aged it may assume grave forms, and death has occurred in some instances. Regarding duration the prognosis should be guarded, for the termination may be prolonged. The possible continued neuralgia and other sensory and motor disturbances should be borne in mind. If the eye becomes involved, loss of sight may result.

Treatment.—Zoster being a self-limited disease, abortive measures are seldom resorted to. It is, however, the opinion of the writer that attacks can be cut short by the administration of full doses of quinine or salicylate of soda. For the neuralgia antipyrine, in from three- to fifteen-grain doses every three or four hours, will be found useful. If this does not relieve the pain, recourse can be had to morphia. If the patient is in a run-down condition, active tonic treatment is indicated. To combat the neuritis tincture of nuxvomica or the sulphate of strychnia, either alone or combined with iron and arsenic, will be found useful. In some instances benefit will be derived from cod-liver oil. The first indication in external treatment is to remove all pressure from the affected skin and to protect it from the air. Dusting-powders composed of stearate or oxide of zinc, to which opium or camphor has been added, are valuable. Painting the vesicles with collodion is highly recommended by some. If the neuralgia is severe, blistering over the nerve-roots will frequently give relief. The oleate of morphia or cocaine rubbed into the inflamed skin will often relieve the pain. Alcoholic solutions of menthol, carbolic acid, or camphor will also be found to have a local sedative effect.

Ointments should be used with caution if the vesicles are unbroken, for they macerate and irritate the skin; but if the blisters are ruptured and ulcerations have taken place, they aid in protecting the denuded surface. Probably one of the most effectual therapeutic measures for the prodromal or post-neuralgia is the application of the constant current: this, according to Duhring, will often abort an attack; if it does not do this, it certainly will soothe the pain.

PEMPHIGUS. (JAMES M. WINFIELD, M. D.)

Definition.—Pemphigus is a chronic affection of the skin characterized by the development of variously sized blebs, rising from a non-inflammatory base, running an indefinite course, sometimes ending fatally.

Considerable confusion regarding this disease was manifested by the older writers: they grouped together under pemphigus all skin-affections in which bullæ were found; consequently, many forms were described. One writer (Martins) gave no less than ninety-seven distinct varieties. It is due to Duhring of the United States and Brocq of France that the subject is gradually being brought out of the obscurity that so long surrounded it. The American School of Dermatology recognizes pemphigus as a distinct disease, and place all other inflammatory bullous eruptions under the head of dermatitis herpetiformis. This distinction is not made through any knowledge regarding the etiology, but rather through the clinical appearance and history.

The term pemphigus is applied to bullous affections attended with little or no inflammatory symptoms, running a subacute or chronic course. Pemphigus should be classed with the rare skin-affections: according to the statistics of the American Dermatological Association, the disease occurs only 103 times out of 123,746 cases of general skin-affection. Crocker gives it in proportion of 2 per 1000 in England, while Kaposi makes the proportion as high as 4 per 1000. In the last ten years the writer has observed it only 5 times in about 25,000 cases of cutaneous diseases of all kinds.

In writing a concise article on the subject it will be necessary to confine our remarks to those divisions of pemphigus generally recognized in the modern works on dermatology: we will, therefore, make three main divisions of the subject—namely, pemphigus vulgaris, pemphigus foliaceus, pemphigus vegetans.

Pemphigus Vulgaris.—In small children and old people the beginning of the cutaneous disturbance may be ushered in by febrile manifestations, usually of slight character, temperature ranges about 100°; there may also be nausea and vomiting. The pyrexia usually subsides when the crop of bullæ ceases forming, but may recur at each fresh attack. Many cases of pemphigus are absolutely unattended by subjective symptoms; particularly is this true if the disease has run a chronic course. In typical cases the skin shows no prodromal signs, such as edema or redness. Some authors claim that frequently the formation of the bleb is preceded by a small urticarial wheal. The eruption may occur on any part of the body, either symmetrically or asymmetrically; the seat of election, however, appears to be the trunk on or near the pubic region; late in the disease the face and scalp may become involved. The number of lesions varies from one to over a hundred; if few in number and irregularly distributed, it forms the variety called by some writers pemphigus disseminatus. When a circle of fresh vesicles or blebs is formed around older ones, the term pemphigus circinatus is applicable.

The typical bleb is either hemispherical or ovoid in shape, in size ranging from a pea to a large hen's egg. The recent ones rise abruptly from the skin

without any inflammation around the base. The individual bleb may remain the same size throughout the whole period of evolution, or it may rapidly enlarge, either peripherally or by coalescence with neighboring ones, until it becomes a hard, tense elevation of the epiderm, filled at first with a clear serum or in rare instances serum mingled with blood (pemphigus hæmorrhagicus). After a day or so the fluid contents of the bullæ become more opaque, resembling buttermilk; this change is caused by the admixture of pus and epidermal cells: at this stage of the bleb the skin surrounding its base may present a slightly red collarette. The watery portion of the exudate is gradually absorbed; the blister-wall, epidermal scales, and pus-cells desiccate into a thin brown scab or crust which falls off after a few days, exposing a surface slightly pigmented and covered with a young epiderm, but no signs of scarring. When the eruption is closely grouped together, or if pus is confined under the scabs, the neighboring lymphatic glands may become swollen and tender, due, undoubtedly, to pyogenic absorption. If the bleb-walls become broken, the denuded surface is covered with a slightly bloody serum which soon dries into a thin scab.

The subjective symptoms are usually insignificant, consisting of slight itching and burning. If the blebs are numerous, there may be a feeling of tension. If there are excoriations, pain may be complained of. Sometimes the skin itches intensely, and the formation of the blebs is interfered with by scratching. This condition has been called pemphigus pruriginosis; this variety, however, more properly belongs under the classification of dermatitis herpetiformis. The evolution of the bleb is from two to eight days. If the blisters are few in number, the disease may terminate in from one to three months; but successive crops may prolong the attack for many months or even years. Recurrences are apt to occur even after complete convalescence.

In passing, mention should be made of an acute bullous eruption which has been classed by some writers as acute pemphigus. It is by no means a settled question whether this disease is an acute manifestation of pemphigus vulgaris or, as Zeisler suggests, a type of febris bullosa. Its existence has been denied by Hebra, who considers the reported cases to be examples of mistaken diagnosis.

The disease, which usually occurs in children, is ushered in by chills, fever, and general prostration, and the eruption of bullæ appears in various parts of the body. The patient convalesces in about three weeks. If, however, the child should be illy nourished, the termination may be prolonged, even resulting fatally.

Pemphigus foliaceus is characterized by the flaccid condition of the blebs and the proliferation of the surrounding epiderm into piecrust-like lamellæ. This form of pemphigus is very rare; Crocker's ratio is 1 in every 5000. It begins with all the distinctive symptoms of the foliaceus form, or a chronic pemphigus vulgaris may merge into it. The blebs are usually smaller than in the simple type, the walls are never tense; in some places the fluid is so scanty that there seems to be no elevation of the epiderm. The eruption, as a rule, begins on the chest, situated on a slightly inflamed base, usually as a solitary blister, which soon spreads by the formation of new ones peripherally and becomes general. The contents of the blister are opaque or reddish-yellow from the first and show no tendency to drying. The blister soon bursts and the fluid oozes out, excoriating the free epidermal surface. New epidermis seldom forms on the diseased parts, except occasionally, early in the course of the disease, a thin, friable variety may cover the site of the lesion. This, however, is speedily broken down, either accident-

ally or by renewed exudation underneath. After a few months the eruption becomes general; the condition of the patient is deplorable; the bare cutaneous surface looks as if it had been burned; the diseased skin is fissured; dark-red or brown spots are scattered over the body; the hair falls out; the eyes are red and inflamed; ectropium often occurs; there is a disgusting, nauseating odor emanating from the body; fever, which, at first, is intermittent, soon becomes continuous; the mucous surfaces are frequently involved; here true bullæ are seldom observed, because the epithelium is rapidly broken down. The surface appears red and raw, covered in places with diphtheria-like membrane. If the lesion is situated in the throat, deglutition becomes difficult; death may result from suffocation. The bullous process may extend to the intestinal tract, and diarrhea and intestinal hemorrhage result.

It has been pointed out by various writers that when the pemphigus lesion is observed on the mucous surfaces before its appearance on the skin, together with fever, the prognosis should be guarded, for this indicates the grave character of the disease.

Pemphigus Vegetans.—This almost absolutely fatal form of pemphigus was first described by Neumann in 1886. Cases of this disease have been described by many authors under many names. The general opinion was that it was one of the manifestations of malignant syphilis. Since it has been classed as a variety of pemphigus abundant clinical observation has proven that it is not syphilis. Fortunately, the disease is exceedingly rare. The initial bullæ are situated in the mouth or about the nostrils, anus, and, in females, the external genitals. There is considerable pain in the parts affected. If the bullæ are situated upon the soft palate or in the throat, deglutition may be interfered with. Typical bullæ soon form over various parts of the body, preferably about the flexures of the joints and in the groin. Prodromes may be absent or the advent of the lesions be attended with slight fever. The blebs, instead of drying into scabs, break down and leave a red and excoriated surface, which is enlarged by the formation of new vesicles at their margin. This is speedily changed into a fungating warty mass resembling syphilitic condylomata. These vegetations about the mouth and genitals were the cause of mistaken diagnosis. When the advent of the bullæ on the cutaneous surface occurs the real disease is at once known. The warty excrescences secrete a disagreeable-smelling fluid which excoriates the adjacent skin. If many bullæ be present at one time, the patients' condition is truly pitiable, and they rapidly succumb.

Sometimes the disease may be prolonged for months or even years before its fatal termination. Death is produced by simple exhaustion or some intercurrent disease, general nephritis or affections of other internal organs. Cases of complete recovery have been reported, but the rule is a fatal ending.

Etiology.—The etiology of pemphigus is largely a matter of conjecture. No two observers agree as to the causes. Age, sex, climate, or nationality seems to have no etiological influence; it has been claimed by some that it is more frequent in males. Kaposi places the proportion about three to one. The age of the individual seems to exert but a slight etiological effect, although young children and the debilitated aged seem to be more prone to its outbreaks. In some instances the disease may be congenital. The subject of the accompanying illustration is an example of congenital pemphigus which has existed from the first few days of life. The child is now six years of age, and has hardly been free from bullæ in all that time. The slightest friction is capable of producing blebs. This child shows an idiosyncrasy to

arsenic; any of the arsenical preparations is sufficient to provoke a severe outbreak of the eruption.

Etiologically, there seems to be some relationship between pemphigus and nervous diseases; hysterical and neurotic persons are frequently the subjects of pemphigus (pemphigus hystericus).

Many of the diseases of the spinal cord are accompanied with bullæ; it is a common occurrence to see blebs on the lower extremities of persons affected with ataxia or on the legs of paralytics.

Degenerative changes of the posterior column are often accompanied by bullæ. Pemphigous eruptions are sometimes observed in chronic myelitis, progressive muscular atrophy, and acute spinal meningitis. The writer recalls a patient seen with Dr. McNaughton of Brooklyn who was suffering from degenerative change of the median nerve produced by traumatism. There was almost complete anesthesia of the skin of the affected arm, with bullæ and trophic ulceration of the fingers; later, blebs appeared on the abdomen and thigh.

There are a sufficient number of authentic cases on record to pretty clearly establish the influence of a chill on the production of pemphigus foliaceus. With all these theoretical surmises the etiology of the various forms of pemphigus is still, at best, hypothetical.

Pathology and Anatomy.—Although positive etiological proof is wanting, still post-mortem examinations have, in many instances, shown anatomical change in the nervous system, consisting of inflammation or tumors in the spinal cord, ganglion, or peripheral nerves.

The anatomy has been carefully investigated by Kaposi, Leloir, Crocker, Robinson, and others. According to Robinson, the bulla is formed from the rete lining; the lower cells are separated and elongated by the exuded liquid, and the upper layer flattened. These elongated cells are thrown off and suspended in the vesicular fluid; the papillæ are edematous; the tissue is infiltrated with a serous effusion. The bullæ are more superficial than those of herpes or eczema, their roof being composed of the horny layer and upper part of the rete. The floor is formed by a lower rete layer. The superficial situation of the blebs explains why there is no loss of substance or cicatrization. Other writers differ somewhat from Robinson; they claim that the bulla consists of a roof formed from the upper horny layer, while the base is formed by rete-cells. The contents of the blebs are at first serum containing a few white corpuscles, but soon pus, fat, and epidermal cells appear. Some observers have found urine, and others ammonia, in the fluid. The various findings depended greatly upon the age of the blister.

Diagnosis.—There should be but little difficulty in differentiating pemphigus from other diseases occasionally presenting bullæ. The student should have prominently in mind a few essential facts: First, pemphigus is a comparatively rare disease. Second, it generally runs a subacute or chronic course; the bullæ, as a rule, spring from apparently healthy skin; inflammatory symptoms are rare and slight. The eruption has no predilection for any locality. And lastly, a true pemphigus bulla never ulcerates or heals by cicatrization unless it has been subjected to traumatism. The only cutaneous change after involution is pigmentation, varying in degree as regards color.

The diseases that may be mistaken for pemphigus are herpes iris, urticaria, pustular and bullous syphilis, scabies, impetigo, eczema, and bullous varicella.

Pemphigus may be differentiated from herpes iris by remembering that the latter rises from an inflammatory base, and that the vesicles do not return

PLATE 16.



Pemphigus vulgaris (drawn from life).



when they have once disappeared. Herpes is acute; the lesions consist essentially of vesicles which by coalescence may become bullæ. Further, the vesicles of herpes iris are arranged concentrically, and situated usually upon the arms and hands.

Urticaria is to be known from pemphigus by the fact that it shows signs of inflammation and the presence of wheals.

Bullous or pustular syphilis is rare, and occurs in infants who are the victims of the inherited disease; the bullæ are situated over an exulcerated base which dries into a thick brownish or green scab. The history and other syphilitic symptoms will also aid in diagnosis.

Scabies has characteristic symptoms of its own which will render differentiation easy.

In eczema the occasional bulla is generally accompanied by other characteristic symptoms of eczema. The raw weeping surface of eczema rubrum might suggest pemphigus foliaceus, but observation for a short time will reveal the half-filled flaccid bullæ of this form of pemphigus.

Bullous varicella is known from pemphigus by being an acute epidemic disease running a cyclical course.

The **prognosis** should be guarded. In pemphigus vulgaris it is favorable as regards life, but the disease is apt to become chronic, for relapses are almost certain to occur. If the character of the disease should change into the foliaceus form, the outlook becomes exceedingly grave. The occurrence of pemphigus vulgaris as a complication of debilitating diseases, such as phthisis, bronchitis, etc., makes the prognosis much more doubtful and grave.

In pemphigus vegetans and pemphigus foliaceus the chances are decidedly against recovery, although cases do now and then get well.

The **treatment** of pemphigus consists of both general and local measures. There are two drugs which seem to be especially beneficial: these are arsenic and quinine. The former is best given in small doses often repeated, as recommended by Bulkley. Fowler's solution of the Asiatic pill will be found the most useful preparation. Quinine should be employed in large doses. It has been my custom to combine arsenic and quinine, each capsule to contain one-sixtieth of a grain of arsenic and five grains of quinine, to be given three or four times a day. In addition to the above-mentioned drugs general tonic treatment will be found useful—iron, strychnine, and cod-liver oil, some of the various preparations of malt, and, in short, any therapeutic measure that will sustain and build up the nervous and general system. The diet should be carefully looked after; care should be taken to give the patient food which can be easily digested and at the same time is highly nutritious. The surroundings should be hygienic. Local treatment consists of oily lotions—for instance, a 2 per cent. lotion of carbolized oil—or, as Dr. Sherwell recommends, applications of linseed oil accompanied with internal administration of linseed meal. His method of applying the oil is to place the patient either naked or clad in one thin garment, on a bed which is covered with a rubber or oil-cloth arranged to allow flooding the whole body with the oil.

All blebs should be pricked and their contents pressed out, care being taken to preserve their coverings intact. If the blebs are ruptured and the skin is denuded and sore, ointments are indicated. A 5 per cent. ointment of ichthyol in equal parts of lanoline and cold cream will be found a useful application.

In pemphigus foliaceus and vegetans the continuous bath is especially indicated; this prevents the air from chilling the denuded skin and protects

from sudden changes of atmosphere. The patient is placed in a specially prepared bath-tub; the water, either medicated or plain, is constantly flowing in and out of the tub. The patient is kept in the bath for a period of time varying from months to years, depending upon the severity of the disease. Although there are many objections to carrying out this method in private houses, still, the beneficial effects more than compensate for the extra trouble it entails.

IMPETIGO HERPETIFORMIS (HEBRA). (JAMES M. WINFIELD, M. D.)

Definition.—A rare, acute, inflammatory disease of the skin, characterized by the formation of miliary pustules, attended with severe constitutional symptoms.

We are indebted to the writings of Hebra and Kaposi for our knowledge of this disease, which has been further supplemented by other observers in various parts of the world.

It was at first thought it was a disease peculiar to females, especially pregnant women, but subsequent observations have shown that it or a similar one occasionally occurs in males.

Cases of this affection have been reported by American observers, notably Zeisler, Heitzmann, Sherwell, Allan, etc.

Symptoms.—The eruption, as a rule, begins on the lower part of the abdomen, the inner side of the thighs, perineum, and later the axillæ. It consists of small, pinhead-sized pustules situated in circular or oval-shaped groups upon an inflamed area.

The contents of the eruption consist of pus from the beginning. The number of pustules rapidly multiply until in a few hours or a day the individual groups are from a half inch to two inches in diameter. As the patches enlarge peripherally the centers desiccate into a dark-yellow or brown crust resembling somewhat the scab of impetigo. The erythema precedes the eruption by about a day or so and gradually extends as the patch is enlarged. Upon removing the crusts the denuded mucous layer is seen, either red or else covered with a grayish deposit. When the scab drops off the exposed surface is reddish brown or livid, and soon becomes covered with a thin, dry epidermis that exfoliates in large scales. If the eruption is situated on approximate surfaces, crusts do not form; the skin becomes excoriated and intensely inflamed, and is soon covered with a grayish coating. The extent and size of the patches are variable; they become confluent by coalescence; their centers are either covered with crust or scales or else excoriated and fissured, bathed in a fetid secretion. The borders of the patches are outlined with a ring of pustules. In about three or four months the entire skin becomes involved. The eruptions of impetigo herpetiformis may appear on the mucous surface, especially of the lips and mouth; here they are either a simple erosion or an ulcerated patch covered with a gray deposit.

Kaposi found on autopsy ulcerations upon the folds of the esophagus and stomach; eruption was more marked near the cardiac extremity of the latter.

The constitutional symptoms are continued or remittent febrile attacks. Tongue dry and coated; pulse rapid and of diminished volume. There are anorexia, extreme thirst, and profound prostration, active or low and muttering delirium; besides this, other nervous symptoms have been observed, such as convulsions, contraction of sets of muscles, nystagmus, and localized paresis, incontinence of urine and feces. Diarrhea is usually present, and fre-

quently the stools are bloody. The urine is of high specific gravity, with an excess of urea, and in the latter stages often albuminous.

The subjective symptoms are variable; in some individuals there may be intense itching, in others this symptom is absent or slight. If the mucous membrane of the mouth and throat is affected, the patient complains of a burning pain upon deglutition. The disease lasts from three to six months.

Etiology.—All the earlier cases observed were in pregnant women: consequently, the gravid condition was considered to be in some way etiologically connected with the disease. Later observations, however, have shown that this disease is not exclusively one of pregnancy, but may occur in males as well as non-pregnant females. In some of the male cases Kaposi found the evidences of tubercular enteritis and peritonitis. Neumann attributes the disease to pyemia, and considers it to be a sort of metastasis. Sherwell considers "this and similar diseases (dermatitis herpetiformis) to be reflexes on the skin of either effete productions or septic or pyemic substances having primary or secondary effects on the nervous system."

Attempts have been made to ascribe the disease to morbid germs, but, although numbers have been isolated, none of these seem to have any etiological bearing on the cause. Notwithstanding the inability to isolate any distinct pathogenic germs, still the belief is gaining ground that the disease is infectious, or at least inoculative. Yet, as in many other rare diseases, we have but little of a definite nature to offer regarding cause, and are obliged to await further discoveries.

Pathology.—Autopsy and microscopic examinations disclose very little of value: the lymph- and blood-vessels are dilated, their interlinings swollen, and their covers infiltrated with round-cells.

Diagnosis.—The principal diseases that may be confounded with the one under consideration are dermatitis herpetiformis, pemphigus, pemphigus vegetans, and pustular syphilis.

At first Duhring claimed that impetigo herpetiformis was merely the pustular form of dermatitis herpetiformis, but further study of Kaposi has led him to modify his views.

The lesions of *dermatitis herpetiformis* are multiform in character, consisting of papules, vesicles, and bullæ; while pustules are not common, erythema is always present. Itching is at all times severe. It affects both males and females. Pregnancy has no bearing on the attacks. Finally, it is, comparatively speaking, a rare disease, seldom ending fatally.

Pemphigus is differentiated by remembering that in pemphigus the lesions are bullæ from the start, and that they show no tendency toward grouping.

Pemphigus vegetans may resemble impetigo herpetiformis while the eruption is confined in or about the mucous orifices, but after careful observation for a varying period the characteristic blebs will be found on the skin.

The diagnosis from *pustular syphilis* is made by obtaining a history of previous infection, the occurrence of secondary symptoms, ulcerations, and gummatous deposits, and improvement under antisyphilitic treatment.

Prognosis.—The prognosis is grave; nearly all cases so far have terminated fatally. In pregnant women recoveries have occurred, but relapse at the next pregnancy.

Treatment.—The therapeutic indications are sustaining measures and antiphlogistics. Quinine, iron, and strychnine have been found useful; arsenic has always seemed to aggravate the trouble. External applications of carbolized oil or ointment, ichthyol, and lime-water seem to relieve the irritation, but the most the physician can do is to treat the symptoms as they arrive.

DERMATITIS HERPETIFORMIS (DUHRING). (JAMES M. WINFIELD, M. D.)

Synonyms.—Hydroa; Hydroa herpetiformis; Dermatitis multiformis (Piffard); Pemphigus pruriginosus; Herpes herpetiformis; Herpes gestationes (Bulkley); Herpes circinatus bullosus; Impetigo herpetiformis (Hebra); Pemphigus diutinus pruriginosus (Hardy); Duhring's disease, etc.

Definition.—Dermatitis herpetiformis is one of the rarer diseases of the skin, characterized by an eruption of multiform lesions consisting of erythematous patches, vesicles, urticarial wheals, pustules, and blebs, which develop in groups, either singly or mixed, with attendant subjective symptoms of burning and itching, running a chronic course, sometimes ending fatally.

In 1884, Dr. L. A. Duhring of Philadelphia published his first brochure on this interesting disease. For many years before erythematous bullous eruptions had been described by different names, but all the descriptions were more or less misleading because they lacked the proper classification and grouping together under one head of all the essential clinical features.

Dr. Duhring's view at first seemed too comprehensive, until further knowledge was gained by the publication of his subsequent studies. A great deal of credit must also be given to Brocq of France for further elucidating this subject. At the present time there is scarcely a dermatological observer who does not recognize this disease as a distinct entity. Until very recently impetigo herpetiformis was considered to be a pustular manifestation of the disease in question, but from thorough discussion and unprejudiced opinion Dr. Duhring is inclined to consider impetigo herpetiformis (Hebra) a distinct variety of skin-affection, although it has many features in common with dermatitis herpetiformis.

Symptoms.—The first symptoms noted are malaise, sensations of chilliness, in some cases amounting to a decided chill, anorexia, and constipation, and if the attack is severe there may be considerable fever. Itching, more or less intense, usually precedes the advent of the cutaneous eruption by about twelve hours to two or more days. In the milder varieties all systemic symptoms subside at the advent of the eruption; the itching and burning, however, generally continue throughout the whole course of the disease. The eruption is multiform in character and varies in its mode of attack; it may come on gradually or suddenly; it is bilateral and usually symmetrical, situated most abundantly on the flexor surfaces of the wrists, forearms, then the abdomen, front of trunk, and outer surfaces of the thighs and buttocks; the legs below the knees remain comparatively clear, but the whole cutaneous surface is eventually involved. At first the lesions are macules or rose-colored papules which are from one-twelfth to one-fourth of an inch in diameter. The centers soon become depressed and the color may change into a purplish hue. As the eruption is so variable in appearance and color, it would be better to take up the various types seriatim. The characteristics are erythema, vesicles, bullæ, and pustules, or all of these combined. Ulceration seldom if ever occurs; when it does it is the result of scratching. The erythematous type is the one generally seen in the beginning of the disease, it being the primary manifestation of the cutaneous eruption. The erythematous patches are mingled with urticarial wheals. This type is difficult to diagnose, for it may resemble urticaria or erythema multiforme. As the disease progresses vesicles appear; the erythematous patches are not sharply outlined from the surrounding skin, but fade away imperceptibly. The crops appear successively; more or less pigmentation remains, at first red or red-

dish brown, later fading into a dull yellow. The most frequent variety of dermatitis herpetiformis is the vesicular; the tendency for grouping upon an erythematous base suggests the name herpetiformis. The shape and size of the vesicles are variable; they may be found so small that they are hardly visible, while others may be large enough to be classed as bullæ; when they desiccate the lesions present a puckered appearance. In shape they may vary from a star to a perfect circle. They appear glistening and semi-transparent at first, but as the disease advances the contents become changed in character and the blisters appear yellow and opaque. The vesicles are frequently arranged in groups, simulating the clustering of herpes. Each individual crop of vesicles develops rather slowly, taking sometimes more than a week for complete evolution. Itching is a prominent symptom. If the vesicles become enlarged, it is called the bullous form. The blebs are formed by coalescence or the peripheral extension of the individual vesicles. The change of type from the vesicular to the bullous may take place rapidly or gradually. The blebs, as a rule, are tense or on rare occasions flaccid, ranging in size from a split pea to a hen's egg. The shapes are stellate, circular, or oval. The contents are serous, or later may be puriform. Number variable, but, as a rule, numerous, with pustules interspersed. This variety bears a close resemblance, both clinical and symptomatic, to pemphigus pruriginosus. The vesicles and bullæ resemble herpes in reference to their covering; they seldom if ever rupture spontaneously. The pustular form is one of the uncommon manifestations of this polymorphous disease; it is in many respects similar to the vesicular or bullous type; the only marked difference is that the contents are purulent; the contour of the lesion is more irregular; it is common to find papules, vesicles, and blebs intermingled with the characteristic pustules. They vary in size, and are generally surrounded by a distinct red area; the pustules show a tendency to grouping, although in a less degree than in the vesicular type. They appear in successive crops; sometimes parts of the body will display desiccating lesions, and others the beginning eruption. This may continue indefinitely for several weeks or months, or the skin may clear up from the active process, and remain so for a week or two, when a relapse takes place and the disease goes through the same involution. The pustular type is probably the most severe of any of the varieties, the constitutional symptoms being more pronounced than in the others. Another uncommon form of dermatitis herpetiformis is the papular. Here the eruption is more scanty than in the preceding varieties, the itching being severe; the skin is excoriated and covered with blood-crusts. In the beginning of the eruption papules predominate, but they change into vesicles, although some papules remain through the whole attack. When all the various types are intermingled we have what is known as the mixed variety; this should not, however, be classed as a distinct type, but a clinical demonstration of the changes that may take place in this multiform eruption. This, as all other forms, is accompanied with intense itching and burning. A fully-developed attack of the mixed variety presents an appearance entirely different from any other skin-disease; here may be seen almost any lesion common to cutaneous affections. Scattered over the body are erythematous patches, urticarial wheals, macules, papules, vesicles, and sometimes small blebs and pustules. If the crops come out in rapid succession and are numerous, the skin appears red and eczematous. A number of other types have been mentioned, but, as they are only illustrations of this polymorphous disease, they will not be described.

Etiology.—Dermatitis herpetiformis, along with other diseases, as

pemphigus, urticaria, erythema multiforme, etc., suggests a neurotic origin or, as Dühring says, neuritic. Many authors claim that fright and mental worry are capable of producing an attack. The writer has reported instances of dermatitis herpetiformis following nervous shock, in which the examination of the urine revealed the presence of sugar in varying amounts.¹ This has been verified by Sherwell, who originally suggested to the writer the probability of such an occurrence.

Elliot, Brocq, and others have recorded cases where polyuria was one of the symptoms: this finding, coupled with sugar, would seem to be further evidence of a neurotic etiological factor. The weight of opinion is that the disease is a cutaneous manifestation of some reflex neurosis. It is claimed by Dühring and others that the cutaneous outbreak is the result of a peripheral neuritis. There is a possibility of the disease being due to diseased kidneys, the skin-eruption being the result of a uremic toxemia. Exposure to cold seems to be another factor. As many cases are not traceable to any cause, it would appear that much has to be cleared up before a definite etiological conclusion can be arrived at.

Pathology.—As in all diseases where the etiology is essentially theoretical, the knowledge of the pathology must necessarily be obscure. Still, it is generally conceded that there is some pathological change in the nervous system. Renal changes, such as nephritis, have been observed in some instances; alterations of the urinary secretions, as increased amounts, the presence of sugar, diminution of nitrogen, etc. Examinations of the blood and vesicular fluid have been mainly negative. Examinations of the lesions themselves have revealed nothing pathognomonic.

Diagnosis.—To differentiate this disease from some others is no easy matter, and to arrive at a correct diagnosis the physician must have a broad and comprehensive understanding of the disorder. The diseases that will be most commonly mistaken for dermatitis herpetiformis are pemphigus, urticaria, herpes, eczema, and erythema multiforme.

Pemphigus is distinguished throughout by bullæ which spring from a non-inflammatory base and show no tendency toward grouping; they are never mingled with vesicles and papules; itching is not a troublesome accompaniment, while it is one of the most annoying symptoms of dermatitis herpetiformis.

Urticaria bullosa shows no tendency to grouping; it attacks certain parts of the body or may be general; it never forms in circles; the lesion is more elevated and universal in size and the bullæ form from pre-existing wheals.

Herpes Zoster.—The history and the previous neuralgia in the part of skin affected and subsequent course of the disease will serve to distinguish this affection from the one under consideration.

Dermatitis herpetiformis can readily be mistaken for papular and vesicular eczema. It should be remembered that in eczema the vesicles are small and regular in outline, never stellate nor angular; the papules of eczema are smaller and develop more gradually; neither of these eczematous lesions ever shows any tendency toward grouping.

Erythema multiforme is a disease that will cause the greatest difficulty in differentiation. It should be remembered that dermatitis herpetiformis is a more chronic affection, that the cutaneous lesions are vesicles, wheals, bullæ, and sometimes pustules; moreover, the lesions of erythema multiforme show no tendency toward grouping, but present a regular and uniform distribution.

¹ "Glycosuria as an Additional Symptom indicating the Neurotic Origin of Dermatitis Herpetiformis," *Journ. of Cut. and Gen.-w. Dis.*, Nov., 1893.

The **prognosis** should be guarded, for, while relief from individual attacks may be guaranteed, still it is apt to be a chronic and persistent disease. If it is accompanied by pregnancy (herpes gestationis), relief can be expected at parturition, but relapses may occur at each succeeding pregnancy. If the attack is produced by a nervous or run-down condition, improvement of the general health will, as a rule, be followed by a cure. Fatal termination has been noted in the severe types of the disease.

Treatment.—Although many cases of dermatitis herpetiformis appear to have no definite cause, still there are a sufficient number which seem to be induced by some neurosis, such as sudden fright or mental worry; consequently, the first endeavor should be directed toward removing anything that might produce any sort of nervous upset. While this disease is extremely obstinate and chronic, careful watching and close consideration of individual cases will produce good results, if not a cure. All excesses of any sort should be guarded against; attention should be paid to the digestive tract; the food should be light and nutritious; tonics, such as arsenic in small doses either alone or in combination with iron, quinine, and strychnine, are indicated. Iron is most useful if the patient is anemic. If there should be any tendency to rheumatism or gout, alkalies combined with tonics will be indicated. Some authorities claim good results from arsenic pushed to its extreme limit; this method has not proved beneficial in my experience. Sedatives in some cases will be found necessary to counteract the itching and to relieve the sleeplessness. Bromide of sodium in fifteen- or thirty-grain doses, either alone or combined with chloral, will often meet these indications. Tincture of belladonna will often allay much of the cutaneous disturbance. Cannabis indica is probably one of the most valuable sedative remedies we have. The best preparation is the fluid extract, given in doses of two or three drops every three or four hours according to indications. If the patient is able to seek a change of climate, much benefit can be expected from a sojourn in a warm, dry region.

The most important treatment, however, is the external. Duhring recommends the use of unguents and lotions that act revulsively; he claims to have obtained good results from sulphur ointment. While stimulating unguents act favorably in the majority of cases, there are those occasionally seen that require the mildest measures. If the eruption is universal, cotton batting, saturated with $\frac{1}{2}$ per cent. carbolized oil and lime-water in equal parts, wrapped around the body, will relieve the intense itching. Lotions are often preferable to ointments; this is especially true in the erythematous type; here tar preparations are useful, as, for instance, the liquor picis alkalinus in the proportion of one to two drams to a pint of water. Ichthyol, either in ointment or lotion, seems to exert a happy effect on the eruption. This drug possesses the good qualities of both sulphur and tar. All external applications should be firmly and thoroughly rubbed in and the affected parts protected from exposure. It is best to begin with the mildest measures, strengthening the applications as the disease advances. Enough has been said, and a sufficient number of drugs enumerated, to give the practitioner a clue to the treatment of this interesting but obstinate disease.

ECZEMA. (W. A. HARDAWAY, M. D.)

Definition.—Eczema is an acute or chronic catarrhal inflammation of the skin characterized by polymorphous lesions and the presence of itching, infiltration, and discharge. Crusting, scaling, and fissuring, and even hypertrophic changes, are to be noted as secondary results.

Symptoms.—The essential symptoms of eczema are itching, infiltration, and a serous discharge: one or more of these features of the disease may be found at all times in every case, especially the first two, but the local or lesional expressions are very variable. Willan and some of his modern disciples held that eczema was always anatomically represented by the vesicle, and to-day Kaposi contends that this is really the acme of the process. It may be said that eczema always begins as a congestion of the skin and always terminates in desquamation; but there may intervene papulation, vesiculation, pustulation, the result of infection, and the various secondary changes that will be presently described. It was Hebra's special distinction that he recognized the protean character of the disorder, and assigned to their proper position the so-called *liehen*, *impetigo*, *pityriasis*, etc. of older writers.

Eczema is especially characterized by its exudation or discharge, in which it differs from other cutaneous inflammations and bears a resemblance to the catarrhal processes of mucous membranes; but it is by no means true that this weeping surface is always present, for in certain cases this feature is never developed, at least spontaneously, although a dry papular or erythematous eczema may be made to exude as the result of irritation. This exudation quite characteristically stiffens the linen with which it comes in contact.

The disease rarely attacks the whole body, except in elderly or weakly persons, and, notwithstanding the loss of sleep and the excessive irritation from scratching, the general health usually remains unimpaired. Eczema is not developed symmetrically—as in psoriasis, for example—but, roughly speaking, if it is found on one hand or leg or ear, it is often present on the other; but in a great number of cases this bilateral arrangement is not seen at all. The principal subjective symptoms in eczema are itching and more or less soreness and pain that usually follow violent scratching. In truth, it may be said that eczema is the itching disease *par excellence*. The degree of pruritus will vary according to the age of the patient, the location of the eruption, and the type of the lesions present. Thus papular eczema is, perhaps, the most and pustular eczema the least annoying in this respect. In some cases and under some circumstances the sensation of itching amounts to little more than a slight tingling, which may even be pleasurable; on the other hand, it may cause the most excruciating agony, the patient gouging and tearing the skin with ungovernable fury, and desisting only when, the parts being lacerated, a free exudation of blood and serum has given relief to the tortured skin.

From a practical standpoint it will be convenient to speak of acute, subacute, and chronic eczema, although these terms are not to be taken altogether in their usual significance, as will appear farther on.

An acute attack of the disease may be ushered in with some slight elevation of temperature, but usually all constitutional disturbance is absent; but the local disorder presents the ordinary symptoms of inflammation—namely, heat, redness, and swelling—together with burning and tingling. Probably in the majority of cases the affection may be said to be subacute from the first; but it is to be specially noted that an acute condition may supervene upon a subacute or even chronic process. When the disease continues for a length of time, with or without occasional exacerbations, the skin becomes thicker, itching is a marked feature, and various secondary changes take place; in other words, a chronic eczema is established that may last for years.

Notwithstanding that in eczema the underlying pathological conditions are uniform, and the varying and shifting local expressions of the disorder

represent but different links in a single chain, still at times one or another elementary form will predominate and measurably establish the anatomical general type of the eruption. Therefore in the interest of clinical convenience the disease may be studied under the following aspects :

Eczema Erythematosum.—Erythematous eczema is usually confined to limited regions, such as the legs, back of the hands, inner surfaces of the thighs, under the breasts, and, most especially, the face; more rarely the whole body may be invaded. It makes its appearance in the form of ill-defined, red, and slightly infiltrated patches, accompanied by burning, tingling, and itching, although this latter symptom is not so pronounced as in other varieties of the disease. The shades of color vary from a light-red to a reddish-purple or tawny hue. The eruption may disappear rapidly, or under various exciting influences it may come or go; on the other hand, it may persist indefinitely, producing thickening and fissuring of the skin, which may also be covered with scales. Simple redness of the skin is usually the only lesion present, but at times minute papules may be detected or papules capped with a droplet of serum. Itching followed by scratching is apt to produce small excoriations, or, if the traumatism is at all severe, the ordinary features of eczema rubrum, with rawness and crusting, will be developed. In the lax tissues of the face great swelling of the skin with closure of the lids often occurs, leading to an erroneous diagnosis of erysipelas.

Eczema Papulosum.—Papular eczema was formerly called lichen, which term to-day has quite a different significance. The papules are usually red, acuminate, and the size of a pin's head, and, as regards distribution, may be closely set on an inflamed base or else irregularly scattered over the surface. In certain situations where the skin is soft the papules may attain some size, and this is also true of them where the skin has been much scratched. The subjective symptoms consist of burning, tingling, and especially intolerable itching. If the disorder should become chronic, the papules run together, losing their separate identity, and finally form leathery, scaly patches, or if the surface has been greatly irritated, an eczema rubrum results. The extensor surfaces and the face are the favorite sites for this form of the disease. The papular type of lesion may persist throughout the course of a given attack, or there may be at one or another time vesicles, vesico-papules, and pustules. Frequent and persistent attacks are common.

Eczema Vesiculosum.—Although vesicles and vesico-papules are comparatively frequent accompaniments of other types of eczema, as a primary type in its *typical form* it is by no means so common as some observers would have us believe. This difference of opinion, however, may be due to circumstances but poorly understood, such as climate, diet, etc. For example, Crocker says that vesicular eczema is common, while Unna declares that it is the least frequent. Really, however, the nature of the elementary lesion will depend upon the degree of irritation. A vesicular eczema will always begin with burning and tingling and a diffused or punctate redness of the skin, to be presently followed by minute, closely-set vesicles, that soon rupture spontaneously or accidentally and pour out a clear, or later opaque, sticky fluid. Burning and itching are marked symptoms, and the skin becomes considerably swollen and infiltrated. The exudation or weeping stage will often persist after the rupture of the vesicles, either from the development of new lesions or as a general oozing from the raw and denuded surface. On the other hand, the exudation may dry into yellowish, gummy, easily detachable crusts, which upon removal exhibit a moist surface. Under appropriate treatment the vesicles may dry up without rupture, the integument being left red,

scaly, and thickened. Therefore, it will be seen that both *eczema madidans* and *eczema squamosum* are quite frequent sequelæ of the vesicular form. The favorite sites of this eruption are the flexor sides of the limbs, the hands, especially the sides of the fingers, although often attacking the dorsum and even the palmar surfaces. Vesicular *eczema* is comparatively common on the faces and scalps of children.

Eczema Pustulosum.—Pustular *eczema* was formerly variously designated *impetigo*, *porrigo larvalis*, *eczema impetiginodes*, etc. It may originate directly in the form of pustules, or the pustular lesions may develop from vesicles or follow in the wake of other primary types. It is to be remembered, however, that the presence of pus-cocci and a congenial soil are the responsible factors. Pustular *eczema* is accompanied, as a rule, by less irritation and itching than any of the other elementary forms of the disease. It is most frequent about the heads and faces of children, especially the ill-nourished, and also is often seen in weakly adults. In the shape of a secondary folliculitis the eruption is comparatively common on the bearded face, in the axillary and pubic regions, and other hairy parts. Crusts left after the bursting or desiccation of the pustules are usually dark, with varying shades of yellow and green.

While any one of the elementary forms of *eczema* may run its entire course as such, or may be more or less commingled with some other primary type or types, it is the rule that certain secondary changes are most frequently met with in practice. These changes are the result of the further evolution of the disease or are due to some kind of extraneous irritation. Then, again, there are certain clinical varieties that agree in the main with our present conception of *eczema*, but which further investigation may eventually relegate to some other nosological position. These various forms will now be examined briefly.

Eczema Rubrum or Madidans.—Any of the elementary types may be followed by this condition, although it is much more frequent after the vesicular and pustular forms. Owing to the exposure of the rete from free shedding of the upper layers of epithelium the surface is intensely red, and pours out a clear or turbid, straw-colored, sticky fluid that is apt to dry into thin, yellow, flaky incrustations. At other times the surface has a bright-red, smooth, and somewhat glazed appearance, or, again, there may be noted little apertures or small points of ulceration corresponding to glandular orifices or ruptured vesicles; or, when there is marked infiltration, there may be present cracks and fissures from which issue a serous or sanious discharge. In some cases pustules may develop and the discharge will become sero-purulent or purulent with corresponding crusts. Itching is very intense, although usually paroxysmal in character. *Eczema rubrum* may occur anywhere on the body and involve large or small surfaces, but it is perhaps most typically seen on the legs of middle-aged people and in the flexures of joints; it is also often encountered on the faces of children. *Eczema rubrum* corresponds most closely with the popular idea of salt rheum.

Eczema Squamosum.—Squamous or scaly *eczema* is either indicative of a decline in the activity of the inflammatory process or else shows a low grade of the original inflammation. It may follow any of the elementary types of *eczema*, but is more particularly connected with the erythematous form. Scaly *eczema* occurs mainly in reddish patches of variable size, that are covered with large or small scales and exhibit more or less infiltration. It is often observed on the face, scalp, back of the neck, and sometimes

widely dispersed over the body. Mild grades of squamous eczema were formerly called pityriasis.

Eczema Sclerosum.—On certain parts, especially the skin of the palms and soles, there occurs great thickening of the integument, and when, from movements of the parts, the skin having lost its normal elasticity, fissures and cracks occur, the condition known as *eczema fissum* is produced.

Occurring on the palms and soles, the lesions are symmetrical, and often both hands or feet are involved. The infiltrated patches may occupy the entire palmar and plantar surfaces or appear in quite circumscribed areas. There are no previous papules or vesicles, but little itching and no desquamation.

Eczema Verrucosum.—This condition is characterized by notable papillary hypertrophy, and the skin presents a diffused warty appearance. It is apt to occur at the lower parts of the legs.

Ulcers.—Ulceration is rare in eczema, but in strumous children suffering from pustular eczema it may be noted occasionally. The so-called varicose ulcers complicated with eczema are very common. Boils and abscesses from pus-infection, particularly in children, are very annoying and not infrequent accompaniments of the eczematous eruptions.

Eczema Parasiticum.—Crocker describes a form of unsymmetrical eruption that has the appearance of a dry eczema, but with a border more distinctly defined than in *eczema squamosum*. According to this author, it occurs chiefly on the legs below the knee, but also on the arms. It is made up of minute papules which run together to form a moderately red, scaly patch with outlying papules. It remains for years if untreated, slowly extending or forming fresh patches. There is mild pruritus. No parasite has been detected, but it is amenable to antiparasitic remedies. H. Hebra has also described a parasitic eczema, which, however, is accompanied by discharge and formation of crusts. I have several times seen the circumscribed papular eruption mentioned by Crocker, but it has been found on the body as well as on the trunk, and has been very itchy. A case recently under my care was distinctly vesicular, and in another case there was peripheral extension by means of an undermining of the epidermis with fluid. In all these cases relapse has been the rule, even where healing had apparently occurred, the new lesions, papules or minute vesicles, appearing first in the center of the patches.

Authors have described various eruptions of the skin having the clinical symptoms of eczema, as scborrheic eczema, sweat eczema, diabetic eczema, follicular eczema, neurotic eczema, etc. Since, from the point of view taken in this article (see Etiology), eczema is a catarrhal inflammation of the skin, having the greatest variety of causes both internal and external, I can see no particular objection to these titles, especially since in a measure they point to the cause or causes of the affection, and thus more or less directly to the proper treatment.

Eczema Infantile.—Eczema is a very common disease among children, especially in the first five years of life, but it differs in no essential particular from the same affection in the adult, except, perhaps, in the matters of causation and location. In a general way it may be said that eczema occupies certain situations more often in the child than in the grown person—the scalp and face, for instance—and that the eruption is more inflammatory. All the elementary lesions of the skin may be seen in children, although perhaps the pustular form is more common with them than with the adult. Squamous eczema and *eczema rubrum* are frequent, but leathery-like thickening is rare.

Among other features of importance connected with infantile eczema should be noted cutaneous abscesses, glandular swellings, and post-eczematous furunculosis. It is exceptional for the enlarged glands to suppurate.

Generalized eczema is rare in infancy and childhood, although there may be present, scattered over the body and limbs, infiltrated patches of variable size, sometimes scaly or composed of aggregated papules exhibiting moist and excoriated surfaces. The disease also attacks the hands, feet, and legs, and the flexures of the joints. Eczema intertrigo, or that form of the disease found in the groin and between other opposing surfaces of skin, is frequent, but not attended by much itching. The surfaces are very red and moist and have a bad odor. Moreover, the eruption may spread over these localities to the adjacent portions of the thighs, back, and abdomen. The face is the region most frequently affected in children. The primary lesions are usually papules or vesico-papules which run together to form exuding, reddened, and crusty patches that are intolerably itchy. In this situation relapses are apt to occur, as every varying condition of the system is promptly reflected on a part especially rich in its vascular and nervous supply. A very common starting-point also is the scalp, with its rich sebaceous secretion, where, perhaps, both traumatism in the shape of washing and combing and parasitism play a not inconsiderable rôle in etiology. From this region it may spread to the forehead, ears, and face, in the end producing the well-known picture of *crusta lactea* or milk-crust. The itching here is generally excessive, and the little sufferers, if old enough, will make frantic efforts to get relief by scratching, while infants will rub the head and face against the pillow or the nurse's breast.

It will not be necessary at this place to enter into the further details of the symptomatology of eczema in general, as this will be fully attended to when the clinical features and special therapeutics of regional eczema is considered. The principal local varieties of the disease are as follows:

Eczema faciei ;	Eczema capitis ;
Eczema tarsi et palpebrarum ;	Eczema barbæ ;
Eczema narii ;	Eczema aurium ;
Eczema mammæ ;	Eczema umbilici ;
Eczema genitalium ;	Eczema ani ;
Eczema crurum ;	Eczema articularum ;
Eczema manuum ;	Eczema pedum.
Eczema unguium ;	

Etiology.—Eczema is the most common of all diseases of the skin. An examination of the combined returns of the American Dermatological Association shows its statistical frequency to be somewhat in excess of 30 per cent. of all classes of cutaneous affections. It attacks all periods of life from old age to infancy, and both sexes perhaps alike. It is more common, according to Bulkley, in the first five years of life and between the ages of twenty and thirty. Ræ declares that it rarely occurs in old people as a first attack, but in them it is usually a recurrence or a relapse. Rich and poor, the apparently strong as well as the weak and sickly, are alike subject to it; but a careful search will generally discover special local or constitutional vulnerability. Eczema is not hereditary in the sense that syphilis is, but eczematous parents often beget eczematous children. In such cases the predisposed and susceptible skin is inherited rather than a so-called diathetic condition. The disorder is not contagious, so far as we know, even in the assumed parasitic form, but an acrid and irritating discharge coming in contact with the susceptible skin of another person may give rise to it. Certain authorities

regard the seborrheic form as distinctly contagious, at least to the individual bearing it; and of this fact there seems to be but little doubt. Moreover, a purely local eczema may reflexly determine an attack at some remote part and even precipitate a general attack.

It seems to be pretty well understood to-day that eczema is not a diathetic state, dependent upon any single condition of the system, whether called gouty or dartrous or rheumatic, although any one of these conditions may act in a predisposing way. Stated briefly, the eczematous subject possesses a distinctly vulnerable cutaneous system, and under certain conditions the disease may be evoked by any irritant, external or internal, capable of arousing this susceptibility. We see the same pathological nexus in catarrhal inflammations of mucous membranes. It is quite clear to me, however, that the eczematous inflammation is something more than a dermatitis, displaying other features and another course.

It remains, then, to determine what are the more frequent provocative causes of the disease, and, since this is a matter of considerable therapeutic importance, it will be well to examine the question somewhat systematically.

Internal Causes.—There is no question that derangements of nervous function are frequent direct or indirect causes of eczema. It is difficult to explain the exact connection except in vague or purely theoretical language, but the objective relationship is not difficult to determine. Instances of the disease coincident with mental shock, extreme mental worry, and nervous exhaustion are familiar to practical observers. Colomiatti has demonstrated actual structural changes in the nerves in some cases, and his observations have been confirmed by Leloir. Reflex nervous irritation from the uterus, stomach, intestines, etc. is generally admitted as a factor of undoubted importance. Hebra long ago called attention to eczema during pregnancy, and climacteric eczema is of common occurrence. Erythematous eczema of the face dependent upon gastric disturbances of various kinds is a notoriously frequent and exceedingly rebellious variety of the disorder. Unna recognizes a special nervous eczema of dentition, and G. H. Fox affirms that an adherent prepuce is often responsible for the disease in children. The observations of Elliot and Barham may also be mentioned in this connection.

Among the common exciting and predisposing causes should be placed quite prominently gastro-intestinal derangements. Thus it may be said that certain articles of food and drink are capable of causing eczema, inasmuch as they induce derangements of the stomach and bowels. So also gout, lithemia, and other general affections perhaps act in the same manner.

Eczemas of people in middle age are often associated with diabetes, and more rarely albuminuria. Years ago Yandall urged that malaria bore a direct etiological relationship to eczema, and recently Brocq has reported some facts of a like nature. Bulkley finds eczema so frequently associated with asthma that he regards the latter as, in a sense, a sort of eczema of the pulmonary mucous membrane. I do not at all doubt that mucous membranes suffer from the eczematous process. Von Sehlen¹ sums up his views as to the relation existing between eczema and certain affections of the mucous membranes as follows: First, chronic eczema of the skin may attack adjoining mucous membranes and produce upon them apparently independent affections; second, eczema of the lips, catarrh of the external ear, eczema of the lids, and a certain form of conjunctivitis are to be regarded as special localizations of the eczematous process; third, certain inflammatory conditions of

¹ *Monatshft. f. prakt. Derm.*, Bd. xix. No. 1.

the anal mucous membrane and of the genitalia in both sexes stand in a close relation to eczema of the skin.

The ill-nourished and strumous, particularly among children, are peculiarly prone to eczema, especially of the pustular type, with swollen glands, ciliary blepharitis, and otorrhea as concomitants. And such children, according to Unna, may develop general or local tuberculosis. Eczemas follow in the wake of eruptive fevers, particularly measles, and post-vaccinal eczema is of common occurrence. As in the adult, errors in diet, with consequent gastro-intestinal disturbance and the formation of toxins, are at the bottom of most eczemas in children.

It is a matter of great importance to recognize the fact that eczema may be evoked by purely external agencies. The old notion that the disease was due to a so-called diathesis or bad state of the blood was not only unscientific, but often directed attention away from some obvious local cause whose removal would have promptly cured the disease. It will not be necessary to enter into minute details as to the various substances that are capable of setting up an eczema. Briefly stated, it may be said that any irritant is efficient in this direction—for example, chemicals, sugar, flour, lime, soap and water, rough garments, etc. etc. Both heat and cold are to be held responsible, for the disease arises from exposure to the rays of the sun and also from artificial heat, and in the winter season eczema is more common than in summer. A varicose condition of the veins is a common exciting cause. Scratching produces eczema, not only extending and increasing it where the disease already exists, but inducing it in other pruritic affections, such as nettle-rash, itch, ichthyosis, prurigo, etc.

Seborrhea, as long since pointed out by Hebra, is a prolific source of eczema. Morris affirms that seborrheic eczema is merely the eczematous process going through the various phases of its evolution in a skin that has long been the seat of seborrhea. But he adds that the real irritant is of a parasitic nature. Whether this view of the seborrheal dermatitis is a correct one or not, there is no question that parasitism plays an important rôle in many forms of eczema; but this fact in no way prevents us from concluding that the soil is in many ways prepared for the micro-organism by a great variety of local and general conditions.

Pathological Anatomy.¹—It has seldom been possible to study the earliest stage of eczema. It may, however, be confidently asserted that in most cases, at least, the first pathological appearances consist of a congestion and dilatation of the blood-vessels of the papillary layer of the corium, soon followed by an abundant diapedesis of white blood-corpuscles, which fill up the papillæ and soon make their appearance as migratory cells in the epidermis. There occurs at the same time an exudation of serum from the vessels, which distends the papillæ and the adjacent parts of the corium, giving rise to an edematous infiltration. In some cases this edematous infiltration is not confined to the papillary layer, but invades the deeper portions of the corium and the subcutaneous tissue, causing a great swelling and prominence of the affected area. In some instances, as upon the legs, there is also an infiltration with red corpuscles. When the exudation and edematous infiltration are confined to a limited area, especially about the hair-follicles, small papules are formed having the follicle for their center.

The epithelial alterations in eczema have received much attention of late years, and have acquired great prominence from the studies of Leloir and Unna chiefly. Leloir believed that the serous exudation from the corium is

¹ Dr. John T. Bowen of Boston has kindly supplied this section of the article.

responsible for the epithelial changes, while Neisser, on the contrary, regards this as improbable in cases where the eczema is produced by external agencies, and thinks that where the affection is obviously due to an irritant acting from without, the epithelium is directly and in the first instance affected. These epithelial changes, as described by Leloir, consist in (*a*) the immigration of leukocytes into the spaces between the prickle-cells; (*b*) an edema of the epidermis, and especially of the basal horny layer; (*c*) a tendency to dekeratinization, shown by the disappearance or lessening of the eleidine and of the granular layer; (*d*) the persistence of the nuclei of the cells of the horny layer, which in consequence of the dekeratinizing process are no longer coherent, having lost their normal adhesive attribute and tend to exfoliate in the form of scales. At a later stage begins the process of vesiculation, of the formation of the elementary lesion of eczema, which has its place usually in the middle or upper layers of the rete Malpighii. This process of vesiculation consists in the formation of a clear space or cavity between the nucleus and protoplasm of the cell, Leloir's "alteration cavaire," which goes on increasing until a reticulum of various-sized meshes is formed, containing the nuclei. When this becomes filled with leukocytes it constitutes a pustule. Unna's views are somewhat at variance with those just given, particularly with regard to the formation of the eczema vesicle, as he believes that the elementary cavities are formed not *in*, but *between*, the epithelial cells. In the main, however, most modern writers are agreed that these epithelial alterations are characteristic of eczema.

At a still later stage of the inflammatory process we begin to find a proliferation of the epithelium, with the presence of karyokinetic figures in the lower rete-cells. The papillæ are from this cause broadened and elongated, and in some cases of chronic eczema a papillomatous condition is produced. In all cases of chronic eczema there is some degree of epithelial proliferation. In the chronic stage the blood-vessels in the papillary layer are dilated and surrounded by a mass of cells. These cells, which are also found at a distance from the vessels, go to make up the eczematous infiltration. Unna regards them all as small connective-tissue cells, and he states that at this stage there is a complete absence of leukocytic emigration, with very few mast-and plasma-cells. In chronic eczema a proliferation of the connective-tissue cells is a marked feature, which leads to the formation of new connective tissue. The extreme of this connective-tissue proliferation is reached in the cases of so-called elephantiasis nostras. The lymph-channels are dilated, and the sebaceous and sweat-glands, together with the hair-follicles, undergo more or less atrophy.

Diagnosis.—If the general symptoms of eczema—the itching, the infiltration, and the discharge—be kept clearly in mind, the diagnosis will be attended with few real difficulties. Of course under certain circumstances, as from over-treatment or neglect or traumatism, some of the more salient features of the disease may have become disguised, but even then attention to the history of the case or a few days' careful inspection will disclose the true nature of the trouble. Following is a brief account of those diseases with which it is usual to confound eczema:

Acne Rosacea.—Erythematous eczema presents some general likeness to rosacea, but in the latter disease the absence of itching or the presence at the latest stage of papules, pustules, and telangiectases is sufficiently distinctive.

Erysipelas.—Erythematous eczema of the face and erysipelas of the same region bear a superficial if not real resemblance to each other. It is to be noted, however, that erysipelas is characterized by more or less febrile

reaction, while in eczema, if fever exists at all, it is transient and slight. The eruption in erysipelas begins at a single point, usually at a muco-cutaneous outlet or in a mole or abrasion of the skin, and gradually extends with a well-marked line of demarkation between the sound and healthy skin; in eczema there is no initial point of departure, but the whole of a given region becomes involved at once and the sound skin and affected skin are imperceptibly blended. In erysipelas the tissues are dense, shiny, and have a brawny feel; in eczema the inflammation is superficial. In erysipelas there is no exuding surface except from the rupture of blebs late in the disease; in eczema there is apt to be discharge or oozing some time in its course. Erysipelas is always an acute disease; eczema is apt to become chronic and exhibit marked thickening of the skin and considerable pruritus.

Psoriasis.—Squamous eczema and certain ill-defined forms of psoriasis are sometimes difficult to differentiate without a careful inspection of the entire surface of the body. In psoriasis the disease is nearly always bilateral, and is generally found on elbows, knees, and scalp. There is no history of moisture, itching is absent, at least not pronounced, the scales are larger and whiter, and when removed show a punctiform bleeding surface. Psoriasis occupies the outer or extensor surfaces of the limbs, while eczema is more apt to be located on the inner or flexor sides, although this rule is by no means invariably true. The patches of psoriasis are sharply defined, and do not, like those of eczema, shade off into the surrounding healthy skin. The patches of psoriasis are clear in the center, while those of eczema show a tendency to healing at their borders. An inquiry into the history of the case will probably reveal other attacks of an identical character, while if the eczematous patient has suffered other attacks of the disease, they were perhaps entirely different in lesional features and location from the present one.

Scabies.—The eruption of scabies is in reality an artificial eczema, and presents certain symptoms not unlike the latter disease. Both affections have multiformity of lesion and both itch at night; but in scabies there is generally a history of contagion and the site of the eruption is always definite—namely, at the wrists, between the fingers, under the arms, and at the bend of the elbows, the pubic region, the buttocks, the inner sides of the thighs, the penis in the male and under the breasts in women, and, in fact, wherever there are heat and moisture. Scabies is never found on the faces or feet of adults, but in infants these situations are not exempt. In eczema the lesions are rarely as discrete as in scabies, nor is the body so universally infected. The discovery of burrows and the itch-mite itself is of course proof positive, but these are not always readily found.

Syphilis.—Syphilis of the palms and soles is very suggestive of eczema of these parts; but eczema is apt to be symmetrical, the patches lack definite outline and present an irregular contour, while in syphilis a single palm or sole may be affected, the patches are clear-cut, and have a wall-like margin and a circular or semicircular form. Eczematous ulcers of the legs are to a degree suggestive of the same lesions produced by syphilis; but the eczematous ulcer is complicated with varicose veins, is painful, and occupies usually the lower part of the leg; whereas the syphilitic ulcer is more often found on the upper third of the limb, is indolent, rarely painful except at night, and has a more punched-out appearance. Pustular syphilis of the scalp somewhat resembles pustular eczema of the same region, but in syphilis the discharge is offensive, and upon removal of the crust loss of substance may be detected. Besides, the syphilitic disease is less widely distributed. Papular eczema is to be distinguished from the small papular syphilides by the fact

that the latter do not itch, are usually grouped in twos and threes, and are made up of a dense specific infiltration that does not pale upon pressure. In all cases the history and concomitant symptoms are of great aid in coming to a correct diagnosis.

Lichen Planus.—This disorder and eczema of the papular type present certain features in common, but a close scrutiny discloses no essential likeness. Both diseases are more or less pruritic. Both affections are characterized by a papule as the elemental lesion; but the lichen papule retains its identity as such, while the papule of eczema may undergo various changes. The papule of eczema is red, acuminate, or rounded; that of lichen planus is angular for the most part, umbilicated, and of a dull crimson color and shining aspect. Eczema leaves no pigmentation after recovery; this is marked in lichen planus. Even when the lesions of lichen planus have run together, forming thickened, scaly patches, a few of the characteristic papules may generally be detected at the outlying borders.

Urticaria.—Papular urticaria, or the so-called lichen urticatus, is not unlike papular eczema, but, as a rule, the lesions are more discrete, and generally the presence of definite urticarial wheals may be detected some time in the course of the disease.

Herpes.—It is scarcely possible to mistake any form of herpes for eczema, yet, as this mistake sometimes occurs, it is well to remember that in herpes zoster, for example, the vesicles are larger than in eczema, are always characteristically grouped, affect one side of the body, and obviously follow the lines of cutaneous nerves. In eczema there is itching, but in herpes zoster there is apt to be violent neuralgic pain. Herpes facialis should be readily differentiated.

Dermatitis Exfoliativa.—This condition is to be differentiated from eczema by the history of the case, the absence of any marked degree of itching, the appearance of the scales, and the further fact that in exfoliative dermatitis there is neither infiltration nor discharge.

Pediculosis Capitis.—A pustular condition of the scalp due to the inroads of lice resembles closely pustular eczema of that region; but in pediculosis the lesions are invariably found in the occipital region, the secretion is yellow and gummy, and the glands of the neck are greatly enlarged. Pustular eczema, on the other hand, is not necessarily limited to the occiput, but is more scattered over the scalp and the inflammatory symptoms are less violent. Finally, in pediculosis it is possible to discover the louse or its nits.

Other cutaneous affections that bear more or less resemblance to eczema are favus, tinea circinata, intertrigo, erythema, seborrhea, sycosis, pediculosis, pityriasis rubra pilaris, prurigo, and impetigo contagiosa. These will be fully described in other sections of this work.

Prognosis.—As regards an existing eruption the prognosis may be usually considered as favorable. But it is to be remembered that eczema, like catarrhal affections in general, is prone to relapse whenever the exciting cause or causes come into operation. Therefore, in making a forecast of the probable duration of a given attack of the disease or the probability of a possible recurrence, it is necessary to take into account the history of the patient in the past, especially in the matter of former attacks, and his present actual condition both as regards constitutional tendencies and the character and location of the eruption. Eczemas apparently dependent upon chronic deviations from normal health, such as gout, lithemia, dyspepsia, dilatation of the stomach, etc., are more prone to relapse than those due to temporary causes. Thus, also, in the case of individuals addicted to alcohol, strong tea, and

injudicious habits of life and diet generally, relapses may be expected. Eczema due to incurable varicosity of veins or the pressure of irremovable tumors can often only be palliated. An acute eczema, if promptly handled, admits of a much more favorable prognosis than a chronic one with marked infiltration and the habit of scratching thoroughly established. The seat of the disease has a marked influence on the probability of speedy cure; thus eczema of the hands and feet, of the face and of the genital and anal regions, will tax the skill and patience of the physicians to their utmost extent. Professional eczemas, as those cases due to the occupation of the sufferers, such as grocerymen, bakers, washerwomen, bricklayers, plasterers, etc., often remain uncured until some other calling in life is taken up. Of late years surgeons and physicians possessing susceptible skins have suffered much from the various antiseptics in which their hands are so constantly immersed. Age must be taken into consideration in prognosis, for, although infantile eczema is often exceedingly obstinate, the young usually recover more rapidly than the aged.

Treatment.—The successful treatment of eczema is something more than the hasty prescription of some preparation for internal use and a salve or lotion for external application. To the physician acquainted with the varied etiology of the disease it means a careful study of the patient, his antecedents, constitutional peculiarities, his habits, occupation, present physical condition, and the location and nature of his existing eruption. There was a time when some dermatologists under the sway of the Vienna School looked upon such general inquiries as evidence of an unscientific spirit, and directed their sole attention to external remedies; but one may utterly reject a vague humoralism and altogether fail to understand an equally vague diathetism, and yet believe that internal medication, properly understood, is of great value in appropriate cases.

The old question whether it is safe to cure an eczema at all, fearing to check some presumed beneficial discharge, has again been revived of late years. But it is safe to say that to-day it is hardly possible to renew any interest in such a question, since general experience is thoroughly agreed that not only no harm arises from such practice, but that the general well-being is promoted by removing a constant source of local and general irritation. The eczematous patient should endeavor to avoid anything that causes irritation of the skin, either external or internal. Among the common external sources of irritation may be mentioned many chemical substances, and lime, sugar, flour, dust, rough undergarments, hard water, and bad soap. I have often seen an acute eczema brought on in farmers by the dirt and irritating dust of the threshing-floor, and a too fanatical devotion to the bath is sometimes ill-rewarded—that is, if persons persist in vigorous rubbings with coarse towels and flesh-brushes. Strongly alkaline soap is a common offender. Individuals who sweat profusely in warm weather or from undue exertion at tennis, etc., should always keep sensitive surfaces well powdered. Alcoholic drinks and tea, over-indulgence in tobacco, and the use of fermentable food, such as oatmeal, pies, pastries, etc., should be strictly avoided. Dr. White says that eczema is easily provoked and often aggravated by acid fruits, and in this opinion I fully agree. I have long regarded oatmeal as especially obnoxious, more particularly with children, and it would seem that the harm indirectly done by it is indisputable. It is quite likely that the American manner of cooking the cereal, and the manner of eating it smothered with rich cream and sugar, are largely responsible for its evil effects. Dr. Jamieson of Edinburgh says that he doubts that oatmeal in itself can initiate an eczema,

but it is quite probable that it can light up an improperly cured one or perpetuate the disorder if already existing.

If a rigorous dietary régime is important in adults, it is doubly so in children. The usual stuffing with unwholesome and indigestible food should be forbidden, and the physician will find it wise to write out carefully prepared diet tables—such as Starr's, for example. If the child is being suckled, the mother should abstain from indigestible or unduly stimulating food and drink, and if, on the other hand, she is ill-nourished and anemic, her condition should receive appropriate attention.

As regards actual administration of drugs, it must be clearly apparent that we possess no specifics for eczema in the same sense that we have for syphilis or malaria. The internal treatment is mainly symptomatic; that is, we direct our efforts to the removal of presumable exciting causes or obvious complications. Very often, indeed, the eczematous patient appears in perfect general health, in which case the disease is due to some purely local cause or the exciting internal one has passed away; in such instances it is not incumbent upon the physician to invent a condition in order to prescribe for it.

It may be stated that if one takes a number of persons at random, a considerable percentage of them would be found to be suffering from indigestion or constipation, and therefore it is not at all astonishing that a certain proportion of eczematous patients would also be discovered in a like condition. Let this be granted, but, nevertheless, I think experience will show that relief of these states would prove beneficial to the eczema.

While indiscriminate purgation, so common in former times, is to be avoided, a brisk mercurial purge followed by a saline is often of great value in acute eczema, while habitual constipation should be treated on the usual hygienic and medical principles. The accompanying dyspepsia should receive a like consideration. I may say that in addition to appropriate diet I am in the routine habit of ordering a large goblet of very hot water one hour before breakfast, to which has been added a half teaspoonful of bicarbonate of soda or the same quantity of Carlsbad salts. For the fermentative dyspepsia so common in the gouty and lithemic five-grain tablets of strontium salicylate have proved of great benefit in my hands. Startin's well-known *mistura ferri acida* is to be highly recommended in the constipation of anemic women, especially young women with menstrual irregularities:

R̄. Magnesii sulphatis,	ʒj ;
Ferri sulphatis,	gr. iv ;
Sodii chloridi,	ʒss ;
Acidi sulphurici diluti,	ʒij ;
Infus. gentianæ,	q. s. ad ʒiv.—M.

Sig. Tablespoonful in goblet of cold water one hour before breakfast.

The syrup of rhubarb, with or without magnesia, is a good aperient for children, although minute doses of calomel, grain $\frac{1}{20}$ to $\frac{1}{10}$, several times a day or in nightly doses for a considerable period, are usually efficient as a laxative and antiseptic. Salol or salophen and strontium salicylate are also very serviceable.

The strumous and the anemic must be dealt with according to their several necessities. The syrup of the iodide of iron and Parrish's chemical food should be prescribed for delicate children. Cod-liver oil is clearly indicated in pustular eczemas and in persons of tubercular tendencies. The following formula offers a happy combination of several valuable agents:

Ry. Ol. morrhuæ,	ʒiv ;
Pancreatini saccharati,	ʒj ;
Pulv. acaciæ,	q. s.;
Glyceriti hypophosphitis,	
Syr. calcii lactophosphatis,	
Aquæ,	āā. ʒiv ;
Olei gaultheriæ,	gtt. xxx.—M.

Sig. Tablespoonful three times a day for adults.

Mention may now be made of certain drugs that are often administered for their presumed direct effect upon the eczema itself or indirectly as combating some symptom of the disorder. Very naturally, arsenic first comes to mind, since both in the profession and out of it this drug bears the reputation of a specific in skin-diseases; yet it is well known that most dermatologists would deny its alleged specificity altogether and quite sharply limit its range of employment. Arsenic should never be prescribed in acute eczema, and its beneficial effect even in chronic types is very doubtful. However, if there be no contrary indications to its use, it may be tried in dry, scaly, eruptive forms, in affections of the nails, and in so-called neurotic cases. We are learning daily how potent for mischief arsenic is, and in view of its dubious efficacy much care should be used in prescribing it. Arsenic should always be given directly after meals, well diluted, and I am confident that small doses do as much good as large; besides, there is less risk of disturbing the stomach. Iron in the form of the wine or some one of the elegant peptonated preparations may be combined with the arsenic in suitable cases. Mr. Morris has of late years revived the use of antimony in the treatment of eczema. He says that in acute cases for subduing the inflammation it has no equal. If the patient is in good health otherwise, he begins by giving ℥10 to ℥13 of the wine, repeating the dose in an hour, and, if required, two hours later. The time between the administrations is gradually increased, while the amount is diminished, until a dose of ℥7 is reached; this latter quantity is then taken three times in the twenty-four hours as long as the acute symptoms last. When there are depression and no great arterial tension the antimony should not be given.

Alkaline diuretics are recommended by many when the urinary secretion is scanty or loaded and the general surface of the skin inactive. Bulkley advises the following prescription:

Ry. Potassii acetatis,	ʒiv ;
Tr. nucis vomicæ,	ʒij ;
Infus. quassiæ,	
(vel tincturæ cinchonæ comp.),	q. s. ad ʒiv.—M.

Sig. Teaspoonful in water after meals.

Crocker advises turpentine in uncomplicated cases where there is no irritation of the stomach or bowels. It should be given in emulsion in the doses of ℥10 three times a day after meals, but this quantity may be increased by ℥5 at a time until ℥15 to ℥30 are taken; at the same time, as a diluent, the patient should take as much as a quart of barley-water a day.

In rebellious cases, with constantly recurring exacerbations, Crocker has found the application of counter-irritants over the vaso-motor centers of the parts very useful. The counter-irritant may be a blister, dry heat, or merely

mustard leaves. If the disease affected the upper half of the body, the revulsive agent was applied to the nape of the neck; if the lower half, it was put on over the lumbar enlargement.

In most cases of localized eczema it is quite possible to allay pruritus by appropriate external applications, but where the disease is extensive, especially in elderly people, the relief of the intolerable and agonizing itching becomes a question of the gravest importance. It is always well to insist upon absolute mental and bodily rest in these instances, and where the conditions are favorable the antimonial wine should be prescribed and the patient put on the usual fever fare. But in more chronic cases or in less acute types of the disease such means may prove ineffectual, and we are forced to secure rest by more direct methods. It has always seemed to me that opium was inadmissible, as it is known that it causes cutaneous irritability, but Morris strongly urges its administration. Nevertheless, in spite of so excellent an authority, I should only prescribe it as a last resort, trying first phenacetine, sulphonal, chloral, etc. Pilocarpine by the mouth or hypodermically is worth trying, but it must be given cautiously. Quinine in tolerably large doses often acts well. Dr. Pye-Smith recommends quinine as particularly useful in the pruritus of infantile eczema, a half grain being given to a child of one year an hour before bed-time, a grain for a year older, and as much as five grains at the age of fifteen. The valerianate of ammonium is helpful in nervous and hysterical patients. Both the tincture of belladonna and extract of *cannabis indica* are worth remembering in obstinate cases.

Although the chloride of calcium is an old remedy in eczema, it has been recently advised by Savill as of especial value in many forms of cutaneous itching. Wright had before this called attention to the salt in the treatment of urticaria. It is advised to give doses of at least twenty grains after meals, largely diluted with water. It may be continued for a considerable period. I have generally prescribed the liquor calcii chloridi of the B. P. in from fifteen- to thirty-five-drop doses after meals. After fully taking into account the effect of the associated dietetic and local treatment, it has seemed to me that we possess in chloride of calcium a remedy of decided value as an antipruritic.

The local treatment is of paramount importance. Internal treatment, it must be confessed, is not called for in a large proportion of the cases, either because the exciting agents in the production of the disease are of a purely external nature or, as heretofore remarked, because the internal causative influence has already passed away. It may be expressed as almost a law that the more circumscribed an eczematous eruption is the less will be needed in the form of general medication; or, to put it another way, local eczemas require local applications.

Aside from the direct medicinal treatment, it is as important to counteract or remove local exciting causes as it is to do the same for general or constitutional causes. In this way a close study of the patient's occupation, clothing, habits of ablution, toilet articles, etc. is absolutely necessary. Whenever there is any obvious or even suspected source of external irritation, it should be removed or neutralized at once. Two important courses of action face the physician immediately he begins the treatment of an eczema—viz. does the disease need soothing or stimulation? It is a safe practice, in my judgment, in the majority of cases to try the effect of mild treatment first; it is certainly safer at the hands of the inexperienced, for the soothing measures will at least do no harm, while harsh remedies might provoke much mischief. If soothing treatment has been determined upon, the effort of the practitioner should be

to put the inflamed surfaces as much at rest as possible—a rest that means, as far as possible, immobility of the parts, exclusion of air, avoidance of the irritating qualities of soap and water, the use of fixed dressings, and the quelling of the incessant desire to scratch. If, on the other hand, a stimulating plan seems required, the object is to use such remedies as will reduce infiltration, allay itching, or even substitute an acute, and therefore more manageable, phase of the disorder for a chronic and rebellious one. The assumption that all eczemas are parasitic in character, and that therefore antiparasitic remedies are demanded at all times, seems to me practically a dangerous doctrine, although I am perfectly willing to admit its usefulness in some instances.

It is no uncommon thing to see prescriptions going the rounds of medical journals that are alleged to be “good for eczema.” In order to know what is good for the case in hand, after removing crusts and scales by the application of sweet oil, or occasionally soft soap, there are a number of matters to be duly considered, among the more important of these being the stage of the disease and its location. Before taking up the regional treatment of eczema in detail it will serve a useful purpose to examine briefly the various local preparations that are found beneficial in the different stages of eczema, and endeavor to point out as exactly as may be their special indications.

Lotions.—These preparations are called for mostly in erythematous and papular eczema and in the acute vesicular form of the disease. They should not be employed in hairy regions or where there is a free discharge. Lotions may be soothing and astringent or stimulating. Among the soothing and somewhat astringent lotions useful in the acute inflammatory stage may be mentioned the following :

R \bar{y} . Tr. opii,	
Liq. plumbi subacetatis,	$\bar{a}\bar{a}$. $\bar{5}$ ij ;
Aquæ,	$\bar{5}$ iv.—M.

Taylor's compound lead lotion is also valuable :

R \bar{y} . Liq. plumbi subacetatis,	$\bar{5}$ ij ;
Tr. opii,	$\bar{5}$ ij ;
Tr. camphoræ,	$\bar{5}$ j ;
Glycerini,	$\bar{5}$ ij.—M.

Sig. To be mixed with a quart of water and applied on lint.

The black-wash in full strength or diluted one-half is recommended by Dr. White in acute eczema. It should be mopped on for ten or fifteen minutes at a time, and afterward a little zinc salve should be smeared over the surface with the finger. Jamieson's modification of the black-wash is very acceptable :

R \bar{y} . Lotionis nigræ,	
Liquoris calcis,	$\bar{a}\bar{a}$. $\bar{5}$ iv.
Mucilaginis tragacanthæ,	$\bar{5}$ j.—M.

Without doubt, the preparation having the widest range of employment is the well-known Startin's lotion, also called the compound oxide-of-zinc lotion :¹

R \bar{y} . Zinci oxidi,	$\bar{5}$ ss ;
Pulv. calaminæ præp.,	$\bar{9}$ iv ;
Glycerini,	$\bar{5}$ j ;
Liquoris calcis,	$\bar{5}$ vij.—M.

¹ This latter name will be used in the pages that follow.

This may be painted on with a brush or mopped with a rag, or else cheese-cloth cut into strips may be dipped into it and bound on the parts with a roller. To increase the antipruritic effect carbolic acid in the strength of ℥v-x may be added to each ounce. To assist still further in the allaying of itching menthol may be added after the following manner :

R̄. Acidi carbolici,	℥xl ;
Menthol.,	ʒij ;
Alcoholis,	q. s. ;
Lotionis zinci oxidi comp.,	ʒiv.—M.

This lotion is not to be continuously applied, but may be mopped on from time to time as needed. Boeck speaks highly of this preparation. Tale and starch, of each 50 ; glycerine, 20 ; lead-water, 100. This is diluted with twice the volume of water, and then applied with a mop or brush. If the skin is very tender, one-half the lead-water may be replaced by a 1 per cent. boric-acid solution. The carbolic-acid lotions are indispensable aids to other treatment :¹

R̄. Acidi carbolici,	ʒij ;
Glycerini,	ʒss ;
Alcoholis,	q. s. ad ʒviii.—M.

Sig. Apply to limited patches.

Such a lotion is exceedingly useful when mopped on the skin in connection with the use of a salve : for example, if the salve is, as it should be, spread on muslin, this can be lifted up and the lotion mopped on whenever itching is present. Menthol may be added to this lotion, but its use is best restricted to those cases in which the skin is unbroken. Bulkley has lately called attention to the value of weak solutions of permanganate of potassium as an antipruritic. A drying lotion frequently referred to by English physicians is made by adding gr. xvj of nitrate of silver to the ounce of sweet spirits of nitre.

Stimulating lotions are of value in chronic, more or less thickened patches of eczema. A combination of tar and lead, much prized by Hutchinson, is thus prepared :

R̄. Liq. plumbi subacetatis,	℥x ;
Liq. carbonis detergentis,	ʒj ;
Aquæ destillatæ,	q. s. ad Oj.—M.

Sig. Mop on affected parts twice daily.

Dubring has brought forward, as a substitute for the various proprietary preparations of tar, a compound tincture of coal-tar made in the following way : A strong tincture of quillaia-bark is made by adding one part of the bark to four of 95 per cent. alcohol. One part of coal-tar is digested with six parts of this tincture, with frequent agitation, for not less than eight days. It should be prescribed in the strength of from three to fifteen minims to the ounce of water, to which may be added a few minims of glycerine.

A preparation much esteemed by Bulkley is called "liquor picis alkalini :"

R̄. Picis liquidæ,	ʒij ;
Potass. causticæ,	ʒj ;
Aquæ,	ʒv.—M.

¹ *Monatshft. f. prakt. Derm.*, Aug. 1, 1895.

This may be used as an antipruritic lotion of from one to four drams to the pint of water or rubbed full strength into localized patches.

One of the most valuable stimulating lotions is the *spiritus saponatus kalinus*, which is made of two parts of green soap and one of alcohol. This should be rubbed briskly into the affected region, then washed off, the parts dried, and then covered with diachylon ointment spread on strips of muslin. Tar may be added in the following proportions :

℞. Picis liquidæ,	
Saponis olivæ præp., ¹	
Alcoholis,	āā. ʒij.—M.

Various other lotions are in common use, made of salicylic acid, sulphate of zinc, alum, *grindelia robusta*, thymol, etc. ; also strong solutions of caustic potash.

Powders.—The range of application of powders is not very wide. In acute generalized erythematous eczema, and in some instances where neither lotions nor salves are tolerated, powders may prove of some advantage. They may be dusted on with a powder-puff or a bit of absorbent cotton, or kept applied constantly in Unna's quilted pouches.

Anderson's antipruritic powder is well known :

℞. Pulv. amyli,	ʒvj ;
Zinci oxidi,	ʒiiss ;
Pulv. camphoræ,	ʒss.—M

Hebra's powder was composed as follows :

℞. Zinci oxidi,	
Pulv. aluminis plumosi,	
Pulv. rad. iridis flor.,	āā. ʒj ;
Pulv. amyli,	ʒij.—M.

For eczema intertrigo oleate of zinc and thymol are excellent :

℞. Thymoli,	gr. j ;
Pulv. zinci oleatis,	ʒj.—M.

The stearate of zinc and its various combinations are very useful. There also may be mentioned fuller's earth and emol keleet. This latter agent is said to be unrivalled in softening water.

Liniments.—When large surfaces are involved the old-fashioned carron oil, to which may be added 1 per cent. carbolic acid, makes a soothing dressing. Olive oil or oil of sweet almonds may be used instead of linseed oil. Crocker makes use of this liniment in acute dermatitis :

℞. Pulv. calaminæ præp.,	ʒij ;
Zinci oxidi,	ʒss ;
Olei olivæ,	
Liq. calcis,	āā. ʒj.—M.

Skinner's² modification, which is said to replace advantageously the one just given, is made in the following way :

℞. Calaminæ pur.,	ʒj ;
Zinci oxidi,	gr. xv ;
Liq. calcis,	ʒss ;
Olei amygdalæ dulcis,	q. s. ad ʒj.—M.

Mix the powders with the oil, then gradually add the lime-water.

¹ Bagoë's soap, prepared under this name, is superior to the imported green soap.

² *Brit. Journ. Derm.*, May, 1897.

Ointments.—Salves are of especial value when there are crusting and exudation, and, since a majority of ezeematous cases are seen in this stage, although they are of great service in other conditions, it follows that a thorough knowledge of the preparation and use of ointments is necessary to the practical physician. To secure success it is necessary that the ointment should be thoroughly prepared and that the ingredients should be fresh. Soothing salves nearly always should be spread on suitable strips of cotton cloth and neatly bound on the parts, but when stimulation is required the remedy may be rubbed in with the fingers. When it is desired merely to protect the surface with a bland unguent, the unguentum aquæ rosæ serves an excellent purpose, and it is, besides, a most excellent ointment base. To increase its astringency and to allay itching the following combination is admirable :

R. Bismuthi subnitratris,	ʒss ;
Acidi carbolicæ,	℥v-x ;
Ung. aq. rosæ,	ʒj.—M.

In case of doubt as to the freshness of the cold cream, vaseline may be substituted.

Jamieson recommends as a soothing ophthalmic ointment a preparation of lanoline, ʒiij ; oil of sweet almonds and water, of each, ʒss.

A standard preparation of great value, a modification of Hebra's diachylon ointment, is composed of these ingredients : Take of lead plaster and vaseline equal parts. Melt together, strain, and add oil of lavender or rose geranium a sufficient quantity. This is now generally known as unguentum vaselini plumbicum. As fresh lead plaster contains a considerable amount of glycerine, the pharmacist should keep in stock a quantity of it cut into small bits which has been placed in a large box covered with cheese-cloth. At the end of some months the plaster thus dried out may be used in making the ointment.

Various ingredients may be combined with the unguentum vaselini plumbicum, such as boric acid, oxide of zinc, starch, pitch ointment, and carbolic acid. These combinations and their uses will receive appropriate mention under Regional Eczema.

An ointment of much value, particularly in the ezeemas of children, is made as follows :

R. Zinei oxidî,	ʒj ;
Ung. picis liq.,	
Ung. aq. rosæ,	āā. ʒij ;
Lanolini,	ʒiv.—M.

Sig. Spread on lint or muslin.

In the prescription above only enough tar has been added to allay itching, but if it is desired to get the stimulating effect of the drug, the stronger preparation may be employed :

R. Olei rusci,	ʒj-ij ;
Ung. aq. rosæ,	ʒj.—M.

While tar is a remedy of great value, it should always be applied cautiously at first, and, as a rule, reserved for the squamous type of the disease ; and in these latter cases it is necessary to rub the tar very thoroughly in the skin.

Quite a large number of drugs may be employed in the ointment-form

in the treatment of eczema, such, for example, as salicylic acid, sulphur, mercury, tannin, carbolic acid, acetanilid, etc.

Pastes.—Of late years pastes have largely taken the place of salves in the treatment of eczema. They are usually made with vaseline, to which has been added a large quantity of inert powder, with a small percentage of some active drug, and thus constitute a preparation that can be readily smeared on the skin, but which soon dries and forms a protective coating. Pastes are generally unsuited for weeping surfaces, but are more applicable when the acute stage has passed away.

Lassar, who first employed this form of medication, suggested the following formula :

R̄. Acidi salicylici,	gr. x ;
Zinci oxidi,	
Pulv. amyli,	āā. ʒij ;
Vaselini,	ʒss.—M.

G. H. Fox's modification is still more acceptable :

R̄. Acidi salicylici,	gr. x ;
Pulv. amyli,	
Bismuthi subnitrat̄is,	āā. ʒiij ;
Ung. aquæ rosæ,	q. s. ad ʒj.—M.

In eczema intertrigo these preparations answer an admirable purpose, but I have not found them so generally useful as the following combination :

R̄. Bismuthi subnitrat̄is,	ʒiv ;
Zinci oxidi,	ʒj ;
Pulv. amyli,	ʒij ;
Acidi carbolic̄i,	ʒv—xv ;
Vaselini,	
(vel ung. aq. rosæ),	q. s. ad ʒj.—M.

Ihle's paste is well known.

R̄. Resorcini,	gr. x—xx ;
Zinci oxidi,	
Pulv. amyli,	
Lanolini,	
Vaselini,	āā. ʒij.—M.

The linimentum exsiccans of Prof. Pick is an admirable preparation for erythematous and papular types of eczema, but where there is much exudation or great infiltration preparations of this class are not admissible :

R̄. Tragacanthæ,	gr. lxxv ;
Glycerini,	ʒxxx ;
Aquæ,	ʒxxvss.—M.

To the above may be added 10 per cent. of oxide of zinc and 1 per cent. of carbolic acid.

Dr. Elliot's bassorin paste is prepared as follows :

R̄. Bassorin.,	ʒx ;
Dextrin.,	ʒvj ;
Glycerini,	ʒij ;
Aquæ,	q. s. ad ʒxxxvss.—M.

Prepare cold.

For extensive surfaces Unna's paste is of considerable advantage :

R̄. Zinci oxidi,	ʒj ;
Mucilaginis acaciæ,	
Glycerini,	āā. ʒij.—M.

To this may be added 1 per cent. of carbolic or salicylic acid.

Glycerin Jelly.—Pick was the first to make use of gelatin as a vehicle for other remedies, and also to serve as a simple protective coating. It is indicated in the same class of cases as the paste, and I believe is the more useful, but it has the disadvantage of being tedious to prepare and apply. There are numerous formulæ, but one of the best is thus prepared :

R̄. Gelatinæ,	ʒiv ;
Zinci oxidi,	ʒijss ;
Glycerini,	ʒss ;
Aquæ,	ʒvj.—M.

Heat the water, dissolve the gelatine in it, then add the glycerine and zinc, and stir till cold. Ichthyol in 1-2 per cent. strength may be added. For use a bit of the jelly is placed in a china cup, and this in turn in a hot-water bath ; the liquefied material is then painted over the affected parts. As the jelly takes some time to dry, it may be covered over immediately with cotton wool or tissue-paper. Jamieson declares that there is scarcely any part of the body or any form of eczema to which this preparation is unsuitable, but I doubt if this is the universal verdict.

Gelanthum, a new preparation recently introduced by Unna, is thus slightly modified by Skinner :

R̄. Tragacanthæ,	ʒijss ;
Gelatin. opt.,	ʒij ;
Glycerini,	ʒvj ;
Thymol.,	gr. ¼ ;
Aquæ destillatæ,	q. s.

Place the tragacanth and gelatine each in 10 ounces of water in covered jars, and make the final quantity up to 12 ounces with water. To both of these preparations may be added most of the remedies used in cutaneous medicine except subacetate of lead.

Plasters.—The germ of the idea of fixed dressings may, perhaps, be found in Hebra's method of spreading salves on strips of lint. At any rate, they have proved invaluable in practice, and among the most valuable are undoubtedly the various forms of plasters. A number of years ago Unna suggested the use of his plaster and salve mulls, which now can be obtained readily in this country. Consequently, their various combinations need not be given here. However, their expense and the fact of their frequent rancidity have interfered much with their use in America. So far as eczema is concerned, it has been found quite practicable to replace many of them with Pick's salicylated soap plaster :

R̄. Emplastri saponis,	ʒiiss ;
Olei olivæ,	ʒv ;
Acidi salicylici,	gr. xxxvij.—M.

Klotz's modification is made as follows : Diachylon plaster, 60 parts ; soap plaster, 25 parts ; yellow wax, 2 parts ; vaseline, 8 parts ; salicylic acid, 5 parts. For a 5 per cent. plaster Duhring recommends—soap plaster, ʒj ;

olive oil and salicylic acid, of each, 24 gr. For a 10 per cent. plaster no olive oil is required, the salicylic acid, according to Duhring, having the property of sufficiently softening the mass. This observer's formula for a 20 per cent. plaster reads thus: Lead plaster, ʒj; yellow wax, gr. xlviij; salicylic acid, gr. cv.

A formula that I have employed with satisfaction for many years is as follows: Lead plaster, 61 parts; powdered soap, 4 parts; water, a sufficient quantity to form a paste with the soap. Add the lead plaster and evaporate to a proper consistency; then add vaseline 30 parts and salicylic acid 5 parts. Melt together with a gentle heat.

The percentage of salicylic acid may be increased if necessary, and the plaster may be diluted by adding varying proportions of unguentum vaselini plumbicum. A small quantity of camphor is also a useful addition at times.

These plasters are spread on kid or muslin, and neatly bound on the parts with a roller bandage. Often they may be left in contact with the affected surface for some days. They are especially indicated in infiltrated eczemas. Very frequently, after the thickening has been removed, the continued application of salicylic acid does harm, and a simple paste or salve may be substituted.

Paints.—Various medicaments, such as salicylic acid, chrysarobin, tar, etc., may be added to collodion or liquor guttæ perchæ (traumaticine), thus constituting a paint or pigment. In small thickened patches of eczema salicylic acid and chrysarobin, of each 5 to 10 per cent., are valuable, and in eczemas about the mouths of children tar similarly combined is often useful:

℞. Olei cadini,	ʒj;
Collodii	
(vel traumaticini),	ʒj.—M.

Sig. Apply with a camel's-hair pencil.

Leistikow thinks that coal-tar is a better antipruritic than wood-tar. It is a valuable remedy, according to him, in dry eczema of the scalp, neck, and external genitals, although it must be applied over limited regions. His formula runs as follows: Coal-tar, ʒiiss; alcohol (95 per cent.), ʒj; sulphuric ether, ʒss.

Baths.—Variously medicated baths were formerly much in vogue in the treatment of eczema and other skin-diseases, but of late years they have greatly declined in professional estimation. As a general thing, water in any form is hurtful to the eczematous surface, and for cleansing purposes, when necessary, warm milk and water or pledgets of cotton wool dipped in olive oil are much better. Sea-bathing, and especially sea-air, are sometimes, though rarely, beneficial by virtue of their general tonic effect; and in the same way residence at some of the popular springs will prove helpful, provided that the patient fall into the hands of a judicious physician, who will forbid the topical application and encourage the free internal use of the water.

Massage, Scarification, and Mechanical Support.—These various measures are occasionally called for in suitable cases, although their range of usefulness is necessarily limited.

The many different agents that are commonly employed in the management of eczema having been considered in a general and illustrative way, it will now be profitable to take up the subject of the regional distribution of the disease, and give a more detailed account of the treatment as modified by location.

Eczema of the Scalp.—The disease in this situation may occur in the erythematous, vesicular or weeping, and in the squamous forms. As is usually the case with eczema in general, the physician rarely encounters the elementary types, but the case comes into his hands presenting secondary changes—namely, greenish-yellow crusts are seen to be scattered here and there over the scalp or else completely cover it, or the surface is moist and oozing, the exudation glueing the hair together; or, finally, there is a general or sometimes patchy, scaly, infiltrated, and pruritic eruption. The erythematous variety may begin as such, or it may follow in the wake of any of the other forms. Pustular and vesico-pustular eczema of the scalp is most frequently observed in children, and from this situation it is apt to extend to the forehead, face, and ears. Swelling of the lymphatic glands is a common complication, but suppuration is rare. Abscesses of the scalp are a serious, but not particularly frequent, accompaniment. Seborrhea is, perhaps, the common exciting cause of all forms of eczema in this region.

The internal treatment calls for no special comment, except that in the pustular form, particularly in children, cod-liver oil, iron, or other tonic measures are usually demanded. Crusts when present should be removed, and this is best done by soaking in oil, the ordinary poultice being objectionable. Cutting the hair short may be practised with children, but in adult women it is not a wise procedure.

Stiff ointments should not be applied to hairy parts. When the disease is in the acute stage the most beneficial results are to be obtained from lotions of equal parts of olive or almond oil and lime-water, to which has been added 1 per cent. of carbolic acid; or the black-wash pure or, better still, diluted with an equal quantity of lime-water, may be mopped on occasionally, and followed by a mild zinc or bismuth salve. When the hair has been cut or shaved, or in young babies with but little hair, the unguentum vaselini plumbeum may be spread on strips of muslin and kept in place by a snugly-fitting cap. A dram of boracic acid to the ounce is often a useful addition. After the subsidence of the acute symptoms, or when the disease has presented from the first merely a moist, exuding condition, it is proper to feel the way cautiously with slightly more stimulating remedies. Salicylic acid in the strength of 20 to 30 gr. to the ounce often produces striking results, and sulphur in the same proportions is equally beneficial. However, it is usually best to try the following prescription first:

R̄. Ung. picis liq.,	ʒj-ij;
Zinci oxidi,	ʒj;
Ung. aq. rosæ,	ʒj.—M.

Sig. Spread on muslin if there is no hair; otherwise smear on gently with fingers.

In the moist disseminated patches most frequently seen on the adult scalp lotions of tar are demanded by the intense pruritus, and also prove distinctly curative:

R̄. Olei cadini,	ʒss;
Olei olivæ (vel amygdalæ),	ʒj.—M.

Sig. Apply with a medicine-dropper.

Tar and a mercurial are often extremely serviceable, such as—

R̄. Hydrargyri ammoniati,	ʒj;
Liq. carbonis detergentis,	ʒss;
Lanolini,	ʒj.—M.

If the tar is not well borne, the mercurials, such as calomel and white precipitate, may be used alone in the strength of 20 to 60 gr. to the ounce.

Bulkley's tannin ointment may also be recommended :

R̄. Acidi tannici,	ʒss-j ;
Acidi carbolici,	℥v-x ;
Cerati Galeni,	ʒj.—M.

In very obstinate cases of moist eczema Duhring and others approve of a 1 or 2 per cent. nitrate-of-silver solution, applied daily or at longer intervals, followed by a mild salve.

In chronic scaly eczema of the scalp there is nothing so useful, in my experience, as a salicylic-sulphur ointment :

R̄. Acidi salicylici,	ʒj-ʒss ;
Sulphuris præcipitati,	ʒj-ij ;
Vaselini,	ʒj ;
Olei limonis,	q. s.—M.

Sig. Rub into the scalp thoroughly once or twice a day.

Resorcin in about 5 per cent. strength, in the form of a salve or as a lotion with glycerine and alcohol, is also of great benefit, but the combination above is to be commended especially.

In acute eczema, as already stated, the crusts and scales should be removed by oily inunctions, but in the subacute and chronic forms it is occasionally necessary to cleanse the parts of accumulations of salve, scales, etc., and here soap and water may be cautiously employed, but as infrequently as possible. Equal parts of Bage's green soap and alcohol, or from three to six teaspoonfuls of borax or carbonate of soda to the pint of water may be employed ; but as soon as the washing has been effected the surface should be protected immediately with vaseline, oil or the salve that is being used.

Eczema of the Face.—Eczema of the face is more common in children than in the adult ; indeed, with an attendant inflammation of the scalp and ears it presents that frequent type of the disorder popularly called "milk crust." Although papular, vesicular, and pustular lesions, singly or in combination, are frequent in infancy and childhood, the cases as usually seen by the physician present the secondary forms—viz. scaly, red, and somewhat infiltrated areas or inflamed and moist patches covered with crusts or scales. The itching is intolerable, and the little sufferers tear themselves with the finger-nails until the surface is at times a mass of crusts made up of blood and pus, and the skin shows here and there deep excoriations. In young babies the same effort to get relief from itching is shown by violent rubbing against the pillow or the mother's shoulder.

Pustular eczema of the upper lip, which is greatly swollen, is not infrequent in children, and is often associated with nasal catarrh.

Erythematous, erythematopapular, and erythematovesicular eczema are the types of the disease most common in the adult.

Persons in middle life, and even in old age, are particularly prone to attacks of acute erythematous eczema of the face, which in the majority of instances is mistaken by the inexperienced for erysipelas (see Diagnosis). The skin is of a peculiar dusky red, more or less edematous, somewhat infiltrated, hot, and very itchy. The cheeks, the nose, the forehead, and the eyes—the latter being often closed by the swelling—are the usual sites of these outbreaks. Relapses are frequent.

Chronic erythematous and papulo-erythematous eczema of the face is a

most distressing affection: the skin is much thickened and scaly, and is apt to be cracked in its natural furrows, and oozing raw places, which have been caused by scratching, are scattered here and there. The usually paroxysmal itching is very severe. The eyelids are often involved, being thickened and cracked, and in cases of long duration ectropion is a marked feature.

Where crusts are present they may be removed by soakings in sweet oil; or the unguentum vaselini plumbicum, neatly spread on strips of muslin and applied to the parts, will answer just as well, and it may then be continued as a directly curative agent. In nearly all forms of eczema occurring on the faces of children, and especially in the raw, weeping variety, a little tar may be added to the salve from the first, since it is absolutely essential to relieve the pruritus as soon as possible.

A salve of the most general utility in such cases may be called the "compound chalk ointment," and is made as follows:

Ry. Zinci oxidi,	ʒj;
Pulv. amyli,	ʒij;
Ung. picis liq.,	ʒj-ij;
Ung. vaselini plumbici,	q. s. ad ʒj.—M.

Spread on muslin and keep in position with a linen mask when practicable.

This preparation is perhaps more of a paste than an ointment, for it should be of such a consistency that it will adhere to the skin with considerable tenacity. In warm weather the amount of starch may be increased. Instead of the tar, five or ten minims of carbolic acid may be added to each ounce, and in place of the oxide of zinc, an equivalent quantity of boracic acid may be used. In the majority of cases, however, tar in the shape of the dilute pitch ointment is most satisfactory. Washing the eczematous surfaces should be forbidden, but they may be cleansed with olive oil on pledgets of absorbent cotton or with milk and water.

It is difficult to heal eczema about the mouth in children, owing to the constant irritation from saliva and food. Some form of fixed dressing must be employed. After the removal of crusts, if present, linimentum exsicicans or gelanthum, to which 10 per cent. of oxide of zinc has been added, makes a good application. A pigment of tar is sometimes necessary:

Ry. Olei cadini,	ʒss-j;
Collodii (contractile),	ʒj.—M.

In acute attacks of eczema of the face in adults it will be found necessary to pay close attention to the general condition of the patient, and to direct such medication and prescribe such alterations in diet as may be required. The local treatment should be of a soothing character, and generally in the form of a lotion:

Ry. Zinci oxidi,	ʒss;
Pulv. calaminæ,	ʒiv;
Glycerini,	ʒss;
Liq. calcis,	ʒvij.—M.

This lotion may be mopped on with a soft rag, but a more speedy result is obtained by applying it on cheese-cloth cut to fit the parts. Another prescription of value in a like condition, especially when glycerine is found irritating, is as follows:

R̄. Zinci oxidi,	ḡss ;
Mucilag. acaciæ,	ḡj ;
Emuls. amygdalæ,	ḡij ;
Aquæ rosæ,	q. s. ad ḡiv.—M.

Sig. Shake. Mop or smear on gently every few hours.

In less acute conditions the compound starch ointment may be employed, as also, when practicable, the zinc-ichthyol jelly. If patients are unwilling to wear their ointments or lotions during the day, Provan's paste may be used during that period. It is colorless, and can be readily washed off with a little warm water :

R̄. Tragacanthæ,	
Glycerini,	āā. ḡiv ;
Boracis,	ḡss ;
Aquæ destillatæ,	q. s.—M.

Some cases of chronic eczema of the forehead are kept up by the irritation of the "sweat-band" of the hat. During the existence of the disease the part of this band in contact with the forehead may be covered with a bit of diachylon-salve mull, and under other circumstances it is best, in the interest of susceptible skins, to paste a piece of cotton or linen over the sweat-band. In very chronic facial eczema in adults, particularly the infiltrated, cracked, and very itchy type often seen on the forehead, I have secured the best results from the 5 per cent. compound salicylic plaster (see under Plasters). Duhring gives a somewhat similar formula for the same purpose :

R̄. Camphoræ,	ḡss ;
Empl. plumbi,	ḡij ;
Petrolati,	ḡij ;
Olei olivæ,	ḡj.—M.

In certain scaly, more or less defined patches of eczema, which are often seen on the cheeks and around the mouth, and popularly called ringworm, salves of white precipitate and tar are useful :

R̄. Hydrarg. ammoniati,	ḡj ;
Liq. carbonis deterg.,	ḡj ;
Lanolini,	ḡj.—M.

Eczema of the Ears.—The various types of eczema are to be encountered in these parts. The disease in children is generally in connection with an eczema of the scalp ; in the grown person it may also coexist with the disorder on the scalp, but it is often on the ears alone, and is usually symmetrical. Acute or chronic eczema of the external auditory meatus is common, but as these cases are usually seen by the aurist they need no special consideration here.

In acute eczemas of the auricle, particularly if of the vesicular type, soothing and astringent lotions, like the compound oxide-of-zinc lotion or the zinc lotion with almond emulsion, are demanded. In subacute and chronic cases ointments are of more service, especially the unguentum vaselini plumbicum, containing, if much itching exists, about 1 per cent. carbolic acid. In still more chronic conditions a 5 per cent. salicylic plaster will soon reduce the infiltration. The obstinate eczema sometimes found behind the ears of children may often be made to disappear by brisk friction with green soap, followed by ung. vaselini plumbicum properly applied on muslin.

Eczema of the Nares.—The eczema of this region should be carefully differentiated from lupus and syphilis. It is often associated with chronic nasal catarrh, and frequently in children is a sequela to the exanthematous fevers. The nasal orifices are frequently blocked with crusts, and the nostrils become infiltrated and cracked; in other instances the disorder is confined to the alæ. Where crusts are found blocking up the nares, their removal will show an implication of the Schneiderian membrane, the surface either discharging more or less freely or else dry and glazed. The upper lip is apt to be involved in the same process. The general health should be attended to in these cases, and children especially need tonic treatment, such as cod-liver oil and syrup of the iodide of iron. Crusts should be removed by imunction with oil, and afterward there should be applied soothing, somewhat astringent ointments, like the ung. vaselini plumbicum or the following :

R̄. Glycerol. plumbi subacetatis, ʒj ;
 Ung. aq. rosæ, ʒj.—M.

Unna recommends that small rolls of paper covered with zinc and red-precipitate-salve mull should be inserted in the nostril.

Eczema of the Lips.—Exuding and squamous eczema, the last mentioned often accompanied by painful cracks and fissures, are the commonest types of the disease affecting the mucous surface of the lips. As already mentioned, the cutaneous portion of the upper lip is often the seat of pustular eczemas, especially as a complication of nasal catarrh and eczema of the nares.

When the disease attacks the vermilion border of the lip, it is an exceedingly obstinate affection, since it is almost an impossibility to protect the parts from irritation. Acute conditions should be soothed with lanoline and cold cream or the zinc-almond emulsion given above; sometimes the unguentum vaselini plumbicum proves an agreeable remedy.

Chronic eczema of these parts may be treated with Fox's thymol salve—five grains to the ounce of cold cream—or by binding on the affected region a 5 per cent. salicylic plaster. Strong solutions of caustic potash or nitrate of silver in stick or solution may be tried where there is much thickening.

Deep cracks may be treated by pressing into them a sharpened stick of nitrate of silver.

Painting the lips with compound tincture of benzoin or with flexible colodion will frequently afford protection and give relief. Epidermine tinted with carmine is also useful. By a careful investigation of the patient's general health a clue may sometimes be discovered to the cause of this intractable affection, and its removal will result in a disappearance of the local disorder.

Pustular eczema of the cutaneous part of the upper lip is generally due to infection from a nasal catarrh; hence that affection should always receive attention. The most satisfactory application to the lip is the ung. vaselini plumbicum, spread on muslin and bound on with adhesive strips. When the thickening is greatly marked, pressure must be exerted by a bandage, and to get the best results from it a thin wedge of cork may be worn between the lip and the teeth.

Eczema of the Lids.—In association with erythematous eczema of the face a like disease of the lids, as noted above, is usual, although it may occur independently. Moist eczema of these parts is also by no means uncommon. Eczema of the edges of the lids, either scaly or pustular, but mostly the latter, is frequent in strumous children, and, according to modern views, is nearly always coexistent with seborrhea of the scalp. Soothing salves are required for even considerably infiltrated conditions of the lids, and all the

more so when the inflammation is in a more acute stage. A soothing ointment of lanoline with 25 per cent. of cold cream is generally agreeable, and later on may be added oxide of zinc in the proportion of 20 gr. to the ounce. Jamieson's ophthalmic ointment is also to be commended :

R̄. Olei amygdalæ,
Aquæ, āā. ʒss ;
Lanolini, ʒij.—M.

Since disease of the edge of the lids is so often associated with seborrhea of the scalp, and may perhaps be due to infection from that region, it is a good plan in all cases to shampoo the head at least once a week with the tincture of green soap, and to rub in nightly for as long as may be required an ointment of salicylic acid and sulphur, a scruple of the first and 2 drams of the second to the ounce of vaseline. Epilation may be required, but, as a rule, Pagenstecher's ointment is very efficacious :

R̄. Hydrarg. oxidi flavi, gr. ij ;
Vaselini, ʒij.—M.
Sig. Apply to edge of lids with a camel's-hair pencil.

If there is reason to think that the trouble is kept up by some ocular defect, proper glasses should be fitted to the eye. Many of these cases of eczema tarsi are sequelæ of the eruptive fevers, and consequently demand tonic treatment.

Eczema of the Beard.—Eczema may attack the bearded face, and, like the disease on the scalp, any of the elementary types may be present ; but in most instances the primary form is pustular. Squamous eczema may follow in the wake of any of the other varieties of the affection. Circumscribed regions may be affected or the whole beard may be the seat of the disorder ; it may also extend from or into non-hairy parts.

In acute pustular eczema the affected parts are hot and tumefied, and numerous small pustules may be noted between the hairs and the mouths of the follicles. These speedily burst, and the exudate mats the hair together, and also makes large, adherent yellowish crusts. In a more chronic stage the hairs become thinned, and removal of the crusts reveals a red and weeping surface. Ringworm, acne, the tubercular syphilide, and the various essential forms of folliculitis should be carefully differentiated.

Acute pustular eczema should receive soothing treatment. The hairs may be clipped very close, and the parts kept bathed with carbolized oil and lime-water or mopped with diluted black-wash, followed by applications of cold cream or vaseline. So soon as the very acute stage has passed away daily shaving, or at least every second day, should be insisted upon, and immediately afterward the nng. vaselini plumbicum, spread on muslin, should be applied.

More active treatment is required when the affection has become decidedly chronic. It is well to epilate such hairs as may be seated in pustules, and subsequently make use of salves and pastes.

The remedy that I have found most valuable is Rosenthal's paste, both in this disease and in coccogenic sycosis :

R̄. Acidi tannici, ʒj ;
Sulphuris præcip., ʒij ;
Zinci oxidi,
Amyli, āā. gr. cl ;
Vaselini, gr. clx.—M.
Sig. Apply twice a day.

An ointment of white precipitate, gr. xx, compound tincture of tar, ʒss, and lanoline, ʒj, is useful in squamous eczema. A dusting powder of oleate of zinc may be applied during the day after the affection is well on its way to recovery, the required salve being used only at night. A marked tendency to relapse exists, and the treatment should be persevered in, with certain modifications, long after the eczema is apparently well. (For eczema of the bearded lip see the preceding section.)

Eczema of the Breast and Nipple.—Nursing women are the most common sufferers from eczema of these parts, although it may occur in virgins and in the male sex. One or both nipples may be attacked, and, in its usual form, there is generally present a raw surface with slight discharge, which, when not disturbed, dries into yellowish crusts. In other instances the nipple is greatly denuded, swollen, or sometimes sunken, and the surrounding areola is deeply crusted. Mastitis may supervene. The whole breast may become involved from the starting-point at the nipple, and there may be still further extension of the process to the trunk.

Eczema intertrigo frequently attacks the under surface of the breasts in fat women. For fissured nipples Veiel recommends Lister's ointment :

R̄. Acidi boracici,
Ceræ albæ, āā. gr. xv ;
Paraffin,
Olei amygdalæ, āā. ʒss.—M.

Sig. Wash the nipple after nursing with borax-water (1 : 25), then apply the salve spread on muslin.

Pencilings with tinctures of myrrh and benzoin, light touching of the cracks with crayon of nitrate of silver, brushing with a weak solution of the same (gr. xvj—ʒj), lead or rubber shields, etc., have been highly praised, the multiplicity of the remedies testifying to the stubbornness of the condition. In non-nursing women friction with green soap, followed by diachylon ointment, is an excellent method for eczema rubrum of the breast. Lassar's paste is valuable for the eczema intertrigo. Scabies and Paget's disease should be carefully excluded (*q. v.*).

Eczema of the Umbilicus.—Eczematous inflammation of the navel is usually excited by seborrhea of the part, and commonly takes on the type of eczema rubrum, with very offensive discharge.

A remedy of value is the ung. vaselini plumbicum, with a dram of boracic acid to the ounce, spread on lint, and inserted in the navel. Ointments of calomel, gr. xv—xx to the ounce, also salicylic acid and sulphur, and weak preparations of resorcin, may also be tried.

Eczema of the Flexor Surfaces of the Joints.—Eczema of these regions is apt to assume the appearance of an intertrigo, although from the motions of the parts the skin may become much infiltrated and fissured. Lassar's paste or a paste made of bismuth and corn starch, with 1 per cent. of carbolic acid, suffices in acute cases, but the chronic patches need stimulation in the shape of the tar-and-zinc salve :

R̄. Zinci oxidi, ʒj ;
Ung. picis. liq., ʒij ;
Ung. aq. rosæ,
Lanolini, āā. ʒiv.—M.,

or the compound salicylic plaster. Obstinate cases will require frictions with green soap, followed by ung. vaselini plumbicum spread on muslin and neatly bound on the parts.

Eczema of the Anus and Perineum.—The disease in this region is not often acute. The eczema may be confined to the anus, or the perineum and scrotum may also be involved. The affected parts may be congested, fissured, and exuding, or dry, scaly, and much thickened. The glairy discharge when present is very offensive. The eczema may extend up the anus and involve the mucous membrane. In long-standing cases the skin assumes the appearance of "white parchment." The pruritus is usually severe, occurring mostly in nocturnal paroxysms, and the rawness resulting from the scratching adds greatly to the pain and discomfort. Hemorrhoids, catarrh of the rectum, and prolapse are more or less frequent complications, if not always etiological factors.

The internal treatment is very important. The diet should be carefully regulated, smoking prohibited, and constipation relieved if it exists. The compound liquorice powder or a teaspoonful of equal parts of sulphur and cream of tartar are good laxatives in this condition. To secure permanent relief in many cases it is necessary to remove by appropriate measures any complicating rectal disorders. Gouty and lithemic states of the system, if present, should receive necessary treatment. Nothing is of so much value for the tormenting pruritus as Bulkley's method of using hot water. Before beginning the fomentations the following salve is spread on lint :

R. Zinci oxidi,	ʒij;
Pulv. amyli,	ʒij;
Ung. picis liq.,	ʒij—iv;
Ung. vaselini plumbici,	q. s. ad ʒj.—M.

The patient, sitting on a low chair, places between his feet a vessel holding very hot water; into this he dips a suitable piece of soft cloth, which is immediately withdrawn and pressed in a mass against the anal region for one minute. This process is repeated three times, and the parts are then quickly dried and the ointment applied immediately. If necessary, this fomentation may be repeated in the morning, but, as a rule, it is only requisite at that time to reapply the ointment. Many patients get relief from mild mercurial and carbolic salves, and an excellent remedy is the Lassar paste if properly prepared. Duhring recommends the following ointment as worthy of trial :

R. Sulphuris præcip.,	ʒij;
Naphthol.,	ʒj;
Morphin. sulph.,	gr. ij;
Zinci carbonatis,	ʒj;
Ung. aq. rosæ,	ʒj.—M.

Where there is great thickening of the skin more decided measures are required, such as pencilling with solutions of nitrate of silver, potash, or coal-tar. Scarifications will sometimes cure rebellious cases.

Eczema of the Genitals.—Erythematous and weeping eczemas of the scrotum are comparatively frequent, but, as a rule, they begin insidiously and gradually lead to leather-like infiltration and an exaggeration of the natural furrows of the skin. Hard nodules, that eventually suppurate, are a common and annoying complication. Eczema occurring on the penis is mostly erythematous in character, occasionally involving the whole organ, that portion of it in contact with the scrotum, or the prepuce alone. The labia majora and their mucous surfaces in women are often attacked. The parts are raw, swollen, and exuding, and the pruritus is intolerable.

Genital eczema in both sexes may be strictly limited to the parts originally

affected or it may spread to the mons veneris, the abdomen, and the thighs. In the female it may involve the clitoris, nymphæ, and vagina. In all rebellious ezeemas of the genital regions the urine should be examined for sugar, the possibility of the presence of pediculi borne in mind, and in women the condition of the vaginal tract and the uterus should be ascertained.

In acute eczema of the penis and scrotum soothing remedies, such as the zinc-and-calamine lotion or a calamine-and-zinc liniment, are urgently demanded.

Hot applications, followed by tar-and-zinc ointment, as described in the preceding section, are of great advantage in subacute scrotal eczema. In other cases the unguentum vaselini plumbicum, spread on muslin, or the compound bismuth salve, similarly applied, are better tolerated.

The chronic forms of eczema of the scrotum, when the skin is much infiltrated with marked scaling and smarting, require a decided stimulating plan of treatment. A valuable method is to rub the scrotum with a salicylic-acid solution in alcohol (3j-3iv), and afterward to apply, spread on muslin, the ung. vaselini plumbicum, with a dram of boric acid to the ounce. Frictions with green soap, followed by the last-mentioned salve, will often effect a cure in rebellious cases. The 5 per cent. compound salicylic plaster, neatly spread on strips of muslin and strapped around the scrotum, as for swelled testicle, may be also recommended. Among other remedies should be mentioned Wilkinson's ointment—

R. Ol. cadini ;	
Sulphuris sublimati,	āā. 3iv ;
Saponis viridis ;	
Adipis,	āā. 3j ;
Crete præparat.,	3iiss.—M.,

and various preparations of mercury and mercury and tar. Painting the skin with solutions of nitrate of silver, caustic potash, ten to twenty grains to the ounce, tincture of iodine, rubbing with pure or dilute Vlemineckx's solution, etc., may all have to be tried in a disorder that is notoriously obstinate in its chronic condition.

The same general line of treatment is also to be advised in chronic eczema of the vulva, although necessarily the preparations employed must be considerably weaker. Fox's modified Lassar's paste serves a useful purpose in preputial eczema and in erythematous eczema of the penis.

Eczema of the Hands and Feet.—The hands and feet are frequently affected. All four members may be involved at the same time, but the hands alone are much more frequently attacked; and this is undoubtedly due to greater exposure to irritants of all sorts. The disease is usually symmetrical; a scaly, infiltrated patch limited to one foot or hand is presumptively syphilitic.

The dorsal aspects of the hands and feet may be attacked by any form of the disease, especially papular, squamous, and moist varieties, and between the toes and fingers an eczema intertrigo is not uncommon. Acute vesicular eczema may also affect these parts; in fact, in my experience it is comparatively frequent on the hand, the whole member being covered with a multitude of minute vesicles. On the palmar surfaces, owing to the thickness of the cuticle, the vesicles burrow for a long distance before rupturing. Various degrees of dry and squamous eczema are to be observed on the palms and soles; in some instances the condition present is merely one of moderate

thickening and unusual dryness of the epidermis, or there are to be noted more or less defined, infiltrated, and fissured patches; or, again, the whole surface is involved, even to the extent of seriously interfering with the use of the members. This same state of affairs is often confined to the tips and sides of the fingers, and observation will demonstrate that these lesions begin without redness or itching, merely as areas of infiltration, often with a central depression which finally fissures. Pruritus is not particularly marked or is altogether absent in these dry eczemas of the palms and soles.

Strips of cheese-cloth dipped in the calamine-and-zinc lotion, and neatly bound to the parts, usually afford prompt relief in acute vesicular eczema of the hands. Five to ten minims of carbolic acid may be added to each ounce of the lotion. After the acute stage has passed away, leaving the parts red and slightly scaly, an ointment of tar and zinc (ung. picis liq., $\mathfrak{z}\text{ij}$; zinci oxidi, $\mathfrak{z}\text{j}$; ung. aq. rosæ, $\mathfrak{z}\text{vj}$) will bring about a permanent cure. Eczema of the dorsal surfaces of the feet and hands must be treated according to the character of the lesions present and the stage of the disease. Subacute papular and vesico-papular eczema is benefited by the following paste:

Ry. Bismuthi subnit.,	$\mathfrak{z}\text{iv}$;
Zinci oxidi,	$\mathfrak{z}\text{j}$;
Pulv. amyli,	$\mathfrak{z}\text{ij}$;
Acidi carbolicæ,	$\mathfrak{m}\text{x-xv}$;
Vaselini,	$\mathfrak{z}\text{j}$.—M.

White precipitate salve (gr. xx-xxx to the ounce), tar-and-zinc ointment, Lassar's paste, and the compound starch ointment mentioned above may all be called in requisition at one time or another. Eczema rubrum often requires soap-frictions, followed by ung. vaselini plumbicum. Eczema between the toes and fingers should be treated by the same, with 1 or 2 per cent. of carbolic acid, spread on muslin and neatly fitted to the parts. The disease occurring between the toes will sometimes do better under a powder:

Ry. Thymol.,	gr. j;
Pulv. zinci oleatis,	$\mathfrak{z}\text{j}$.—M.,

or a paste like Lassar's or Ihle's. Painting with a solution of nitrate of silver (16 gr. to $\mathfrak{z}\text{j}$) may be demanded in obstinate cases.

It is absolutely necessary in horny thickening of the palms and soles to get rid of the infiltration. For this purpose Unna's salicylic-acid plaster mull, 15-20 per cent., best serves the purpose, or in its stead a salicylic collodion ($\mathfrak{z}\text{ss}$ to $\mathfrak{z}\text{j}$) or traumaticine. Duhring's formula for a compound salicylic-acid plaster will perhaps do as well (see above). If a plaster is employed, it should be spread on muslin strips and kept in place by gloves or bandages. Occasionally it is necessary to blister with cantharidal collodion or rub in a solution of caustic potash.

These cases are notoriously rebellious to treatment, and the physician should not fail to direct such general hygienic and medicinal measures as may seem to be indicated. Eczemas of the hands are often due to the calling of the individual—bricklaying, plastering, etc.—and it is obvious that the exciting cause must be removed before a cure can be effected.

Eczema of the Nails.—This may exist alone or in connection with the disease on the hands. The nail is roughened, furrowed, and brittle, and at times the skin around the base and sides of the nails is involved. Arsenic in moderate doses, long continued, is of undoubted value in these cases, especially in the very chronic forms. The various combinations of salicylic acid,

tar, and mercury may be tried locally. Salicylic collodion should be painted on the infiltrated skin around the borders of the nails, followed by ung. vaselini plumbicum spread on muslin and covered with cloth or kid finger-stalls.

Eczema of the Legs.—All types of eczema may be observed on the lower limbs, but it is rather a disease of adult life, especially among those obliged to stand long on the feet, and is less common in children. An erythematous eczema, accompanied by considerable itching, is not infrequent, as is also a papulo-squamous affection about the ankles. But the most typical and striking form occurs in the shape of an eczema rubrum. Small discrete patches may be alone present, or these, running together, form a large area on the anterior surface. The disease may not, and usually does not, pass the ankle below or the knee above, but it may extend to the foot and run up over a part of the thigh. As a rule, when the patient comes under the care of the physician the disease has been in existence months or even years, and exhibits a red, raw, and weeping surface, here and there covered with crusts and giving evidence of excessive scratching. Sometimes the limb is free of crusts, and presents only a purplish, shining, and turgid aspect. Varicose veins and ulcers are frequent accompaniments and undoubted etiological factors in these cases; still, these latter lesions are by no means constant. Hypertrophic changes in various degrees often follow eczema of the leg, and deep pigmentation is usual after healing.

If it should chance that the case is seen in the acute weeping stage, White's plan of sopping on black-wash every few hours, followed by zinc ointment or zinc and cold cream, is a valuable method.

In classical eczema rubrum of the leg nothing gives so satisfactory a result as Hebra's method of soap frictions, followed by ung. vaselini plumbicum. The following directions, taken from my *Manual of Skin Diseases*, should be closely followed: In the first place, before beginning the soaping, the lead salve should be evenly spread on strips of muslin and put aside in a convenient place; the next step is to dip a piece of flannel into lukewarm water, and, having wrung it nearly dry, to smear on it a piece of the green soap of the size of a hickory-nut. The soap should now be firmly rubbed into the affected parts for a few minutes, and when this has been accomplished the flannel should be dipped into the water again, and while still wet briskly rubbed over the surface once more. As soon as this process has been concluded, the lather should be washed off, the skin gently dried, and the prepared muslin evenly and neatly applied, and the dressing kept in place with a roller bandage. According to circumstances, the soap frictions may last from five to twenty minutes and be repeated once or twice a day. After the first rubbings the skin will look very angry, but after a time the itching diminishes, the infiltration disappears, and the surface gradually assumes its normal appearance.

Van Harlingen highly recommends Squire's glycerole of the subacetate of lead of the strength of 15-30 grains to the ounce of glycerine. Strips of linen soaked in this preparation are applied, and covered with wax paper, and carefully bandaged. In cases with less crusting and exudation, and especially when complicated with ulcers, the glycerine jelly makes an admirable dressing (see formula above). The leg from the foot to the knee should be painted with the melted jelly, and then, while still moist, a gauze or cotton bandage is applied on the flat, and this, again, is painted over with the jelly, great care being taken to avoid wrinkles. As the preparation takes some time to dry, it may be covered with thin layers of cotton wool or ordi-

nary tissue-paper. The ulcer may be dressed in any way desired, and over it is placed a piece of cotton, and over this, again, the jelly is applied. When the discharge from the ulcer has soaked through the dressing a small hole is cut through it, just the size of the ulcer, and this is gradually enlarged until it reaches the size of the lesion below.¹ If for any reason it is advisable to put on a Martin's bandage, great care should be taken to powder the leg first—that is, in cases of ulcer with a limited amount of eczema in its neighborhood—and then to draw over this a long stocking, as the rubber itself should never come in contact with the bare skin.

It remains now to speak of the various salicylated soap plasters in the treatment of eczema of the leg. It seems to me that they are not so useful in eczema rubrum as in more scaly conditions with considerable hypertrophy, but such excellent authorities as Pick, Klotz, and Duhring speak highly in their favor; and it must be admitted that they are often very serviceable. In practice they should be evenly spread on muslin cut in narrow strips and firmly bound on with a roller bandage.

Universal Eczema.—A true eczema involving the whole cutaneous surface is comparatively rare, and may exhibit any type of the disease, presenting different forms in different localities. Elderly people not uncommonly suffer from a fairly widely diffused papular eczema, occupying, however, most prominently the nape of the neck, face, arms, and thighs. On the forehead, neck, and arms the papules become fused and form scaling and fissured plaques that are excessively pruritic.

When practicable, persons, especially the aged, suffering from extensive eczema should be put to bed and kept as quiet as possible. Powders of various composition, usually containing a little camphor or carbolic acid, and lotions like that of calamine and zinc, are demanded in dry forms of the disease. Moist eczemas are best treated by liniments, such as lime-water and olive oil, with a little creasote or carbolic acid, for the itching, or a liniment containing oxide of zinc and calamine. The following cream, advised by McIntosh, is a very acceptable preparation :

R̄. Bismuthi subnit.,	ʒij ;
Zinci oxidi,	ʒss ;
Glycerini,	ʒjss ;
Acid. carbolicæ,	℥xx-xxx ;
Vaselini,	ʒvj.—M.

Sig. Apply with a brush.

For universal application the amount of carbolic acid may be decreased or else omitted. Chronic and recurrent papular eczema in these situations or elsewhere is particularly obstinate. For the pruritus lotions of carbolic acid and menthol may be prescribed with hope of giving relief :

R̄. Menthol.,	ʒij ;
Alcoholis,	q. s. ;
Acidæ carbolicæ,	ʒss ;
Lotionis zinci oxidi comp.,	ʒvj.—M.

Thickened and scaly patches may be treated with Wilkinson's ointment (see above), pigments of salicylic acid and chrysarobin, of each 10 per cent. in traumaticine, or lotions of sulphate of zinc (ʒij-iv to the pint of water) and solutions of tar and lead :

¹ See a good paper on Unna's dressing by C. E. Ide, *Phila. Polyclinic*, March 20, 1897.

R. Liq. carbonis deterg.,	ʒij;
Liq. plumbi subacetatis,	ʒij;
Aquæ,	ʒviiij.—M.

DERMATITIS REPENS. (W. A. HARDAWAY, M. D.)

Definition.—A spreading dermatitis, usually following injuries, and probably neuritic, commencing almost exclusively on the upper extremities (Crocker).

Symptoms.—Crocker was the first to call attention to a form of inflammation of the skin which, originating in some kind of traumatism, steadily extends, leaving behind it a red, denuded, and oozing surface. The advancing border is undermined by a serous exudation, and is clearly defined. The skin in the wake of the morbid process becomes covered with new epidermis, but it retains for a long time a red, glistening, and somewhat atrophic appearance. The cases vary much in severity, but under certain circumstances they are very chronic, often lasting for months. The disease almost invariably attacks the upper extremities, but probably because they are more exposed to injury. Sometimes it is confined to a single finger or it may involve the whole arm. The apparent exciting causes have been various—viz. a splinter under the nail, a burn from sealing-wax, cicatrix after amputation. In an instance under my own observation the irritation of a hangnail initiated an attack that lasted for months.

Crocker regards the affection as due to a peripheral neuritis with secondary parasitic invasion. Pollitzer believes that parasitism is the fundamental factor in the disorder. Since the original observations of Crocker a number of similar cases have come under notice.

Diagnosis.—It is possible to confound an eczema with dermatitis repens, but the latter disease is characterized by its sharply defined, slowly advancing border and the absence of itching—features that are not seen in the former affection.

Treatment.—Internal treatment has not proved of any advantage. Antiparasitic local measures seem to hold out the best chances of success. Among the remedies that have proved valuable may be mentioned a saturated solution of pyoktanin blue, a 10 per cent. solution of permanganate of potassium, a solution of hyposulphite of sodium, lactate of lead, salicylic acid, iodoform, sulphate of copper, and nitrate of silver. In one of my cases a dram of aristol in an ounce of unguentum vaselini plumbicum apparently stopped the process; in another it had no effect. A disease that has many remedies usually has none, and it is quite likely that in dermatitis repens time is the real curative agent.

PRURIGO. (HERMANN G. KLOTZ, M. D.)

Definition.—A chronic disease, beginning early in life, characterized by the most intense itching, the appearance of peculiar hard, pale papules, mostly on the extensor surfaces, dryness and hardness of the skin, and inflammatory changes secondary to scratching.

Symptoms.—Prurigo has long been the subject of controversies among dermatologists, and even now it is not everywhere recognized as a distinct species of disease, as originally defined by F. Hebra, the intermingling of the terms "prurigo" and "pruritus" having added much to the confusion. The existence of prurigo in this country has often been doubted, but in recent years more cases have been observed, mostly in immigrants (Austrian

and Hungarian) and their descendants. This reputed rarity of the disease in America may partially be accounted for by the unwillingness of dermatologists to make the diagnosis in cases of a milder type. Indeed, the symptoms may be present in so varying a degree that a distinct differentiation has been made between *p. ferox* and *p. mitis*, the typical severe and the milder cases. But, as there is no real difference except in the intensity of the symptoms, there is no reason to uphold such a distinction.

The characteristic symptoms, the papules, seldom appear before the second or the beginning of the third year of life. It will be found, however, that the little patients had previously been affected for some time, usually from eight to twelve months, with frequent and severe eruptions of wheals (urticaria), and particularly of the papular form, peculiar to children (*u. papulosa*, lichen urticatus). Mingled at first with wheals, but later on alone, more or less numerous, hard, firm, solitary papules begin to appear, in size not exceeding a hempseed or small lentil, situated mostly on the extensor surfaces of the extremities, less on the trunk, sometimes on the face and forehead. These papules usually at first do not differ much in color from the skin, and are slightly raised, so that they can better be detected by the touch than by sight. It is rarely one sees these papules in their natural condition, because, owing to the intense and incessant itching and subsequent scratching, they soon change their appearance, becoming more prominent, sometimes resembling wheals, excoriated or covered with a brown or black (bloody) crust. Gradually the entire skin will be affected by the irritation from the scratching; it becomes hard, rough, dry, difficult to be raised in a fold, deeply pigmented, and bearing all kind of excoriations, crusts, pustules, ecthymatous ulcers, broken-off hair, etc. The whole surface is dry, and perspiration is almost entirely suspended. In well-developed cases these conditions are present on the extremities, with the exception of the flexor surfaces of the large joints and the palms. The lower portion of the extremities is generally more severely affected than the upper half, and the lower limbs more than the arms. The trunk and back, as well as the face, show less marked changes; the scalp is mostly in good condition, but dry. The mucous membranes are not affected; the superficial lymphatic ganglia, particularly the inguinal ones, are considerably enlarged and sometimes bulge out in the shape of a large tumor. The condition of the patients in severe cases is most pitiable; the intense itching, going on all day and night, does not allow quiet sleep at night nor any enjoyment during the day; it prevents the patients from following a regular occupation or from mingling freely with other people, on account of the constant desire for scratching. And they do scratch terribly. The entire body shows the effects in the shape of abrasions, deep lacerations, and recent and old cicatrices. New crops of papules alternate with periods of remission or alleviation. In a number of cases the process is more acute and the suffering more aggravated in winter, while in others the period of greatest severity coincides with the warm season. In this way the disease may go on unabated through life, mitigated only by treatment and hygienic influences. Other cases change their character under treatment and continue with minor severity. It seems that in a number of prurigo patients who brought the disease into this country the symptoms have become milder and more amenable to treatment, the better hygienic conditions and the more liberal use of water being favorable factors. In other cases, again, the symptoms are not so pronounced at any time, the papules are not so well developed and not so widely distributed, and the itching is not so incessant, so that the secondary effects of

scratching never become so marked. These milder cases, which by some writers are considered as an unusual form of urticaria or as aggravated eczema, do not always begin in the first years of life, but as late as the seventh, eighth, or even the thirtieth year.

Etiology.—Prurigo has been most frequently observed in Austrian and Hungarian countries, although a rare disease even there, with a certain predilection for the Jewish race. It is not evident how much climatic conditions are responsible or the habits and surroundings of the people. Most patients belong to the lower walks of life, and want and poverty may exert a great deal of influence, while heredity apparently has none or very little. The children affected are themselves poorly nourished, rachitic, or scrofulous, rarely of previous good health. Males are affected in considerably larger proportion than females.

Pathology and Anatomy.—The pathological conditions underlying prurigo are by no means well known. Even the existence of the papules and their nature have been the subject of much dispute, and in connection therewith the question whether prurigo is a pure neurosis or dependent partly or entirely upon pathological conditions of the skin itself. The character of the papule, however, seems now to be well established by the almost identical results obtained by the independent investigations of several pathologists in different countries. Accordingly, the papule is invariably formed by a cystic cavity within the rete Malpighii, probably connecting with the duct of a coil-gland and originally forming part of it. It contains a clear fluid and some epithelial cells. The corneous layer is left intact by the cyst and forms its cover. Other pathological changes present do not differ from those in other forms of chronic hyperplasia. The nerves and their end-organs do not seem to be affected. How much the disease is due to action of the nerves (direct or vaso-motor) or the presence of some toxic substance in the blood, or perhaps to an organic parasite, remains doubtful with our present knowledge.

Diagnosis.—Typical cases of prurigo are not difficult to recognize, particularly if the entire body is examined. The dry pale face, with a certain expression of suffering and of stupidity, the pigmented, thickened skin of the extensor surfaces in contrast with the soft, smooth, flexor surfaces of the joints, the marks of scratching, and the enlarged glands form a picture not easily to be forgotten when once seen. Parasites, mainly those of scabies and phthiriasis, have to be excluded by careful examination. It is, however, often difficult to demonstrate the characteristic papules, so that, clinically, only the features of an intense dermatitis or eczema may be present. The history of the early beginning and of the long duration, of the regular intermissions in summer or in winter, will help to decide the question. In milder cases the diagnosis is much more difficult, and must often remain doubtful, because, except for the history, the appearance itself is more that of papular eczema.

Prognosis.—In general the prognosis of prurigo cannot be any longer considered so absolutely bad as claimed by F. Hebra. Not only do cases run a mild course throughout, but some of the severe ones can, by treatment and hygienic measures, be changed into mild ones, and show a natural tendency toward abatement of the symptoms at the age of puberty. In the single case the prognosis depends a great deal upon the character of the disease as developed at the start, as it will remain more or less unchanged: if no improvement takes place about the age of puberty, the prospects for a change for the better become very poor.

Treatment.—Under all circumstances prurigo calls for energetic treat-

ment: even where we may not hope to thoroughly and permanently relieve the patient, much can be done to alleviate his suffering and to ameliorate his condition. Our first aim must be to improve the hygienic surroundings, to submit the patient to the beneficial influence of a liberal use of water and soap, of clean clothes for body and bed, and to give attention to the general health by generous and judicious feeding: cod-liver oil, extract of malt, syrup. ferri. iodat., and similar preparations are of the greatest value. Among the drugs recommended are phosphorus, carbolic acid, ergot, anti-pyrine, tincture of cannabis indica (beginning with three times 5 drops with children of about eight years). Some of them have a soothing influence only: none have proved effective on the disease itself. The preparations of jaborandi, and particularly the muriate of pilocarpine, may be considered the most reliable remedies, either internally or by hypodermic injections of the alkaloid, because their action on the sweat-glands and on the entire perspiration has a powerful effect upon the general condition and nutrition of the skin. Unfortunately, their administration is not free from the danger of severe collapse, and small doses ought to be given at first (for children, 1 grain to 2 ounces of water, two to three times a day one teaspoonful; for adults, 2 to 3 grains in 2 ounces: subcutaneously it is safer to begin with $\frac{1}{10}$ of a grain or less in children). Local treatment is mainly directed against the secondary condition of the skin. Baths, either plain or alkaline or in combination with rubbing with tar (tar-baths) and ointments of tar and sulphur, or both combined (Wilkinson's ointment), naphthol (2-10 per cent.), resorcin and ichthyol, Unna's ointment (zinc. ointm. 100 parts, carbolic acid 5, corrosive sublimate $\frac{1}{4}$ to $\frac{1}{2}$ part), are the most valuable remedies. Rubber coverings have been employed, both for their protecting and for their macerating influence; dressing with cotton and other means which exclude the air lessen the tendency and the opportunity for scratching. In a disease of so long a duration it is necessary to continue the treatment with occasional changes in the remedies and their methods of application.

PSORIASIS. (HERMANN G. KLOTZ, M. D.)

Definition.—A localized disturbance of the nutrition of the papillary layer of the cutis and of the epidermis, principally affecting the development of the corneous strata. It manifests itself by the formation of gray or white imbricated scales over well-defined, dry, red, level or slightly elevated patches of various number, size, and shape. It is non-contagious and eminently chronic, not only in the course of the lesions themselves, but still more so in its tendency to frequent remissions and relapses, often extending throughout life.

Symptoms.—Psoriasis is essentially a disease of the skin, affecting no other organ of the body, and, as a rule, leaving the general health unimpaired. It has been called a disease of the healthy, but in reality, besides the strong and robust psoriatics, many weak, anemic, and poorly developed ones will be found.

Fever of a moderate degree occasionally accompanies more acute outbreaks. Itching is often present, but never with such intensity as in eczema and similar skin-diseases. It is more prominent, either where the lesions develop very rapidly and over a large area, or in chronic cases where cleanliness and hygienic measures are neglected; in a considerable proportion it is entirely absent. Some authors insist on the frequent coincidence of psoriasis with gouty and rheumatic joint-affections, and on the existence of some

PLATE 17.



Psoriasis nummularis. The scales are comparatively thin and light-colored; slight accumulation of the patches around the knees. (From the collection of Dr. J. A. Fordyce.)

definite relations between them. The mucous membranes never participate in the psoriatic process; conditions of the mouth and tongue, described as psoriasis buccalis or lingualis, have nothing in common with psoriasis of the skin, but rather depend upon other cutaneous or general diseases (syphilis, lichen planus), or appear independently (leukoplakia). The lesions of the skin themselves are of a more uniform and well-defined character than in most other skin-diseases. Commonly, psoriasis appears in isolated patches or islands of diseased skin surrounded, or where more numerous separated, by perfectly healthy portions of the skin. Sharp and often slightly raised outlines cause them to stand out quite conspicuously. The border of a patch is generally smooth or red, without a congested or inflammatory zone in the periphery. The patch itself is invariably covered with layers of white or gray dry scales, mostly sufficiently thick to disguise the color of the skin itself. The elevation of the patches usually depends upon the accumulation of the



FIG. 237.—Generalized psoriasis, showing on the back numerous isolated round patches of different size—from pinhead-size (*psoriasis punctata et guttata*) to the size of smaller and larger coins (*psoriasis nummulata*). On some of the larger spots the silvery appearance of the scales is quite distinct. The left arm is in a state of chronic infiltration (see Fig. 239). (From the collection of Dr. J. A. Fordyce.)

scales, but in inveterate cases considerable infiltration of the cutis itself may occur. The scales are peculiar, whitish, glistening, from a mother-of-pearl to a silvery appearance, unless discolored by dirt or blood. They are formed by thin, brittle laminae overlapping each other, and altogether loosely adhering, so that they are cast off voluntarily in large quantities where their supply is plentiful, or can be readily removed by rubbing or scratching. Underneath the scales the surface of the skin appears of a more or less deep-red color, dry and smooth, except for minute drops of blood oozing from fine points. No serous or purulent discharge is ever found under the scales in uncomplicated psoriasis. After removal the scales rapidly form again. Over joints, and other parts exposed to frequent motion or other injuries, fissures may occur between the scales.

The psoriatic patch in all instances begins as a flat, pinhead-sized papule

bearing a minute white scale in the center, and grows by peripheral extension. In its further development, however, it leads to different configurations according to the size and shape. Certain types, occurring more frequently, have been designated by special names without implying a change in the character of the disease itself. In rare instances, where the lesions remain for some time in the primitive stage of pinhead-sized spots, we speak of *psoriasis punctata*, and of *psoriasis guttata* when they increase to the size of a split



FIG. 238.—Disseminated psoriasis of the trunk in the shape of smaller round patches (*psoriasis nummulata*.) Coalescence into larger areas, thickly covered with scales over and around the elbows (*psoriasis diffusa*) (see Fig. 239). (From the collection of Dr. J. A. Fordyce.)

pea. In *psoriasis nummulata* the patches resemble coins of different size. They may further increase, retaining the regular circular or oval outlines, without any material change in the central portions, to almost any size, until they nearly cover a whole limb or the entire trunk. But more often two or more will coalesce into a large tract of diseased skin with irregular indented borders, sometimes resembling the outlines of a geographical map. This condition is called *psoriasis diffusa*, and *psoriasis universalis* in its highest development, when the larger part or almost the entire surface of the body

is affected. But even in the most extreme cases it is always possible to find areas of healthy skin, however small, within or between the diseased portions. In a number of cases the patches, whether small or large, begin to clear up in the center, leaving only a scaly ring, which in its turn extends peripherally—*psoriasis circinata*; or several rings run together into festoon-like combinations of segments of circles—*psoriasis gyrata*.

Occasionally the eruptions of psoriasis take place in a rapid, almost acute manner, and in a more or less general distribution almost resembling that of the acute exanthemata, of erythema, or of general syphilides. Then small pink spots begin to appear simultaneously on different portions of the body, mainly on the trunk and the extremities, less copiously on the face and scalp, but thinly covered with scales, and quickly increase in size. Regions which, as we shall see, are the favorite seat of localized psoriasis, like the knees and



FIG. 239.—Inveterate psoriasis on and above the elbow; large area with irregular outlines, thickly covered with hard, more or less dark scales. The borders and the dividing-lines between the scales indicate the coalescence of smaller patches into the larger one. On several spots the scales have been fissured and diffused with blood (dark spots). (From the collection of Dr. J. A. Fordyce.)

elbows, in these generalized cases may be found entirely free or certainly not prominently affected. This, for the time being, largely increases the difficulties of diagnosis. As a rule, this quasi-acute stage does not last long; soon new patches cease to develop; the peripheral extension will decrease or stop entirely. Usually the patches make their appearance in a more sluggish and less widely distributed manner. They may vary from a hundred or more, according to size, to a dozen or less—in fact, to a single spot, not even of large size. Single patches or several new ones may be added after days or weeks; their peripheral extension may proceed very slowly and sometimes become stationary for months; still, even these slow cases may occupy a large area and become almost universal.

No portion of the human body is exempt from psoriasis, but the disease

shows a decided preference for certain localities, and there will hardly be a case in which no lesion at all could be found on one or the other of these favorite seats. The extensor surfaces of the extremities are most frequently affected, principally over the knee and elbow. Next in frequency come the scalp, the back of the trunk, particularly the lumbar region, and the face, although here the affection is rarely very intense or very extensive. On the scalp the patches often end with a sharp border just within or without the limits of the hairy growth above the forehead. The palms and soles, generally, do not bear any lesions. In rare instances, however, they have been



FIG. 240.—Large patch of inveterate infiltrated psoriasis on the back, with irregularly-indent-ed borders (psoriasis diffusa, psoriasis geographica), resembling geographical maps. The scales are less brittle, more closely adherent, and smooth, covering a firm, infiltrated cutis. (From the collection of Dr. J. A. Fordyce.)

invaded in quite a characteristic way. The hair and its growth usually are not interfered with, but the nails of the fingers and the toes may become affected in a varying degree; ordinarily, however, not all the fingers and toes are affected. At first the nail itself remains transparent; only a white spot appears underneath. Gradually the nail becomes opaque, thickened, and later on brittle, furrowed, and of a dirty brownish color. It finally breaks off in parts or becomes detached from its bed by the accumulation of scales. On the nails, as well as otherwise, psoriasis shows a pronounced tendency to symmetrical distribution of the lesions—on the scalp probably less than anywhere else.

The psoriatic patch may disappear voluntarily or after treatment, and, except yellow or brown pigmentation varying in intensity according to its duration, leave the skin perfectly intact. Spontaneous disappearance tends to take place congruent with certain seasons of the year; some cases improve or heal on the approach of the warmer season, to reappear in the fall; others are favorably affected by cooler weather and return in the warm seasons. Such spontaneous cures are rarely perfect. Close scrutiny will generally reveal one or more scaly spots on one of the favorite localities, which seem to form a nucleus for future eruptions. Remissions and intermissions take place independently from the seasons, either spontaneously or from treatment. Once removed, relapses may be delayed for more or less extended periods, even for years, but in a large majority of cases they will occur again and again, lasting in many instances through life.

Psoriasis is not a rare disease, statistics showing that it is represented by something over 3 per cent. of all skin-diseases observed. No age is really exempt, but infants and small children are rarely affected; after the fifth, and more after the tenth, year the frequency increases, continuing in its height from fifteen to thirty years, with a gradual decline for the next twenty years, and almost complete disappearance above fifty years.

Complications are rare, but generally obscure the diagnosis, particularly that with syphilides. Local irritation, scratching, etc. may gradually change the appearance. Combinations with different forms of eczema undoubtedly occur, and for a time, at least, can render the diagnosis almost impossible. In a small number of cases general exfoliative dermatitis has been found to develop from extensive psoriasis, obliterating all traces of the primary affection.

Etiology.—None of the opinions advanced on the nature of psoriasis have so far been satisfactorily established. The parasitic theory is the most favored at present, although the demonstration of the parasite and other conditions considered essential are outstanding, and no unquestionable record of contagion or of successful inoculation exists. Some authors look upon nervous influences for its origin, particularly on trophic and vaso-motor ones, of which, unfortunately, our actual knowledge is very limited and obscure; others upon abnormal conditions of nutrition and tissue-change often designated as diathesis. Nothing is definitely known, so far, but that certain individuals have a disposition to develop psoriasis spontaneously or under certain conditions, and that this disposition is often inherited, but not as often as some statistics seem to show. Heredity is usually not general, affecting not more than two or three members of one family; one or more generations are sometimes skipped. The earlier in life psoriasis appears the oftener it can be traced to heredity. Sex, age, race, occupation, climatic, hygienic, social, and economic conditions apparently have no influence. The same must, in general, be held of diet and of the use of alcoholics. It cannot positively be demonstrated that psoriasis occurs with greater or smaller frequency among individuals or among populations addicted to this or to that diet, be it preponderantly animal or vegetable. There is no evidence that it is found more among those who habitually use alcohol in the form of beer, wine, cider, or the stronger liquors than among those who abstain from them.

The immediate causes provoking outbreaks of the disease in those disposed to them, besides the influence of the seasons mentioned before, are changes in the condition of the general health, gravidity, lactation, gout and rheumatism, excesses in eating and drinking (not of alcoholics only, but also of tea, coffee, mineral waters, and last, but not least, ice-water), as well as

the opposite extreme—insufficient and imperfect nutrition, faulty dietary habits. Nervous influences, particularly vehement emotions of fright, grief, etc., are known to have been followed by relapses or even by the primary outbreak. Local injuries, sometimes of a trifling nature, are liable to produce local eruptions; among them vaccination deserves special mention, and dermatitis venenata occurring on the borders of the psoriatic patches treated with chrysarobin.

Pathology and Anatomy.—The pathological process is situated in the superficial layers of the corium and in the deeper strata of the epidermis. The morbid conditions usually observed are an enormous increase of the horny layers, owing to abnormal and premature conversion of the rete-cells, increased development of the prickle-cell layers of the rete except over the papillæ, down-growth of the interpapillary processes, with consequent (real or apparent) enlargement of the papillæ and dilatation of the blood-vessels and cell-exudation in the papillary layer, principally around the hair-follicles and extending along the blood-vessels and the ducts of the coil-glands. Opinions differ whether the process begins in the rete or in the papillary layer, and whether it is a simple hyperplasia or of a real inflammatory nature. Unna considers that the abnormal keratization of the intermediate strata of the rete (parakeratosis) is the first change, the further development occurring by either proliferation of the rete-layers or by dilatation of the papillary blood-vessels. He tries to explain the contradictory opinions by the prevalence of either of these conditions in different cases and specimens. As the primary cause he assumes the presence of a parasite which neither he nor others, so far, have been able to demonstrate.

Diagnosis.—Ordinary cases are easily recognized by the characteristic patches and their scales and their localization; the history and the course, often the absence of itching, deserve consideration. The greatest difficulties for diagnosis are presented by cases of *rapid generalized development*. It is sometimes impossible to draw a line between them and the disseminated discoid form of dermatitis seborrhœica, better known as Unna's seborrhœic eczema, which in former times would have unhesitatingly been classed as psoriasis. More dirty yellowish scales, less dry, brittle, and laminated, greasy to the touch, a less dry and smooth surface after the removal of the scales, considerable itching, favor the diagnosis of seborrhea; the history of former attacks beginning early in life, that of psoriasis. A general papulo-squamous syphilide differs by the less abundant, darker, and more firmly adherent scales, the more bluish (ham) color, the infiltrated center and flattened border. The history and the presence of other symptoms or their marks may decide the question.

Generalized chronic cases, particularly inveterate ones, may resemble eczema, pityriasis rubra pilaris (lichen ruber acuminatus), and dermatitis exfoliativa. In eczema the borders are less distinct, interspersed patches of healthy skin are absent, the scales are less abundant, there is a tendency to weeping and intense itching. In pityriasis rubra pilaris it will always be possible, by close inspection, to reveal some distinct conical papules in the outskirts of larger infected areas; the scales are small, not laminated, mostly situated on small cones; the skin itself is rough, and shows the natural folds in an exaggerated manner. The almost universal extension, the abundance of small thin scales, the absence of infiltration in the uniformly reddened skin, distinguish dermatitis exfoliativa and pityriasis rubra. When the dermatitis exfoliativa develops upon psoriasis, for the time being the diagnosis will be almost impossible.

Localized psoriasis has to be distinguished from the late annular and circinate papulo-squamous, and from the dry tubercular *sypphilide*, particularly from the serpiginous forms. Besides the condition of the scales and the infiltration of the patches, the sharp, sometimes nodular, peripheral border, in contrast with the flattened indistinct inner one, and the presence of small ulcerations or cicatrices, have to be considered. Localized *seborrheic dermatitis* usually occupies the sternal region, the back between the scapulae, and the flexor surfaces of the large joints, contrary to the predilection of psoriasis. Prevalence of itching, development from the scalp downward, and more greasy yellowish scales will confirm the diagnosis. The circumscribed round or oval patches of *squamous eczema*, with whitish glistening scales, occurring mostly on the extremities in elderly people, may greatly resemble psoriasis. They are not symmetrical, exhibit a moist surface on removal of the scales, and are quite itchy. Patches of *lichen ruber planus* are of a violaceous color, grow by coalescence of several papules, not by peripheral extension, have scanty scales, usually show at least some hard, umbilicated nodules with smooth polished surface. Like psoriasis, they show a preference for the front aspect of the knees, but the wrist, neck, and genitals are their favorite seat. *Tinea trichophytina* usually is not symmetrical, has few scales, and very superficial infiltration; sometimes the microscope will have to decide. *Pityriasis rosea* generally begins on the thorax and spreads downward. Its limited course is characteristic. *Lupus erythematosus* will but rarely resemble psoriasis.

On the *palms* and the *soles* the distinction from eczema and syphilis is always difficult, and sometimes impossible, unless there exists an undoubted history of former attacks or characteristic lesions of either affection are present on some other portion of the body. Cases of exclusive occurrence of psoriasis on the palms and soles have been reported, but such a diagnosis ought to be made with the greatest caution. On the scalp psoriasis and seborrheic dermatitis may produce conditions exactly alike, and may both be present at the same time.

Prognosis.—In regard to the life and the general health the prognosis of psoriasis is always favorable. The manifestations themselves, as a rule, more or less graciously yield to treatment, but we are powerless to prevent the return of new attacks which, with various intervals, are liable to occur through life. Hereditary cases and those developed at an early age are more obstinate than others appearing later in life. But it must not be forgotten that the manifestations of psoriasis may disappear spontaneously for long periods, or even for ever, without any treatment.

Treatment.—On account of the uncertainty of its origin and of its nature the treatment of psoriasis is mostly empirical. We have no certain means to combat the disposition, but the local symptoms disappear sometimes by local applications alone, sometimes from internal treatment, in a majority of cases from a combination of both. The tendency to spontaneous remissions must not be overlooked in judging of the effect of therapeutics.

Constitutional Treatment.—Impairments of the general health of the patients have to be carefully looked into, and require appropriate treatment on general principles, particularly anemia—conditions so often met with in women during puberty, gravidity, and lactation, gout and rheumatism, dyspepsia, constipation, and nervous troubles. Great attention must be given to the habits and surroundings, principally to the cleanliness, not only of the body itself, by the free use of baths and of soap and water, but also of the clothing—to the quality and quantity of the latter, to its appropriateness to

the climate, season, age, and occupation. The effect of diet is often over-rated. There is no specific diet for psoriasis. Some patients have done well under exclusively animal diet, others under a strictly vegetable one. Milk diet sometimes proves beneficial. Individually, however, the diet must be regulated in regard to the excessive use of animal or vegetable food or of both, to the use of alcoholic drinks of every kind, or to that of water, tea, coffee, and highly-spiced dishes, to tobacco, etc. A deficiency in the quantity of fluids consumed, and consequently of the quantity of urine voided, deserves the same attention as irregularities of the bowels.

Among the drugs, arsenic, in the form of Fowler's solution or Pearson's solution or of pills, is the most frequently employed; also in some natural mineral waters (Levico, Roncegno, Bourboule, Royat, etc.), and rarely by hypodermic injections. Arsenic is harmful in the more acute, generalized cases, but acts well in the more torpid ones, after the cessation of new outbreaks, and as a prophylactic in the free intervals. It must be given in large doses sometimes, until symptoms of intoxication appear, among them pigmentation of the seat of the psoriatic lesions. After the disappearance of the lesions the drug must be continued in reduced doses for from four to six weeks, and be taken up again after an intermission of about the same duration. Antimony and phosphorus have also been recommended.

Another class of remedies are those of saline and of alkaline character. It is uncertain whether their evident effects are due to some specific action or to their antirheumatic and antiarthritic qualities or to their diuretic action. Iodide of potassium in large doses (up to 1 ounce per diem) has principally been recommended by Haslund; salicylate of sodium more recently by Crocker in acute cases; the simple diuretics, acetate and citrate of potassium (15 grains in water), as well as the mild alkaline waters, like Vichy, and the numerous lithia-waters, are useful in recent as well as in chronic cases. Other remedies which have been used with good effect by some authors are the oil of turpentine, carbolic acid, chrysarobin, the bromides, ergot, and others. The results of experimental treatment with thyroid gland and its extracts have not been sufficiently convincing to warrant the recommendation of this by no means harmless remedy.

Local Treatment.—The scales have to be removed as thoroughly as possible with soap and water (in a bath if possible); the finer grades of soft or green soaps, tar, sand, and marble-dust soaps are serviceable. Very abundant scales on more localized eruptions may require a (6 per cent.) alcoholic solution of salicylic acid, covering with rubber tissue, or even the curette. All the remedies which have been found effective in psoriasis possess more or less powerful antiparasitic properties—*i. e.* they destroy vegetable parasites which are known to cause certain skin-diseases, like the trichophyton. Besides, some of them (salicylic acid, pyrogallol, chrysarobin, sulphur) have a favorable influence upon the production of a sound epidermis (keratization), and others (tar, chrysarobin, pyrogallol, mercury) on the reduction of the hyperemic condition and cell-infiltration of the cutis. The most effective way for the application of these drugs is in ointments: the fatty substances soften the epidermis, and thereby render the seat of the pathological process more accessible to the active ingredients. Lard, unguentum emolliens, and vaseline are most frequently used as a basis, the latter advantageously with 10 to 40 per cent. of lanoline or *adeps lanæ*. For a paste Unna's zinc paste (ungt. zinci 90, bol. albi 10) is a good constituent. Basorin, plasmat (cetraria), and other gelatines may be of advantage; for less extensive lesions, plasters, either freshly-prepared ones or the numerous

ready-made plaster mulls and rubber plasters now in the market. The most important drugs are *chrysarobin* (chrysophanic acid), 10 to 20 per cent., sometimes with 1 to 10 per cent. of salicylic acid—not poisonous, but liable to cause dermatitis on the healthy skin and conjunctivitis, hence often applied with traumaticine (10 to 20 per cent.) or collodion or dissolved in chloroform and painted over with collodion. It stains the healthy skin a deep mahogany color, and leaves the psoriatic patches white; it therefore ought to be continued until they are affected exactly in the same way as the healthy skin (Neisser). *Pyrogallol* (pyrogallic acid), 10 per cent. ointment, stains black and is poisonous by absorption; is most useful on the scalp. *Antarobin* and *gallacetophone* are not irritating, but much less effective. *Aristol* has hardly any advantages.

Tar in its various forms has long been a favorite with many dermatologists; it may be applied as an ointment (20 to 50 per cent.) or diluted with alcohol or in the form of the "tar bath." *Oil of turpentine* (8 to 10 parts in oil) is recommended by Crocker. *Salicylic acid* in ointments from 5 to 20 per cent., or dissolved in castor oil and then mixed with oil, or in plaster does often good service, the same as *thymol* (5 to 30 per cent. ointment), *resorcin*, *ichthyol* (5 to 20 per cent.), and β -*naphthol* (5 to 10 per cent.). *Sulphur* has long been used in psoriasis, either in the form of Vlemineckx's solution or in ointments (Wilkinson's, with ol. fagi $\bar{a}\bar{a}$. 5, saponis viridis, axungiae, $\bar{a}\bar{a}$ 10, cretæ 1 per cent.). *Mercurial ointments*, particularly the white-precipitate ointment, alone or combined with tar, are usually non-irritating; the danger of mercurial poisoning seems to be quite remote. *Baths*, plain or sulphurated, particularly protracted warm baths or as practised in some European watering-places, are very useful adjuncts. External circumstances, particularly the facilities of treatment in a hospital, will largely modify the plan to be adopted for the treatment in the single case. It is advisable to change the drugs from time to time, since in so chronic a disease each one is liable to lose its power after some time.

PITYRIASIS MACULATA ET CIRCINATA; P. ROSEA. (HERMANN G. KLOTZ, M. D.)

Definition.—A self-limited affection of the superficial portions of the skin, appearing in slightly red and scaly efflorescences, either in spots or in circinate forms, with very little infiltration.

Symptoms.—In some cases the lesions present themselves as not well-defined, pale-red, round or irregularly-shaped spots, varying in size, but not exceeding that of a quarter, thinly covered with fine scales (p. maculata, p. rosea of Gibert). In other cases round or oval pale-red patches appear, with a distinct border covered with fine adherent scales. The patches gradually increase, the border becoming more prominent and of a more intense red, frequently rather salmon-colored. The center flattens down and assumes a light fawn color. The rings may spread and coalesce with others into gyrate areas of various extent, but finally the border becomes evanescent and only the fawn-colored stains remain. The patches usually first appear on the neck or chest. During their development others crop out farther down on the trunk and on the extremities, but rarely on the face, greatly varying in number. According to Brocq, the disease generally begins with one primitive patch on the neck or arm, which for some time, ten or twelve days or longer, remains solitary and grows slowly, until at once the eruption begins to spread. Moderate itching is often present at night and if the patient gets warm; otherwise the affection runs without any symptoms, and

spontaneously disappears within from four weeks to several months. The disease is probably a rare one. Brocq believes that it is becoming more frequent, but perhaps more attention is paid to it now.

Etiology.—Nothing is known with regard to the etiology of pityriasis rosea.

Pathology and Anatomy.—Until recently many dermatologists (Vienna School) did not recognize pityriasis rosea as a distinct disease, but identified it with what they call herpes tonsurans maculosus and describe as a disseminate development of trichophyton. Other writers (American, British, and French) use both these terms as synonyms. Others, again, who recognize the one, deny the existence of the other. In some cases it is apparently not difficult to demonstrate the actual presence of the mycelia and spores of trichophyton, but in pityriasis rosea most investigators agree that they have been unable to demonstrate the existence of a vegetable parasite. In appearance, pityriasis rosea greatly resembles other affections of the skin known to be parasitic, but the limited course and the resistance to antiparasitic remedies do not well support the theory of its parasitic nature. It rather seems that pityriasis maculata and circinata and herpes tonsurans maculosus are two different conditions.

Diagnosis.—Distinguishing features of pityriasis rosea are the often very faint-red color, the slight scaliness, the gradual appearance, the spontaneous disappearance, and the benignity. Some squamous syphilides may resemble its lesions, but, besides the history and the probability of the presence of some other symptoms of syphilis, the character of the infiltration and the color will be found more intense in syphilides. In psoriasis the scales are more conspicuous, the basis firmer and tending to bleeding. Some forms of seborrheal eczema can hardly be distinguished, except by the evolution of the pityriasis lesions. In favor of herpes tonsurans the microscope alone can decide.

The **prognosis** is entirely favorable. The affection does not interfere with the general health, tends to spontaneous disappearance, and, it seems, does not reappear on the same person.

Treatment.—Most observers agree that this disease does not require any treatment, but runs its course unaffected by local or general measures. Some believe that the application of sulphur or antiseptic solutions (corrosive sublimate, etc.) has somewhat hastened its disappearance. A mild lotion, particularly where some itching is present, or some dusting-powder, will be sufficient for all purposes.

DERMATITIS EXFOLIATIVA AND PITYRIASIS RUBRA. (HERMANN G. KLOTZ, M. D.)

Cases of generalized inflammations of the skin, characterized by redness, dryness, and copious desquamation, have been reported under various names by writers of different nationalities and dermatological schools. At present the terms dermatitis exfoliativa and pityriasis rubra are generally applied to these conditions, but still in a quite confused manner. Some authors (mostly American and British) recognize but one type of disease, and use both names synonymously; others (mostly German) do not recognize a dermatitis exfoliativa at all, and designate all cases as pityriasis rubra; others, again, distinguish the two separate diseases under the two separate names. The rarity of these diseases, which renders the experience of the single observer a limited one, even under the most favorable circumstances, largely contributes

to the difficulties in the way of a permanent solution of the question. Researches on etiology and pathology, so far, have not developed any distinctive features, but sufficient clinical evidence has been brought forward to justify the upholding of dermatitis exfoliativa as a separate disease, and define pityriasis rubra within the lines originally drawn by F. Hebra.

DERMATITIS EXFOLIATIVA (GENERALISATA).

Definition.—A subacute or chronic inflammation of the skin, characterized by redness, dryness, and continuous shedding of fine, paper-like scales, extending very rapidly over the entire cutaneous surface, almost invariably affecting the hair and the nails, occurring either primarily or secondarily, tending to remissions and exacerbations, and frequently ending in recovery.

Symptoms.—As a primary disease dermatitis exfoliativa generally occurs in adults, previously in good health, between forty and sixty years. With a chill and under more or less severe symptoms of fever (temperature 101–104° F., headache, malaise, etc.), sometimes preceded by a peculiar sensation in the skin (formication, heat, etc.), erythematous patches make their appearance in one or more localities, with preference for the flexor surfaces of the large joints (inguinal region, axilla, etc.), accompanied by intense itching. These red patches extend and coalesce so rapidly that within two to ten days the entire body is occupied. Fever usually disappears after the second week or continues in a milder degree, to reappear and become more aggravated again in connection with exacerbations of the cutaneous process. Now the entire surface, sometimes with the exception of the palms and soles, appears red in a bright shade, except on dependent parts, where it is of a deeper hue. After the second week the skin usually assumes a deeper shade of red, becomes slightly thickened and tense, and loses its natural luster; the epidermis begins to shrivel up and to become detached. The scales are of a light brownish color, sometimes slightly iridescent, resembling small pieces of crumpled tissue-paper, adherent at the center or on one margin, and turned up at the borders. They are of different size in different localities; the largest are found on the back, the smallest, more bran-like, on the face; on the hands and feet the epidermis may become detached in large pieces, sometimes preserving the shape of one or more fingers. The desquamation is always the most prominent feature and very abundant; the scales fall off and cover the clothing or the sheets of the bed, and can be collected in large quantities (one pint to one quart in twenty-four hours or more); after removal they rapidly form again. The hair begins to fall out, and usually is entirely lost; the nails invariably undergo alterations—transverse fissures, brittleness, thickening of the nail-substance and of its bed, and shedding of the entire nail. At times a slight moisture and some fetid discharge is observed in the axillary folds and similar localities; occasionally papules, bullæ, or pustules occur; furuncles are not infrequent complications. The superficial lymphatic ganglia are quite often found enlarged, and may suppurate; the mucous membranes, particularly where they adjoin the skin, may show signs of a usually mild catarrhal affection. The general health in the later stages becomes affected in various ways; loss of appetite, constipation, and more frequently diarrhea are observed; kidney troubles are rare. Itching in the majority of cases is not severe. The patients, as a rule, are very sensitive toward cold; only exceptionally will they complain of heat and burning; in later periods a feeling of tightness of the skin and a certain difficulty of moving the joints may be experienced.

In *secondary* cases the same conditions are seen to develop in individuals previously affected with extensive chronic skin-diseases, particularly with psoriasis, eczema, lichen planus, and pemphigus. Many writers, principally continental, as opposed to American and British, do not recognize this secondary form, but consider it as one stage of the original disease, psoriasis or other. In well-developed cases the appearance is exactly like that in primary ones, and no characteristic symptoms of the preceding lesions remain visible. They run the same course, showing relapses, and ending in recovery or in death. After the exfoliative dermatitis has run its course the primary disease may again make its appearance.

Etiology.—Nothing is known about the origin of this disease. A local dermatitis from the application of drugs occasionally has been its starting-point.

Pathology and Anatomy.—Histological researches have shown the usual conditions of chronic dermatitis without any characteristic points. The process apparently begins around the longitudinal vessels of the superficial system of blood-vessels of the derma.

Diagnosis.—It may often be impossible for some time to make the diagnosis of dermatitis exfoliativa. Besides the characteristic redness and desquamation, the absence of healthy portions of skin is the most conclusive sign as distinguishing from eczema, psoriasis, etc. Almost by the rapid development alone can we differentiate it from pityriasis rubra. Erythema scarlatiniforme is of short duration. Pemphigus foliaceus at first sight resembles dermatitis exfoliativa, but upon removal of the scales there will always be found a moist surface and either some isolated bullæ or the serpiginous bullous elevation of the epidermis around the border of the patches.

Prognosis.—In the majority of cases the tendency is to recovery. In mild cases the disease runs its course in from three to four months; in more severe ones, in from five to eight months; by remissions and exacerbations it may be prolonged to one year and longer. When the redness and desquamation disappear, a marked pigmentation may remain for some time. The disease may end fatally, usually after three to four months, mostly from complications from the lungs or from the heart, from diarrhea or from general cachexia.

Treatment.—Drugs have no particular effect on the course of the disease, although many have been tried, and occasionally some benefit seems to have been obtained from pilocarpine, carbolic acid, etc. It is advisable, therefore, to abstain from all internal treatment except what is demanded by certain symptoms or by the general conditions of the patient. The principal aim must be to keep the patient in the best possible state by judicious nourishment and by tonics.

Local treatment is equally ineffective on the disease itself. Whatever is done will mostly serve to keep the patient comfortable. Warm baths, and, if possible, permanent baths in connection with some mild ointment, give the best results. Carron oil (lime-water and oil), the glyceroles of lead and tannin (diluted, 1 part in 4 to 6), are particularly recommended. The itching may call for the application of menthol, salicylic acid, etc.

PITYRIASIS RUBRA.

Definition.—An eminently chronic inflammation of the skin characterized by redness, dryness, and desquamation of small bran-like scales, gradually extending over the entire cutaneous surface, involving the hair,

but rarely the nails, leading to moderate infiltration and shrinkage of the derma, occurring as a primary disease, and usually ending fatally.

Symptoms.—In the description of pityriasis rubra it seems appropriate to follow Hebra's original description as closely as some later observations permit. In most instances the disease begins past middle age, above fifty. Nineteen cases (collected by Jadassohn) show an average of forty-five years, including 2 children of seven and nine years; without them, of forty-nine years. The males slightly outnumber the females.

In the few cases where the early stages were under observation, without any apparent cause and without any distinct prodromi, on circumscribed areas on the flexor surfaces of several of the large joints the skin became red with slightly elevated local temperature, and covered with fine branny scales without infiltration or moisture. The different areas slowly spread, and within several months cover the entire body without any change in the character of the lesions. The skin appears red in various shades, more bluish on the lower extremities, and thinly covered with small bran-like scales or somewhat larger thin lamellæ. A real accumulation of scales, like that in psoriasis, does not take place—not more than a total loss of the epidermis and the exposure of a moist surface, as in eczema. The desquamation may be quite copious, although less so than in dermatitis exfoliativa. On the face and the scalp the scales usually have the smallest size. The temperature of the skin feels increased; on pressure the redness gives way to a yellowish tinge. Moderate itching is usually present; rarely it is severe; but the most important symptom is the great sensitiveness toward cold and draught and the continuous sensation of coldness. Fever, if present, is usually due to some complication.

These conditions may remain unchanged for years, without the slightest tendency to improvement, often allowing the patient to follow his vocation. Gradually the skin begins to thicken, partly owing to the infiltration or to edema, partly to the formation of scales. Later on the color becomes more livid and the shrinkage and tightening of the skin set in, leading to flexor contraction of the joints and over-extension, tears, and ulcers on the extensor surface. The hair on the scalp as well as on the body gets thin and drops out. The nails are not regularly affected, but may become thin and furrowed. During the protracted course small areas of skin may become the seat of moisture, or small papules from the size of a milletseed to that of a lentil may appear occasionally without ever becoming a prominent feature. In a number of cases enlargement of most of the superficial lymphatic ganglia has been observed.

Most of the patients have finally died of marasmus, alone or complicated with diarrhea, pneumonia, and particularly with tuberculosis.

Etiology.—We have no positive knowledge of any cause of this disease, but certain observations point to a possible connection with tuberculosis of other organs (brain, intestines, etc.), and more directly with the changes of tuberculous character occurring in the lymphatic ganglia (Jadassohn and others).

Pathology and Anatomy.—The signs of a moderate inflammation are found in the epidermis, the papillary and subpapillary layers of the cutis. Opinions differ whether the papillæ or the epidermis are the primary seat of the process. In the later stages the cutis was found in a state of atrophy, with an accumulation of pigment in the deeper portions as probably the most characteristic sign.

Diagnosis.—The diagnosis may be very difficult, and at times possible

only after longer observation. In the early stages the condition may greatly resemble eczema or psoriasis, in the later ones dermatitis exfoliativa.

Prognosis.—Some authors still maintain with F. Hebra the absolute incurability of the disease. But from other observations it must be admitted that cases which bore all the characteristic features of pityriasis rubra have taken a favorable course and have apparently been cured.

Treatment.—All treatment has proved unsatisfactory. In fact, no drugs have produced any beneficial results. Locally, warm baths and the application of mild ointments and oils (cod-liver oil) greatly relieve the disagreeable sensation of the patients, particularly in the later stages, the feeling of tightness of the skin. The patient must be carefully protected against the influence of cold.

DERMATITIS EXFOLIATIVA EPIDEMICA (SAVILL). (HERMANN G. KLOTZ, M. D.)

Definition.—An epidemic universal dermatitis, beginning with erythematous blotches, papules, or vesicles, but always resulting in desquamation, usually accompanied by constitutional disturbance and running a more or less defined course of from seven to eight weeks.

Symptoms.—This disease has been observed since 1891 in London in a number of public institutions sheltering large numbers of elderly people. Dr. Savill accurately described it in 1892. It occurs mostly in those advanced in life (average age, 64.8 years), and more in men than in women. Without any marked local or general symptoms the eruption begins in one or more localities, most frequently on the extremities, the face, or scalp, with diffuse erythematous or papular patches or with circumscribed, slightly raised red blotches similar to erythema nodosum, or with some small flat papules, or with minute vesicles which soon break and leave a moist surface. In some instances an isolated patch, spreading at the border and clearing in the center, gave a great resemblance to ringworm or to the reputed primary lesion of pityriasis rosea. After three to eight days there follows a stage of exudation and desquamation, lasting from three to eight weeks. By the confluence of the original patches a large portion of the entire body presents a crimson surface of thickened and indurated skin, continually shedding scales or flakes of epidermis of various sizes, two to three pints sometimes being collected in twenty-four hours. In the majority of the vesicular cases extensive exudation from the moist surface preceded the desquamation; in the minority the surface remained dry throughout, except occasionally slight moisture behind the ears or in the flexures of the joints.

General symptoms regularly accompanied this stage: loss of appetite and great prostration, usually without any rise of temperature except in consequence of complications (boils, etc.). Burning and itching were ordinarily quite severe, largely disturbing sleep. Tremor and twitching of the muscles and labored respiration without physical signs in the lungs were rather ominous symptoms. After a certain time the inflammation subsided, the skin still remaining thickened, with a brown polished appearance, sometimes with painful fissures. The hair and the nails were invariably lost, and did not grow again for several months. The skin slowly resumed its normal suppleness and color. Conjunctivitis was almost invariably observed. Relapses were a common feature, as many as nine having been observed in one case. When the disease ended in recovery, which was quite slow, the patients remained weak for some time afterward. Aggravated symptoms from the

alimentary tract, albuminuria (in about 50 per cent. of the cases), weakness of the heart, lung troubles, or the marasmus brought on a fatal result in about one-tenth of the cases.

Etiology.—The epidemics occurred mostly in warm weather (July and August), and affected mainly the old and infirm inmates of large institutions. Many circumstances point to the infectious character of the disease; the probability of personal contagion from patient to patient, once the disease is introduced, cannot be denied. Diplococci have been found independently by different observers, but their pathogenic properties need further investigation. In some London institutions (Bethnal Green, according to a report of the Local Government Board) circumstances strongly pointed to the milk-supply as having certain relationship to the outbreak of the disease.

Anatomy and Pathology.—A peculiar condition of the nuclei of the prickle-cell layer of the epidermis (Unna's "peridiaphania;" Piffard) seems to give to the disease the stamp of a new and original form of superficial inflammation of the integument.

Diagnosis.—The disease resembles chronic eczema in its moist and dermatitis exfoliativa universalis in its dry forms, and at certain stages it may be difficult to exclude either. The rapid development, the definite course of from six to eight weeks, the intense constitutional disturbance usually observed from the start, more than the immediate condition of the skin itself, will lead to the diagnosis even in sporadic cases, and much more readily during an epidemic. Rubeola, erysipelas, and scarlatiniform erythema may be suspected in the early stages, or ringworm where a distinct primary patch marks the initial stage.

Prognosis.—The disease is quite a severe one. Savill reports a mortality of 12.8 per cent. in 163 patients, and of 22 per cent. for the males alone. Other and later epidemics have shown a milder character. The advanced age of most of the patients partly accounts for the high mortality. Those who recover often remain weak for some time.

Treatment.—No internal medication has proved of any value. Stimulants were often necessary, sometimes in large quantities. Locally only amelioration can be effected. The irritation was best relieved by warm soda baths and bland emollient ointments or lotions, particularly by creolin (1 per cent. lotion or ointments or baths). In several cases the isolation of the primary patch by the free application of collodion was found to check the progress of the eruption.

DERMATITIS EXFOLIATIVA NEONATORUM. (HERMANN G. KLOTZ, M. D.)

Definition.—An acute inflammation of the skin occurring exclusively in the new-born, very pernicious and probably infectious, causing intense redness and the detachment of the epidermis in a various degree over a large area or over the entire body.

Symptoms.—This disease has been carefully described by Prof. Ritter of Prague, whose name it is intimately connected with. He observed a large number of cases in a foundling asylum, and it is in public institutions of a similar character that the disease is most frequently met with. A few cases have been observed in this country. The disease begins within the first days of life, not later than the second week. The first symptom is the sudden appearance of redness, mostly on the lower part of the face around the mouth, which gradually spreads to the adjoining parts, or starts from new places and becomes universal within a short time, attacking the extremities

last. In mild cases the redness is followed by a fine bran-like desquamation. The corners of the mouth, of the nares, and the eyelids are particularly affected, and not rarely show fissures. On the adjoining mucous membranes exfoliation of the epithelium, and sometimes bullæ, are observed. Usually, after one or two weeks desquamation stops and the skin assumes the natural smooth and pliable condition. Only cachectic children die at this stage. In more aggravated cases the epidermis becomes detached over large areas, usually in the face, on the trunk, and on the extremities, resembling severe burns. This thin cover is movable and is easily torn, leaving a moist surface. A regeneration may take place in these cases, but in the most severe forms, which invariably end fatally, the epidermis is entirely lifted off into flaccid bullæ similar to those of pemphigus. Fever and other general symptoms are usually absent; nevertheless, a large number of the children affected succumb to marasmus. Furunculosis, abscesses, and phlegmonous processes are not uncommon sequelæ.

Etiology.—Little is known in regard to the causes of the disease.

Pathology and Anatomy.—Many circumstances point to its infectious nature. Ritter and others consider it a pyemic infection. A fungus has been found by Riehl, but its connection with the disease has not been proven. Kaposi and others look upon the disease only as an abnormal development of the physiological desquamation of the epidermis occurring in the new-born. The microscope does not show anything special besides the usual conditions of dermatitis.

Diagnosis.—Considering the age of the patients, the rapid and extensive spreading of the affection will easily allow to distinguish it from eczema, and, together with the absence of fever, from erysipelas. Other similar diseases, like pityriasis rubra, do not occur at so early an age. Pemphigus acutus, however, a disease not unusual in the new-born, may closely resemble dermatitis exfoliativa whenever the bullæ become large and confluent, but ordinarily the skin in pemphigus will lack the redness and show discrete bullæ surrounded by normal skin.

Prognosis.—The prognosis is bad, particularly for the weak, poorly-nourished children, and more so in public institutions; the usual mortality is about 50 per cent. Some children remain weak for a long period, and some succumb later on to phlegmonous processes and other complications. Milder cases usually recover without any bad sequelæ.

Treatment.—No means are known to effectually interfere with the progress of the disease. In the face of the great tendency to marasmus proper nourishment is the most important point. As a protection against the loss of their natural heat the patients should be rubbed with oil (cod-liver oil) and covered with cotton. Washing with antiseptic solutions (boric acid, resorcin, or ichthyol) is indicated as a prophylactic if not a curative measure.

PARAKERATOSIS VARIEGATA. (HERMANN G. KLOTZ, M. D.)

Under this name two cases of a peculiar epidermal affection have been reported by Unna in collaboration with Pollitzer and Santi. An irregular network of slightly raised but sharply defined efflorescences covered the greater part of the body, leaving small irregular patches of sound skin between its meshes. A fine lamellar desquamation was present; the skin underneath had a waxy, reddish hue. The affection had some resemblance to lichen ruber planus, and did not cause any itching or other symptoms.

Anatomically, the conditions of a very mild superficial dermatitis were

found. Both cases proved very rebellious to treatment, but were finally cured by persistent application of pryogallol.

URTICARIA. (HERMANN G. KLOTZ, M. D.)

Definition.—In a general way the name of urticaria is applied to eruptions of certain cutaneous lesions known as wheals. The wheal, however, like other primary lesions of the skin, as the papule, the vesicle, etc., is apt to appear as a symptom of quite different, often heterogeneous, conditions. In a restricted sense urticaria signifies a more definite disease, characterized by the habitual disposition of the skin, under the influence of certain known or unknown irritations, to produce eruptions of wheals (cnidosis of some authors).

Symptoms.—The cutaneous lesions of urticaria are almost always uniform in character. Their prototype, from which the disease derives its name, is the condition produced by the contact with the skin of the leaves of a plant, *urtica urens*, the common nettle. The first change noticeable is a diffuse red spot, which rapidly spreads, while the center begins to swell, forming a circumscribed flat elevation, smooth, but firm to the touch. This portion soon changes its red color into a light rose, pink, or white, while the outer zone retains a deeper shade of red. A slight minute depression or a dark red point often marks the center of the lesions. These usually are round or oval and of different size. They may remain red, small, and isolated (*urticaria maculosa*), or may spread and coalesce into irregularly shaped and variously sized patches (*urticaria gyrata, circinata, figurata*, etc.). Where the patches run together into large connecting areas we speak of *urticaria conferta*. In some rather rare instances the wheals attain extraordinary size and elevation, up to three or four inches in diameter—the so-called *giant urticaria* (*urticaria gigas* or *tuberosa*.) When the central portions appear particularly white and firm, resembling unglazed china, the condition has been named *urticaria porcellanea*. Around the eyes and on the prepuce and penis, and on other places where large quantities of lax connective tissue are underlying the skin, the eruption of wheals is often accompanied by considerable diffuse edema, sometimes resembling erysipelas or other various conditions (*urticaria oedematosa*).

The eruptions of urticaria are invariably accompanied by severe burning and itching, sometimes by fever of short duration. The itching is the most aggravating feature, particularly on certain localities like the palms and soles.

The wheals, as a rule, are very short-lived lesions. They appear quite rapidly, sometimes cropping up under your eyes within a few minutes or even seconds, and disappear just as quickly after a short duration, rarely exceeding several hours, usually without leaving behind any trace. Only in rare instances the uncomplicated wheals may persist for one or several days as smooth, firm, whitish nodules (*urticaria perstans*), to vanish completely or leaving a more or less distinct pigmentation, which must not be confounded with *urticaria pigmentosa*. Less ephemeral are the irregular and complicated rare forms of *urticaria hemorrhagica, vesiculosa, and bullosa*. In the former a dark-red spot, due to the extravasation of blood, occupies the central portion of the wheal, which but slowly passes away and leaves considerable pigmentation. In the latter varieties the epidermis is raised by the rapid exudation over the center or over the larger part of the wheal into a vesicle or bulla with clear contents. Excoriations, due to scratching, are rarely

missed in these more lasting forms, and by infection often become transformed into pustules.

Urticaria papulosa, or *lichen urticatus*, a not infrequent variety observed almost exclusively in young children, deserves particular notice. The rather firm wheals, which often bear a small vesicle, disappear, as usual, after a few hours, leaving hard papules the size of a millet- or hemp-seed, of a yellowish-brown color bearing a small dry crust. The papules may last for days, and successive crops may perpetuate the condition for weeks. The usual seats are the buttocks, the lower, and less frequently the upper, extremities, and the back. The children are usually poorly nourished, anemic, and, owing to the constant itching and disturbed sleep, nervous and fretful.

During an attack of urticaria, in acute as well as in chronic cases, it can almost regularly be observed that the slightest mechanical irritation of the skin—touching with the point of a pencil or of a match, slight scratching with the finger-nail—will provoke a new outbreak of wheals exactly over the irritated portions in no way differing from the voluntary lesions (*urticaria factitia*). This condition must not be completely identified with what has been called *dermographism* or *autographism* by French authors. This is the disposition of certain individuals, mostly of abnormal nervous conditions, to reproduce on the skin, by the formation of pink or white elevations with a pink zone, any design drawn with some blunt point, even under very slight pressure. These lesions resemble wheals, but lack the essential symptoms of itching or burning or other sensations.

The eruption of wheals may occur on any part of the body, including the scalp. The single wheals may appear isolated or in groups, disseminated over the entire body or only over parts. On the extremities they show a preference for the extensor surfaces. They are rarely strictly symmetrical, but may appear simultaneously on both sides of the body. The mucous membranes, particularly that of the oral cavity, the tongue, the pharynx, and larynx, may participate in the development of wheals, occasionally with sudden and extensive edema of the latter parts, which may seriously interfere with the respiration and require immediate surgical interference. No age or sex is exempt from urticarial attacks; children, however, furnish the large majority of patients.

The single eruption of wheals, with the exceptions noted above, invariably runs an acute course. Even in the more persistent forms the redness and swelling disappear, leaving only the results of the exudation to prolong the existence of the lesions. As a cutaneous lesion chronic urticaria does not exist. We speak of acute and chronic urticaria only in reference to the number of successive attacks in a single case and to the time over which they extend. In this sense *acute urticaria* comprises those cases in which the eruption of wheals takes place more as an accident or as a passing event, coming on suddenly, exhausting itself with a single crop or with a limited number, extending over several days, a week, or even longer. In *chronic urticaria* (called also habitual and sometimes, incorrectly, *urticaria perstans*) the development of wheal-rashes may extend over months and years, or with more or less pronounced intermissions may last for life. The frequency and intensity of the attacks widely vary, principally depending upon the etiological factors.

Etiology.—A certain predisposition is always necessary to render an individual subject to even a passing attack of urticaria, although in a very different degree according to the exciting causes. But few people are immune against the sting of the nettle, many are affected by certain vegetable or animal

articles of food, while others and some drugs cause urticaria so exceptionally that the disposition has to be considered as a real idiosyncrasy.

1. **External Causes.**—The most common causes are the stings of some insects (mosquito, flea, and other parasites), the contact with some caterpillars and some sea-animals (jelly-fish) and some plants (nettle, oleander). In some of these instances there undoubtedly exists a mechanical traumatic effect from the sting or from fine hairs, but usually some chemical substance or action (electric needle) is connected with the trauma. Some drugs, if reduced to a very fine dust, may directly cause urticaria. There we have really to do with dermatitis venenata; indeed, according to J. C. White, urticaria is a very frequent form of this disease. Exposure to low or high temperatures or the change from one to the other frequently causes the eruption of wheals.

2. **Ingestion of Drugs or Articles of Food.**—Where urticaria is due to the ingestion of certain drugs it really represents one of the common forms of dermatitis medicamentosa or drug-eruption. Quinine, opium and morphine, cubebs, copaiba, valerian, are particularly liable to produce wheals. Where it appears in connection with the ingestion of certain kinds of food, it may also be due to the absorption of some chemical substance or indirectly to a disturbance of the stomach or other portions of the alimentary canal caused by the food, or to some unknown reflex nerve-influence. The most common among this class are certain kinds of fish and shellfish (lobsters, crabs, mussels, oysters), some kinds of meat (sausage, venison, salt pork, etc.), and particularly some fruits (strawberries, cantelopes, nuts), some kinds of wine, and others. It is not impossible that often beginning decomposition of the food and the subsequent formation of toxins may be the actual cause of irritation in such cases.

3. Urticaria often appears as a **symptom** of some acute organic disorders of the digestive and other important internal organs. In some instances it seems that the formation and absorption of the chemical products of fermentation are the direct cause, in others some nervous influences. Dyspepsia, acute and chronic indigestion, worms, constipation, diarrheal diseases, the bursting of hydatid cysts in the abdominal cavity, diseases of the kidneys and of the sexual organs, even menstruation and gravidity, spinal and cerebral affections of various kinds, and malaria, acute and chronic, are apt to be accompanied by urticaria. Gouty and rheumatic people furnish a large number of cases.

4. **Atmospheric and weather influences** seem to be responsible for those cases which accumulate at certain seasons, mostly spring and autumn, without any apparent causes; they are closely related and often actually belong to the class of erythema exudativum (erythema urticatum).

5. Urticaria occurs in the course of some **chronic skin-diseases** as a preliminary or secondary symptom; so in prurigo and urticaria pigmentosa, in dermatitis herpetiformis, and in occasional intercurrent outbreaks in eczema, pemphigus, etc.

6. There remain a number of cases, principally of chronic urticaria, in which it is impossible to find any direct cause, and where we have to assume a peculiar irritability of the nerve-center or of the cutaneous nerves themselves. In this class of cases the provoking causes are mostly those that can hardly be avoided, such as changes of temperature, pressure, or even close contact of clothing; mental and psychical conditions play an important part, often in the form of neurasthenia or hysteria.

Pathology and Anatomy.—The wheal is formed by a circumscribed edema of the deeper layers of the corium, due to a spasmodic contraction of

the blood-vessels, veins, or arteries, or both. According to Unna and others, a sudden spasm of the muscular coat of the veins prevents the outflow from the tissues of the lymph, which distends the lymph-spaces and may lead to effusion below or into the rete of a serous (urticaria bullosa) or bloody fluid (urticaria hæmorrhagica). Upon relaxation of the spasm the fluid is rapidly absorbed and redness and swelling disappear. If the spasm is prolonged, real cell-exudation may take place, sometimes perhaps more as a sequel of the scratching. We have no certain explanation of the intense itching. The cause of the spasm must be looked for in the vaso-motor nerves.

Diagnosis.—The wheals are so characteristic that they are easily recognized when they are present, but often the patient presents himself when they have disappeared. The history and the very evanescence of the lesions render their nature almost certain; the presence of scratch-marks, their grouping, and distribution are apt to confirm the diagnosis. Among the rarer forms, urticaria bullosa may be confounded with pemphigus, lichen urticatus with papular eczema or lichen, urticaria œdematosa with erysipelas.

Treatment.—The first aim must be the detection of the cause, which will easily suggest the steps to be taken, among the first being the removal of the cause. This alone will often be sufficient. In urticaria from the ingestion of food-articles an emetic or mild cathartic for the speedy removal of the offending substance will recommend itself; it is often the relief afforded by nature itself. A few days of dieting will restore the normal condition. Where urticaria is symptomatic of organic or other diseases, treatment must be directed against these ailments. Where a particular cause cannot be ascertained and in the erythematous cases moderate doses of salicylate of sodium have given me the most satisfactory results. The administration of a drug so dangerous and so extremely expensive as the muriate of pilocarpine does not seem justified in such trifling affections as common cases of urticaria. Chronic and habitual urticaria is often very rebellious and difficult to treat. Where the origin is not evident the general condition of the patient deserves the most careful consideration; not only the condition of his bodily health, but his diet, his way of dressing, social environments, business relations, have all to be taken into account. Changes of residence and climate, removal to the seashore or to the mountains, changes of occupation, removal from business or other sources of worry, combined with bathing and drinking cures in watering-places, will often prove useful. The clothing requires particular attention where the effects of temperature are evident. In anemic and poorly nourished patients tonic and strengthening treatment is indicated. Among the drugs which have been found to be effective may be mentioned the sulphate of atropine (in moderate doses from $\frac{1}{150}$ of a grain), gelsemium, salicylate of sodium and quinine, antipyrine, phenacetine, ergot, and particularly arsenic (Crocker). Jaborandi and pilocarpine, first recommended in 1880 by Pick, deserve a trial under proper precautions. The bromides, chloral, opium and morphine, cannabis india, and other nervines frequently fail to give relief.

Local Treatment.—Local treatment of the wheals would really not be necessary, as they tend to disappear voluntarily, if it was not for the itching and burning. Cold water often relieves, either alone or with alcohol, vinegar, citric acid (lemon-juice), carbolic acid, sometimes with alkalines as borax, ammonia, soda, etc. Soothing lotions, with sediments of zinc, etc., are often serviceable; menthol is a handy and often quite effective remedy. Dusting-powders and ointments are not very useful, as a rule, not even eamphor-chloral ointment. Baths with soda, salt, or the salts of potassium occa-

sionally give relief. Where the application is convenient the envelopment of the most affected parts with cotton, according to Jaquet's observations, may be tried to prevent the outbreaks of the wheals.

The more persistent forms of urticaria may require some local treatment for the removal of the exudation. In lichen urticatus of small children I have found the most effective remedy zinc ointment with 4 per cent. carbolic acid and $\frac{1}{10}$ to $\frac{1}{2}$ per cent. of corrosive sublimate of mercury (Uma's ointment against lichen).

URTICARIA PIGMENTOSA. (HERMANN G. KLOTZ, M. D.)

Definition.—A rare disease of early life, characterized by the formation of wheals, which do not disappear, but form flat, elevated, pigmented nodules of indefinite duration.

Symptoms.—The disease begins soon after birth, not later than six months, sometimes during intra-uterine life. Cases that have been reported as having started as late as the age of puberty are not free from doubts about their history or about their true nature. Some are probably cases of simple urticaria leaving pigmentation. The lesions, at first, do not differ from those of common urticaria; they appear rapidly, single or in groups, remain in this condition from several hours to a few days, and then vanish, leaving the spot pigmented. These same spots, mostly under the influence of rubbing or other irritation, may again raise into wheals and again flatten down, gradually turning into soft, flat papules of a more or less deep fawn or brown color, somewhat resembling those of xanthoma. They often increase in size, and two or more may coalesce. Successive new eruptions in intervals of a few days or longer continually add new lesions. They vary in size from a split pea to a quarter—are round, oval, or of irregular shape. They occupy the neck and shoulders, and later on the trunk and limbs, the face and head; rarely the palms and soles, now and then the mucous membranes of the palate, throat, and mouth. They may become so abundant, particularly on the trunk, that hardly a spot of sound skin remains. Occasionally bullæ with clear contents form upon the lesions and dry up within a few days. They are often observed during attacks of acute erythematous swelling and redness, extending into the healthy skin, which occur at intervals, mainly during the warm season, accompanied by severe itching. The new eruptions of wheals are usually preceded and accompanied by intense itching. When the disease is fully developed the patients present a peculiar appearance. They are almost entirely covered with more or less deeply pigmented flat spots or slightly raised nodules with the epidermidal cover apparently redundant and loose, forming wrinkles and folds, giving a velvety feeling. According to the prevalence of the flat or nodular forms, macular, nodular, and mixed urticaria pigmentosa have been distinguished.

The lesions for a long time retain the tendency to again be transformed into the original wheals on being scratched or rubbed. Sometimes the healthy skin remains unaffected; sometimes it shows urticaria factitia, but in a less pronounced manner than the nodules.

The formation of new lesions usually continues for about one year. During the following two to six years the erythematous attacks persist, but with increasing intervals with advancing age, and gradually cease toward the eighth or ninth year, when the pigmentations and the lesions themselves begin to disappear, at first on the face and extremities. Recent observations (Morrow and others) show that the peculiar irritability of the lesions may last much longer, through puberty into adult age.

Etiology.—Nothing is known of the origin and the pathogenesis of the disease. Anatomically, the lesions consist of aggregations of heaps of mast-cells surrounding the blood-vessels and the lymph-channels. The course and the permanent anatomical changes sufficiently distinguish urticaria pigmentosa from the ephemeral urticaria vulgaris. Fully developed, it shows such a characteristic appearance that it is easily recognized; the pigmented remnants of the urticaria perstans are of much shorter duration.

No kind of **treatment** has, so far, shown the slightest influence upon the disease; otherwise the prognosis is good, as the general health is not affected and final spontaneous disappearance is surely to be expected.

ANGIONEUROTIC EDEMA. (HERMANN G. KLOTZ, M. D.)

Definition.—This disease was first described in 1882 by Quinke, and has since been observed by many others. It is characterized by the sudden appearance of circumscribed swellings of the cutis and the subcutaneous cellular tissue, which tend to disappear after some time without leaving any change. Similar conditions may occur on the mucous membranes.

Symptoms.—Slight prodromal, mostly gastric, symptoms may precede the eruptions. The swellings, mostly confined to the face, the genitals, and to the extremities, are well defined, sometimes more or less red, sometimes of a waxy appearance, of various sizes, from an egg to the palm of a hand or larger. The epidermis is smooth, slightly lustrous. There is usually no pain, no burning or itching in the affected parts, only the sensation of tension or tightness; rarely the temperature is somewhat elevated. The swellings generally remain stationary from a few hours to one or two days, and then rapidly disappear; but new ones may follow on adjoining or on distant parts of the body, pursuing the same course, and may prolong the disease indefinitely. Even after the eruptions have ceased for a more or less long period, relapses may occur, usually occupying the same parts attacked before. On the mucous membranes of the mouth, including the tongue, the pharynx, and the larynx, the intumescence of the cellular tissues may assume dimensions which may interfere with speaking, swallowing, or even with respiration, and may promptly require surgical interference—scarification and even tracheotomy. Otherwise the health of the patients is not much affected; only the invasion of the stomach may cause some distress and form the principal feature of the disease.

Etiology.—Although children and very old people are not entirely exempt from this disease, adults furnish most of the cases. Heredity seems to play a certain part, the disease having been observed in several, even five, generations of one family. In other instances gastro-intestinal disturbances seemed to have some connection with the attacks; in others the ingestion of certain foods, as in urticaria; malaria was the cause in one case, the swelling recurring with the regularity of intermittent fever.

Pathology and Anatomy.—Angioneurotic edema must be considered a vaso-motor neurosis, like urticaria, to which it bears close resemblance, lacking, however, the itching and other sensory symptoms.

Diagnosis.—The circumscribed area and the evanescent nature of this edema render it easily distinguishable from other forms of edema; on pressure no pitting and only a short-lived depression are noticed. Other rare forms of acute edema, like the arthritic and menstrual one, the persistent œdema durum of Riehl, and the symptomatic inflammatory edema, have to be considered in differentiation.

Prognosis.—Except the dangers mentioned as accompanying the affection of the mucous membranes, angioneurotic edema is a harmless disease; its tendency to relapses must not be overlooked.

Treatment.—Almost all remedies recommended for urticaria have been tried in this disease, generally without any decided effect. Where intestinal troubles and malaria seemed to cause the attacks, they ceased after appropriate treatment. Atropine, ergot, the bromides, etc. have given but little relief; better results have been obtained from salicylate of sodium and from subcutaneous injections of pilocarpine murat. (gr. $\frac{1}{20}$ to $\frac{1}{4}$).

LICHEN RUBER. (M. B. HARTZELL, M. D.)

Synonym.—Lichen ruber acuminatus.

Definition.—Lichen ruber is a chronic inflammatory disease of the skin, characterized by the formation of milletseed- to pinhead-sized, red or violaceous, solid, acuminate papules, having a thin whitish epidermic scale upon their summits. At first discrete, these lesions in the later stages of the affection unite to form variously-sized, dark-red, thickened, scaly patches having a rough, grater-like surface.

The malady was first described by Hebra, who called it lichen ruber because the essential feature of the eruption is a red papule, which remains such throughout the entire course of the disease. Later, Kaposi proposed to call it lichen ruber acuminatus, to distinguish it from the disease first described by Erasmus Wilson under the name lichen planus, this latter being, in the opinion of Kaposi (and other writers), but a variety of Hebra's lichen ruber, which he calls lichen ruber planus. This same author, at the International Congress of Dermatology held at Paris in 1889, declared also that the disease known as pityriasis rubra pilaris, first described by Devergie under the name pityriasis pilaris, and, like lichen ruber, characterized by an eruption of scaly papules, is nothing more than the lichen ruber of Hebra, or, as he prefers to call it, lichen ruber acuminatus; and this opinion he has maintained in more recent publications. On the other hand, Besnier and other equally eminent French dermatologists, who have had special opportunities to study the disease, hold Kaposi's view to be erroneous, denying the identity of the two diseases. Thus it is evident that dermatologists are far from being in complete accord as to what forms of disease should be included under the term lichen ruber; and, notwithstanding the numerous and elaborate discussions which have taken place during the past decade, the so-called "lichen question" bids fair to afford abundant material for discussion for some time to come. Whether lichen ruber and lichen planus are to be regarded as distinct affections or but parts of one process is of little practical importance for us, since the former disease is rarely if ever met with in America, most of the cases which have been reported as such being, in all probability, examples of pityriasis rubra pilaris. This last malady, notwithstanding Kaposi's assertion to the contrary, is probably distinct from Hebra's lichen ruber. In this article, therefore, we shall treat lichen ruber, lichen planus, and pityriasis rubra pilaris as three separate affections—without desiring, however, to deny the possible identity of the first two—believing that confusion will be thus avoided.

Symptoms.—Lichen ruber usually begins somewhat acutely, without constitutional symptoms, with the appearance of discrete pinhead-sized, conical, firm papules covered with thin adherent scales of a red or reddish-brown hue, scattered over the entire body or, as occurs in some cases, limited

to the flexures of the joints. After their first appearance they do not undergo any further change, but remain papules throughout the entire course of the disease. New crops appear from time to time between the old ones, so that in the course of weeks or months variously-sized, more or less circumscribed, dull-red, thickened patches, covered with white scales, are formed, not through the enlargement and coalescence of the lesions, but through their close crowding together. In these patches the papular character of the disease may be completely obscured by the crowding together of the papules, but at their margins new, discrete, characteristic lesions are to be found. New areas of skin are constantly invaded; the old patches enlarge through the springing up of new papules at their edges, so that finally the entire cutaneous surface may be covered by the eruption. When the disease reaches this advanced stage of universal distribution the face is dry, red, and covered with thin scales, the lower eyelids everted; the skin of the trunk and extremities is markedly thickened, dark-red in color, dry and rough, and covered with abundant white or grayish papery scales. In this dry and thickened condition of the skin the movements of the joints may be interfered with to a considerable degree, and this hindrance to movement may be increased through the formation of fissures about the joint which are often quite deep and painful. The greatest amount of thickening is seen upon the palms and soles, which are covered with thick mass of epidermis, and deep transverse fissures extend through these about the joints of the fingers and toes; in consequence of these fissures movements of flexion and extension are painful and the fingers are maintained in a semi-flexed position. The nails of the fingers and toes are likewise involved in the morbid process, being thickened, yellowish or brownish in color, lustreless and brittle, their free margins ragged and broken off. The hair of the scalp and beard becomes thinned, but is not entirely lost. In the early stages of the disease the itching is usually trifling, but in the more advanced stages, when the greater part of the body is covered by the eruption, the itching may be much more troublesome, interfering with the patient's sleep. In the beginning the general health is not interfered with, but as the disease advances and large areas of skin become involved, emaciation, associated with chilliness and loss of appetite, appears; the patient falls into a marasmic state which finally ends in death, or some intercurrent affection hastens the fatal issue. Not all cases, however, are of such severity: the eruption may be limited in extent, being composed of a few thickened, scaly patches seated on the trunk or extremities. In cases of such limited extent the general health is not involved. In the milder cases the face may escape altogether or be only slightly scaly, and thickening of the palms and soles, such as has been described above, with the formation of painful rhagades, is only seen in severe cases. Patches about the joints usually present an elongated oval shape, and, owing to the thickened condition of the skin, they are deeply furrowed by the greatly exaggerated normal lines.

Etiology.—The causes of lichen ruber are as yet completely unknown. In most of the cases reported the patients were in excellent general health previous to the appearance of the malady. Neither age nor sex plays any decided rôle in the causation. Kaposi reports a case occurring as early as the eighth month of life, and two cases as late as seventy years. As to sex, the majority of cases have occurred in males. There is no evidence that heredity plays any part in its production. Lassar reports having found a minute bacillus in the lesions, but this finding has not been confirmed by other observers.

Pathology and Pathological Anatomy.—The pathology is scarcely better known than the etiology. Pathologically, the disease is an inflammation having its seat in and around the hair-follicles. According to Kaposi, there is a hyperplasia of the cells of the external root-sheath in the deeper parts of the hair-shaft, with consequent distention of the follicle, cellular infiltration of the papillæ about the margin of the papule, and hyperplasia of the overlying epidermis. Robinson, who has also studied the anatomy of the malady, does not regard the changes found as inflammatory, but the result of a parakeratosis; he believes that the primary changes occur in the corneous layer, and, owing to an anomaly in the process of cornification, the corneous cells accumulate, and by their pressure upon the tissues beneath produce the changes found in the rete and corium. The changes above described are not peculiar, however, to lichen ruber, but are to be found in other inflammatory diseases accompanied by hyperkeratosis. Doubtless much of the confusion which exists concerning the pathological anatomy is due to the failure to separate lichen ruber from lichen planus.

Diagnosis.—Lichen ruber is to be distinguished from eczema, from psoriasis, and from pityriasis rubra pilaris. In the early stages, while the lesions are still discrete, it might be mistaken for a papular eczema, but it differs from this malady in the more acuminate shape and greater solidity of the papules, the presence of the scale which surmounts their apices, and in the fact that the papules of lichen do not undergo any further development after their first appearance, while those of eczema are apt to be transformed into vesicles or be associated with such lesions; and the itching in eczema is usually much more severe than in lichen. A certain resemblance may exist between the lesions of guttate psoriasis and the discrete papules of lichen, but the former are not acuminate and solid, are covered with abundant scale from the moment of their appearance, and undergo more or less enlargement. The distinction between the advanced stage of lichen ruber and universal psoriasis is much more difficult; but in the former the skin is greatly thickened, much more so than in psoriasis, and this thickening is specially noticeable upon the palms and soles, localities rarely affected by the latter. Patches of lichen are to be distinguished from patches of chronic squamous eczema with thickening by the usually mild character of itching, the absence of moisture, and the presence of characteristic papules about the margin of the patch. From pityriasis rubra pilaris it differs in producing a much greater amount of thickening of the skin, in the limitation of the papules to the orifices of the follicles, in being accompanied by itching in many instances severe, and, lastly, in being associated with grave constitutional disturbance.

Prognosis.—Prior to the employment of arsenic all the cases which Hebra saw terminated fatally, but since the use of this drug the prognosis has become much more favorable. In cases of limited distribution the general health suffers but little, and a cure within a reasonable period may be looked for; in advanced cases, in which the greater part of the skin is involved, with constitutional disturbance, the prognosis is much more grave, and unless vigorous treatment is instituted before serious exhaustion has occurred the disease will probably end in death.

Treatment.—Arsenic is the one internal remedy of value in the treatment of lichen ruber, Kaposi asserting that all cases are curable with it except the generalized ones with a high degree of marasmus. It may be administered as Fowler's solution, beginning with a dose of five drops and gradually increasing it until the limit of tolerance is reached, or pills of arsenious acid may be given, beginning with one-twentieth of a grain. Liquor

sodii arseniatis, which is supposed by some to be less irritating to the gastrointestinal canal than other forms of arsenic, may be employed in the same manner as Fowler's solution. If it seems desirable to produce a speedy effect, these last-mentioned solutions may be used hypodermically, but, as these injections are quite painful, it is better in ordinary cases to rely upon the administration of the drug by the mouth. Considerable quantities of arsenic are usually required to produce a cure, Kaposi reporting an instance in which 4500 Asiatic pills, each containing one-twelfth grain of arsenious acid, were taken during a course of treatment lasting two years. Cod-liver oil by its effect upon the general nutrition is also of service.

For the relief of the itching, which is oftentimes severe, carbolic acid may be applied locally, either as an ointment, in the strength of ten to fifteen grains to the ounce, or as a lotion, one or two drams to the pint of water. Menthol may also be used for allaying the pruritus, preferably as an ointment of the strength of ten to fifteen grains to the ounce. Alkaline baths or those containing bran are useful to relieve the harshness and dryness of the skin; it is always best to follow such baths with the inunction of some bland fat. Crocker recommends an ointment of pyrogallol, a half dram to the ounce of ointment; care must be taken not to apply this ointment to too large an area, since serious systemic intoxication may result from neglect of this precaution. Salicylic acid in ointment, ten to twenty grains to the ounce, is likewise useful for the removal of the scales and the relief of the itching.

LICHEN PLANUS. (M. B. HARTZELL, M. D.)

Synonym.—Lichen ruber planus.

Definition.—Lichen planus is an inflammatory disease of the skin characterized by an eruption of bright-red, yellowish-red, or violaceous solid, angular papules with flat glazed tops and, in many instances, an umbilicated center. It may be either acute or chronic, usually the latter, and may be limited to a few localities or may extend over the greater part of the skin. The lesions occur either discretely or in patches of various sizes, both forms of arrangement being commonly present in the same case.

The affection was first described in 1869 by Erasmus Wilson, who believed it to be identical with the lichen ruber of Hebra—a view since maintained by Kaposi, Neisser, and others. On the other hand, Robinson, from a careful and thorough microscopical study of the lesions of the two diseases, concludes that they are in no way related; and Crocker, who formerly regarded it as a variety of lichen ruber, more recently inclines to the opinion that it is an independent disease.

Symptoms.—It begins with the appearance of minute polygonal, bright-red, or yellowish-red papules with flat shining tops, many of which show a shallow depression in the center. As the lesions grow older they usually become darker in color, being often of a deep dull-red or violaceous hue, and, although smooth at first, they later become covered with a thin adherent scale of epidermis. When examined closely the tops of the papules show minute puncta and striae, a feature to which Wickham has recently again called attention as possessing decided value from a diagnostic point of view, being, in his opinion, pathognomonic of the disease. At first discrete, they usually in time form variously sized, circumscribed patches through the appearance of new papules between the old ones, the patches being of a dark-red or purplish color, elevated considerably above the surrounding healthy skin and covered with small white, adherent scales. In many cases the

eruption shows a marked tendency to arrange itself in lines or streaks in the long diameter of the limbs; on the trunk it often occurs in eurved lines or segments of a circle. While, as a rule, it tends to appear symmetrically, it is sometimes confined to one side of the body, and in rare instances it is limited to the distribution of a definite nerve-trunk. As an example of this last reference may be made to a case recently under the author's observation in which the eruption was distributed over the posterior surface of the right lower extremity, following the branches of the great sciatic nerve. As the lesions undergo involution atrophic areas are left, or patches of pigmentation, varying in color from light brown to almost black, which may last for many months.

The localities most commonly affected are, in order of frequency, the flexor surfaces of the wrists and forearms, the anterior surfaces of the knees and the legs; but no part of the skin is exempt. The eruption may be limited to a single region, and consist of but a single patch, or it may be general in its distribution, covering at times the greater part of the body. The mucous membranes may likewise, in exceptional cases, be implicated, the eruption appearing upon the tongue and the mucous surfaces of the cheeks. Upon the tongue it is apt to be arranged symmetrically upon both sides of the median line, or it may occupy the posterior and central part of this organ. When the mucous membrane of the cheeks is affected the parts between the teeth are the localities involved. The lesions upon the mucous membranes differ in appearance from those upon the skin, owing to the constant moisture of the parts; they are less elevated and are white in color. Upon the glans penis, which is not infrequently affected, they are either pale red or white, depending upon whether the prepuce is habitually retracted or not.

As the eruption sometimes occurs upon the mucous membranes before it appears upon the skin, the real nature of the lesions in this situation may not be at once apparent, and may remain doubtful until the disease appears upon the skin.

When the patches have remained a long time without treatment they may assume a thickened, verrucose aspect, the papillæ being greatly enlarged and covered with abundant scales; this condition is most apt to be seen upon the legs, although not confined to this region; and has been designated *lichen planus verrucosus*.

Although the papules of lichen remain papules throughout the entire course of the disease, in rare cases vesicles and blebs may accompany them, cases of this complication having been reported by Kaposi, Unna, and more recently by Leredde.

In a remarkable case reported by Kaposi the papules were arranged in thick bands like rows of beads in the flexures of the limbs and upon the abdomen, and Rona has reported a similar case; to this form the name of *lichen moniliformis* has been given.

Crocker mentions having seen two cases of an unusual form in which the papules, instead of being hard and firm to the touch, were very soft and of a deep crimson hue, looking like an erythema, and like it disappearing temporarily under pressure.

Unlike *lichen ruber*, the hair and nails are never involved in the morbid process, but preserve their normal aspect, even in the most advanced cases. Itching usually accompanies the disease; in most cases it is of a mild type, and may even be entirely wanting, but occasionally it is extremely severe.

Although occurring in children, it is rare, and differs but little or not at

all from the form seen in the adult. Crocker, however, calls attention to a variety seen in infants which presents some peculiarities in development and course: the lesions appear in groups acutely, and are sometimes acuminate at first and afterward become flattened. Under soothing applications the eruption usually disappears in a few weeks. This infantile form is seen most frequently in infants who sweat excessively.

Etiology.—Although the causes of lichen planus are not yet clearly understood, there is good reason to believe that it is in some way dependent upon disturbance of the nervous system. In many cases the patient suffers from nervous exhaustion, brought about, it may be, by worry or over-work; in some instances, as has already been mentioned, the eruption follows the course of a nerve-trunk, and cases have been reported in which the disease followed injury to a nerve. Age seems to exert some influence upon the occurrence of the malady, since it is usually found between the ages of twenty and fifty, being infrequent in childhood, although not unknown at quite an early age. Sex is apparently without influence, since it occurs with almost equal frequency in males and females.

Pathology.—Lichen planus is an inflammatory process, having its seat

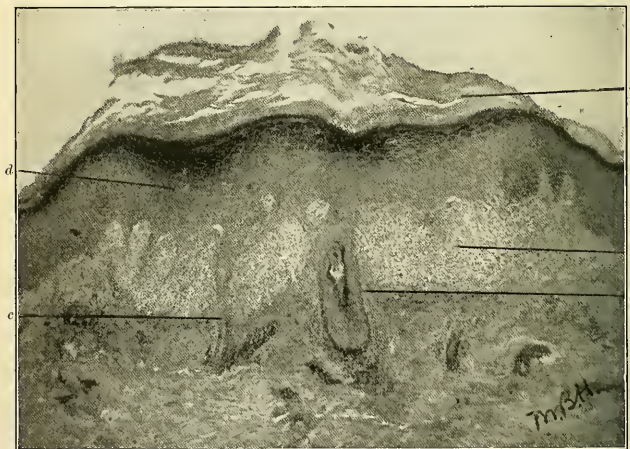


FIG. 241.—Section of a papule of lichen planus: *a*, round-celled infiltration; *b*, hair-follicle; *c*, sweat-duct; *d*, thickened rete mucosum; *e*, thickened corneal layer.

in the papillæ and the upper part of the corium, frequently, if not always, about a sweat-duct. The pathological anatomy has been studied by a number of observers, among whom may be mentioned Kaposi, Robinson, Crocker, Török, and Unna, who agree in the main as to the tissue-changes which occur, but differ somewhat as to the interpretation of them. These changes are found both in the epidermis and the corium, and vary considerably according to the age and character of the lesion examined. In the epidermis, according to Unna, there is first an acanthosis, which later is replaced by atrophy, together with hyperkeratosis, intercellular edema, and colloid degeneration of the prickle-cells. In the corium the papillary body

is densely infiltrated with small round-cells, the cell-mass being sharply circumscribed on its lower margin (Fig. 241). This infiltration consists, for the most part, of connective-tissue cells which extend in all directions along the blood-vessels. The papillæ are pear-shaped and edematous, and the interpapillary prolongations are almost completely obliterated. Through the resorption and hyaline degeneration of the cellular infiltrate there result atrophic depressions at the site of the lichen papules. The sweat-glands are likewise usually involved in the morbid process; there is dilatation of their lumen, with occasional cyst-formation and proliferation of the connective-tissue cells around the gland and the duct. The mouth of the duct is usually filled with proliferating epithelium, forming small horny masses which, falling out, leave a central depression. The histological changes are sufficient to account for the clinical features presented by the lichen papule.

Diagnosis.—The flat, angular, dark-red papules with glazed tops and central umbilication are so characteristic of lichen planus that, with ordinary care, a mistake in diagnosis can hardly happen. It is only when the papules are closely crowded together, forming patches, that error might occur: the patches might be mistaken for chronic squamous eczema or for psoriasis. From the former they are to be distinguished by their violaceous color, by the absence of moisture at any time in their course, and, above all, by the presence of characteristic papules about the margin of the patches. From psoriasis it differs by the absence of scales in its early stages, the dark-red color of the patches, and the comparatively small amount of scales.

Prognosis.—The prognosis is always favorable, since recovery takes place under proper management, even in the most advanced cases. Although the eruption may occupy the greater part of the cutaneous surface, the general health is little or not at all affected.

Treatment.—Since in many cases of lichen planus the nervous system seems to be at fault, such internal remedies should be administered as tend to restore it to its normal condition: quinine, arsenic, cod-liver oil, iron, phosphorus, will frequently be of decided use. As directly influencing the eruption, arsenic may be given, beginning with five minims of Fowler's solution or one-thirtieth of a grain of arsenious acid, and increasing the dose, if necessary, until some decided effect is manifest. In case arsenic is not well borne, as sometimes happens, or fails to favorably influence the disease, bichloride of mercury may be tried, as suggested by Liveing, or alkaline diuretics, as recommended by the late Tilbury Fox and later by Robinson. Crocker has found large doses of quinine succeed well in acute cases with a widely distributed eruption. Fifteen-grain doses of chlorate of potash, followed in a quarter of an hour by twenty minims of dilute nitric acid, have been advised as useful by Taylor and Boeck.

In addition to the employment of some one of the above-mentioned remedies, attention must be paid to the patient's hygienic surroundings and to his nutrition: good, nutritious, easily digested food should be taken in as large quantities as can be properly assimilated. In cases in which the nervous system has been greatly overtaxed rest and change of scene are of the greatest benefit.

The local treatment is just as important as the internal; perhaps more so. Vidal found baths of starch, containing one liter of vinegar to the bath, of use in allaying the itching; he also recommended inunctions with glycerole of starch containing twenty-four grains of tartaric acid to the ounce. Tar in ointment, one or two drams to the ounce, and oil of cade, pure or diluted with an equal quantity of olive oil or fluid cosmoline, are oftentimes useful;

but they must be used with discrimination, since they do not answer equally well in all cases: where there is marked hyperemia they should not be employed at all, or only with care, well diluted. Among the preparations of tar Crocker prefers the liquor carbonis detergens, used as a lotion in the strength of from ten minims to one dram to the ounce of water. The ointment recommended by Unna—one part of corrosive sublimate, twenty parts carbolic acid, five hundred parts ointment of oxide of zinc—is a valuable application. Other useful local remedies are— β -naphthol, ten to thirty grains to the ounce of ointment; salicylic acid, ten to twenty grains to the ounce of alcohol and water, or in an ointment, twenty or thirty grains to the ounce. When itching is marked, menthol as an ointment, in the strength of ten to fifteen grains to the ounce, will often afford marked relief; thymol also, employed in the same strength, is useful. In thickened verrucose patches, which are often very rebellious to all forms of treatment, a plaster of salicylic acid, 10 to 20 per cent. in strength, is sometimes efficacious; the use of such plaster may be followed, as Crocker recommends, by thorough applications of pure oil of cade, well rubbed in, or the oil of cade may be combined with tr. saponis viridis in the proportion of one or two drams of the former to an ounce of the latter, and thoroughly rubbed in with a piece of flannel. Ointments of chrysarobin or of pyrogallol (ten to twenty grains to the ounce) may be used with success in the verrucose forms, care being taken when using the latter not to apply it to too large a surface, lest toxic symptoms be produced.

LICHEN SCROFULOSORUM. (M. B. HARTZELL, M. D.)

Synonym.—Lichen scrofulosus.

Definition.—Lichen scrofulosorum is a chronic inflammatory disease of the skin, characterized by an eruption of pinhead-sized, moderately firm, pale-red or yellowish-red papules, usually arranged in groups, sometimes in circles or segments of a circle.

Symptoms.—The disease begins with the appearance of bright-red, discrete papules in rounded groups, which after a time show a small scale upon their tops. Although bright red at first, they gradually fade to a pale red or yellowish red, or they may even become the color of the normal skin. After remaining unchanged for months, they undergo involution with slight scaling, leaving no trace behind beyond an occasional pale pigmentation. The course of the affection is extremely indolent: as the earlier lesions disappear new ones are formed, so that the eruption may thus be prolonged for years. Subjective symptoms are, as a rule, absent, but slight itching may be present in exceptional cases. The eruption is usually confined to the trunk, being most abundant upon the sides and abdomen, less so upon the back; the extremities are almost never affected: but when they are the arms rather than the legs are the seat of the lesions.

In addition to the small papules just described, larger and deeper-seated nodules are occasionally seen scattered about, which resemble those of ordinary acne, and, like them, sometimes go on to suppuration. These, unlike the small papules, are to be found upon the face and extremities, even when there are none of the smaller lesions in these localities; upon the legs they frequently assume a bluish or livid hue—the lichen lividus of some authors. In severe cases a pustular eczema, having its seat upon the scrotum and pubis, accompanied by abundant exudation and crusting, with an extremely fetid odor, is sometimes present. In a very large proportion of the cases—90 per cent. according to Hebra and Kaposi—evidences of scrofula are

present in the shape of swollen or suppurating lymphatic glands, periostitis, caries of bone, and scrofulous ulcers.

Etiology.—Since so large a proportion of the subjects of the malady are strumous, it is evident that the cause is to be found in the scrofulous diathesis, the active agent being the tubercle bacillus or its products.

Pathology.—Lichen scrofulosorum is a tuberculous affection of the skin. According to Kaposi, who first investigated the disease microscopically, the pathological changes consist in an exudation of round-cells into the hair-follicle and the tissues around it, as well as into the sebaceous glands attached to it. The papillæ about the mouth of the follicle share in the cellular infiltration. The scale which is seated in the center of the papule is formed by the accumulation of epithelial and round-cells in the mouth of the follicle. Sack and Jacobi, who have more recently investigated the pathology, found the structure of the papule to resemble that of miliary tubercle, it being composed of round-, epithelioid, and giant-cells. Jacobi succeeded in finding bacilli which were stainable with the methods employed in staining the tubercle bacillus; inoculation experiments, however, with papules upon guinea-pigs were without result.

Diagnosis.—Lichen scrofulosorum is to be distinguished from papular eczema, the small papular syphilide, and from punctate psoriasis. In papular eczema the papules are brighter in color, are not arranged in rounded groups, are not apt to be limited to the trunk, and, unlike the lesions of lichen, are usually very itchy; moreover, the papules of eczema are apt to be interspersed with vesicles or to become vesicular in the course of the disease.

The papular syphilide is firmer, larger, and of a deep-red color; the localization is also different, since it occurs most abundantly upon the limbs, usually upon the flexor surfaces of the joints. Other evidences of syphilis are also usually present. In punctate psoriasis the scaling is much more abundant; the papules grow with the duration of the disease, and are not confined to the trunk.

Prognosis.—The disease is rarely the source of much annoyance to the patient, although it may last for years when untreated, but it always yields to the treatment with cod-liver oil.

Treatment.—The treatment consists in the administration of cod-liver oil internally and its application externally. It should be given in doses as large as can be taken without upsetting the stomach; externally it should be thoroughly and plentifully rubbed in twice a day. Under this treatment the eruption always disappears. The external application of cod-liver oil, while effective, is extremely disagreeable, and is apt to be strongly objected to by the patient and his attendants. Crocker has found that vaseline combined with thymol or oil of cade, five grains of the former or five minims of the latter to the ounce, is effective, and it may be tried before resorting to the more disagreeable treatment with cod-liver oil.

LICHEN PILARIS. (M. B. HARTZELL, M. D.)

Definition.—The term "lichen pilaris" is employed by Crocker to designate an inflammatory disease of the skin characterized by an eruption of small red papules seated at the mouths of the hair-follicles, from which project small horny spines of epidermis. This term was employed formerly to designate the non-inflammatory disease now known as keratosis pilaris, but it is limited here to the inflammatory affection.

Symptoms.—The eruption consists of pinhead-sized, red papules, some-

what acuminate in shape, and containing a small plug of epidermis in the center. These plugs give to the hand when passed over the affected surface the sensation of coarse sandpaper; they can be readily extracted, leaving a small central opening in the papule. The lesions appear somewhat acutely, and are arranged in variously sized patches, circular or, it may be irregular in shape, scattered about on all parts of the body. After a week or ten days the papules grow paler until they may become the color of the normal skin. The localities most commonly affected are the back of the neck, the extensor surfaces of the upper arm, the buttocks, the outer surface of the thighs, and the abdomen. The subjective symptoms are, as a rule, slight, although I have seen itching in rare cases so severe as to greatly distress the patient.

Etiology.—The causes of the disease are not clear. While in some cases the patient's health seems to be below the standard, yet in most no discoverable connection exists between the general condition and the cutaneous malady. It occurs most frequently in the young, but is not limited to early age. According to Crocker's experience, it is met with chiefly in children, and oftener in males than females.

Pathology.—The disease is an inflammation of the hair-follicle and perifollicular tissues of moderate intensity, accompanied by hyperplasia of the epithelial lining of the follicle and consequent formation of a follicular plug.

Diagnosis.—It is to be distinguished from keratosis pilaris, which it nearly resembles, by the red color of the papules, their aggregation into patches, and the greater prominence of the spines. In keratosis pilaris the spines form the whole lesion; in lichen pilaris they project from the center of a papule.

Prognosis.—Left untreated, lichen pilaris may last for many months or even years, but under proper treatment it readily disappears.

Treatment.—Frequent warm baths, to which bicarbonate of soda has been added in the proportion of a quarter pound to the bath, are decidedly useful. After the bath an ointment of salicylic acid, fifteen to twenty grains to the ounce, should be well rubbed in, or tincture of green soap, to which oil of cade, one dram to the ounce, has been added, may be rubbed in with a piece of flannel. If there is much hyperemia, the soap may be omitted, and ointment of oil of cade, a dram to the ounce, may be used instead, since the soap tincture may be too stimulating.

PITYRIASIS RUBRA PILARIS. (M. B. HARTZELL, M. D.)

Definition.—Pityriasis rubra pilaris is an anomaly of keratinization characterized by an eruption of pinhead-sized papules seated at the mouths of the hair-follicles, thickening, desquamation, and redness of the skin.

The first clearly described case of the malady was reported by Tarral as a peculiar form of psoriasis affecting the hairy parts of the skin, and is to be found in Rayer's treatise. In 1857, Devergie, under the title of "pityriasis pilaris," described two cases, but this writer failed to comprehend the malady in its entirety, since he regarded the condition of the scalp and palms as separate affections associated with, but not essentially a part of it. We owe the greater part of our knowledge of the disease to recent French writers, especially to Richaud and Besnier, the latter having given the most elaborate and accurate account of it; and the following description of its clinical features is largely drawn from this author. At the International Congress of Dermatology held at Paris in 1889, Kaposi expressed the opinion that pityriasis rubra pilaris is identical with the lichen ruber of Hebra, but this opinion was not

shared by the French dermatologists, who maintain that it is an affection *sui generis*, and Neumann and the younger Hebra also regard it as distinct from *lichen ruber*.

Symptoms.—The disease usually begins upon the palms of the hands and soles of the feet with the appearance of dry, scaly patches bearing some resemblance to psoriasis, or upon the scalp with a dry seborrhea, accompanied by an abundance of scales; in rare instances the eruption may make its first appearance upon the trunk as small red, scaly papules. Soon after the appearance of the palmar and plantar lesions or the scaly condition of the scalp the characteristic papules appear, usually first upon the extensor surface of the first and second phalanges, on the back of the hands, the extensor surface of the wrists, forearms, elbows, and knees, or, if the trunk is the part first affected, about the waist and upon the abdomen. These are brownish red in color, acuminate in shape, have a small horny spine in the center composed of cornified epithelium, and are seated at the mouths of the hair-follicles. As new papules arise between the old ones they become more and more thickly crowded together, finally forming variously sized and shaped plaques. These are red or yellowish-red in color, covered with fine white scales, and resemble somewhat closely patches of psoriasis; but the scaling is never so abundant nor laminated as in this disease. Owing to the thickening which now occurs, the natural folds of the skin are greatly exaggerated, and in advanced cases fissuring may occur about the joints, particularly of the fingers, interfering with free movement. The eruption is usually confined to limited areas symmetrically arranged, and does not involve the entire cutaneous surface except in rare instances, and then only, as a rule, late in the disease. In the face it usually begins either upon the forehead or in the eyebrows or beard, whence it extends to other parts; the papular lesions seen in other localities are wanting, but, instead, the skin is red, dry, covered with fine white scales, the lower eyelids ectopic. According to Besnier, four types are seen in the face—viz. sebaceous-squamous, red pityriasis, anserine or xerodermic, mixed types.

Upon the scalp the seborrheic condition varies from a slight branny desquamation with redness to a thick accumulation of scales gluing the hairs together, so that it is difficult to see the surface beneath: the hairs themselves are, as a rule, but little or not at all affected. The nails are likewise implicated; they are dull, striated, and brittle, their free margins rough and broken.

In ordinary cases the subjective symptoms are slight or wanting altogether; at most they consist of slight itching, intermittent in character, limited to certain localities, such as the genitalia. In rare cases, however, the itching may be quite severe, causing the patient much annoyance and interfering seriously with his sleep. The general health, even in the most advanced cases, is never seriously affected.

The **course** of the disease is a chronic one. After steadily advancing for some months a period of quiescence, or even temporary improvement, may occur; but this is followed by new manifestations of activity, new portions of the skin are involved in the eruption, or parts which had apparently recovered are again attacked; in this manner the course of the malady is prolonged for years.

Pathology.—Pityriasis rubra pilaris is a hyperkeratosis associated with secondary inflammatory changes. There is an increase in all the parts of the epidermis, most marked in the corneous layer, which is two or three times thicker than normal. The papillæ of the corium contain a moderate number

of small round-cells with a few plasma-cells and "mastzellen," and are slightly swollen. The hair-follicles are the seat of an abundant round-celled infiltration, which surrounds them throughout their entire length, while within the follicles is a mass of cornified epithelium which projects from the center of the papule forming the follicular spine. This spine is produced by the increased keratinization of the epithelial wall of the infundibulum of the follicular duct (Jacquet). About the mouths of the sweat-ducts are found similar but less marked changes (Fig. 242). Unna has very clearly pointed out the histological differences which exist between pityriasis rubra pilaris and lichen ruber; in the former the cells of the rete are larger than normal, but there is no loss of the prickles nor colloid degeneration of the epithelium, as in the latter, while the round-celled infiltration of the papillæ is much less

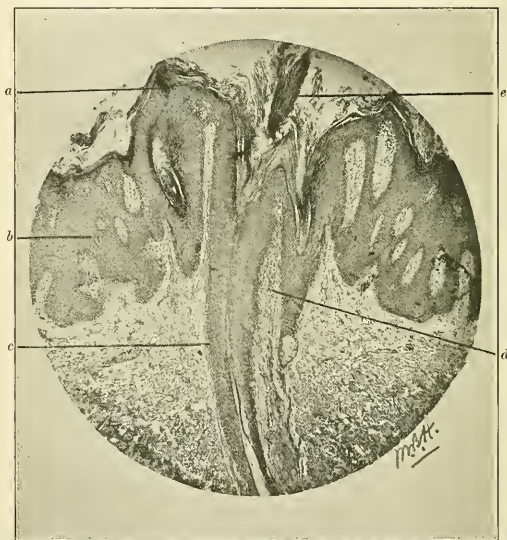


FIG. 242.—Section from a patch of pityriasis rubra pilaris: a, thickened corneous layer; b, hypertrophied rete; c, hair-follicle; d, cell-infiltration about follicle; e, corneous plug in mouth of follicle.¹

abundant, and never followed by hyaline degeneration and sclerosis. The inflammatory changes in pityriasis rubra pilaris are progressive in character, while in lichen they are chiefly regressive.

Etiology.—The disease usually begins without known cause in those who are otherwise in perfect health. There is no evidence that heredity plays any part either in predisposing to the affection or in directly producing it. Neither age nor sex seems to have any share in its causation.

Diagnosis.—When the malady is fully developed there can be but little difficulty in making the diagnosis: the papulo-squamous lesions situated at the mouths of the hair-follicles, the abundant scaling of the scalp and face,

¹I am indebted to Dr. H. W. Stelwagon for the privilege of making sections of lesions obtained from an unpublished case under his care.

the red, thickened, scaling patches formed of papules thickly crowded together, are features which belong to no other disease. The diseases with which it is most apt to be confounded are pityriasis rubra and lichen ruber (Hebra). From the former it is to be distinguished by the slight redness, the comparatively small amount and finer character of the scaling, the presence of small papules having horny plugs in the center seated about the hair-follicles. It differs from lichen ruber in the mild character or even complete absence of the itching, and the absence of any impairment of the general health. In lichen ruber arsenic seems to exert a specific effect; in pityriasis rubra pilaris it not only fails to influence the disease favorably, but in some cases proves positively harmful.

Prognosis.—The disease is a chronic one, usually lasting months and even years, but with appropriate treatment much may be done to remove the eruption for a time and make the patient comfortable. Even in cases in which the greater part of the skin is involved the general health is little or not at all impaired.

Treatment.—Internal remedies have but little direct influence, but they may be employed with the view of relieving some of the symptoms. Pilocarpine or the fluid extract of jaborandi may be given in appropriate doses for the purpose of increasing the perspiration, thus diminishing the abnormal dryness of the skin; for the same purpose the patient may be advised to exercise freely and vigorously. The arseniate of soda may be cautiously tried, carefully watching that no ill effects follow its use, since in some instances acute exacerbations have seemed to be produced by arsenic. In some cases cod-liver oil may be given with manifest advantage.

The external treatment is much the same as for psoriasis. Frequent and prolonged baths, simple or made alkaline by the addition of bicarbonate of soda, and frictions with green soap, are useful in removing the accumulations of scales and preserving the pliability of the skin. Oil of cade, either as an ointment, one to three drams to the ounce, or diluted with an equal quantity of oil of sweet almonds or fluid cosmoline, may be rubbed into the affected parts; tar may be employed in the same manner. Brocq speaks well of pyrogallol used as an ointment, but this remedy should be applied over a very limited area, lest serious toxic symptoms arise from its absorption. An ointment of calomel, from one-half to one dram to the ounce, may sometimes be used with advantage. In the exceptional cases in which itching is an annoying symptom ointments of carbolic acid, menthol, or thymol, ten or fifteen grains to the ounce, will afford relief. For the treatment of thick, scaly patches a plaster of salicylic acid, 10 per cent. strength, will be found very useful. While, as a rule, stimulating applications are demanded and well borne, in exceptional cases the skin is irritable and inflamed, and only soothing remedies are tolerated. In such bran or starch baths may be advised, followed by the application of bland oils or vaseline; or, if the inflammation is marked, the skin may be frequently bathed with a saturated solution of boric acid, and afterward lightly smeared with a paste composed of starch, oxide of zinc, and cosmoline.

DERMATITIS FACTITIA. (M. B. HARTZELL, M. D.)

Definition.—By factitious dermatitis is meant an artificial inflammation of the skin, in most cases produced by the patient himself for the purpose of exciting wonder or sympathy or to escape the performance of some disagreeable duty: under this title are included the greater number of the feigned eruptions.

Symptoms.—Artificial dermatitis varies in kind and degree according to the means employed to produce it, and may present all grades of severity from slight erythema to superficial gangrene. The lesions are often solitary, rarely numerous, and, as a rule, they do not correspond in appearance or distribution to any of the ordinary forms of cutaneous disease. The commoner forms of feigned eruption are variously sized patches of erythema, usually more or less angular in outline, patches of vesicles or pustules, bullæ, and, less frequently, superficial gangrene. Under the name of neurotic excoriations Wilson, and later Sangster and Fox, reported cases of peculiar superficial abrasions produced by the patient herself by mechanical means. Very frequently the eruption, whatever may be its character, is confined to one side, usually the left, and is more likely to be seen upon the extremities than upon the trunk; the posterior surface of the body, for obvious reasons, is almost never affected.

Various irritating and caustic substances are employed for the purpose of producing these inflammations, and the particular kind of eruption produced will depend in some measure upon the agent used: mustard, croton oil, cantharides, turpentine, the mineral acids, all have been used for the purpose of simulating disease of the skin. In some of the cases of the so-called neurotic excoriations long-continued friction with the moistened finger has been the means employed to produce the abrasions. In a case under my own observation recently the left forearm was the seat of a limited number of short linear excoriations which presented a peculiar scooped-out appearance, as if made with the nails, and the binding up of the arm in a dressing which could not be readily removed was followed by the prompt disappearance of the eruption.

The great majority of cases of feigned eruption occur in young hysterical women who desire to excite curiosity or sympathy, in the inmates of prisons, among soldiers and sailors for the purpose of shirking duty.

Diagnosis.—The diagnosis may at times be attended with much difficulty; and even when suspicion is aroused it is not always easy to prove the correctness of our suspicions. Artificial eruptions, however, present certain features which serve to distinguish them in some degree from the ordinary diseases of the skin. In most cases the lesions are few in number, and are limited to those parts which are most readily accessible, as the extremities; they are usually confined to the left side and anterior surface of the body. When liquids have been applied to the skin, they frequently run down in streaks, making linear lesions, or if mineral acids have been used, the edges of the patch are stained brown or yellow, and the fingers are apt to be stained in the same manner. Whatever the means employed to produce the dermatitis, the eruption rarely corresponds in appearance, course, or distribution to any of the usual diseases of the skin. In cases of suspected factitious eruption it is not always prudent nor desirable to tax the patient with deception, since nothing is to be gained in most cases by exposing her to her friends, who, for that matter, will rarely be convinced that the lesions have been purposely produced. When it is practicable it is well to cover the affected parts with some kind of dressing which cannot be removed; under this the lesions will promptly disappear if they have been artificially produced, and the diagnosis of factitious dermatitis will receive confirmation.

Treatment.—The diagnosis having been established, the treatment resolves itself into the prevention of further irritant applications.

SPHACELODERMA. (M. B. HARTZELL, M. D.)

Synonym.—Gangrene of the skin.

Death of the skin may occur as the direct effect of noxious influences acting upon it from without, as when it results from heat, cold, contact with certain chemical substances (as caustics), or direct violence; or it may be the consequence of disease, either in the skin itself or in the general organism. It may be the final result of diseases of the blood-vessels, such as arteritis, atheromatous degeneration of the vessel-wall, embolism, thrombosis, which act by cutting off the blood-supply to the affected area; with these may be included gangrene arising from the long-continued ingestion of ergot, since it is due to the chronic spasm of the arterioles produced by the drug. Diabetes, less frequently Bright's disease, the infectious diseases, may be the indirect cause of cutaneous gangrene, probably through the retention of poisonous excrementitious substances or the formation of toxines which seriously damage the vitality of the skin. Disease and injury of the nervous system, central or peripheral, by interfering with important trophic processes must also be reckoned among its causes. Gangrene may also result from direct bacterial invasion of the skin.

The forms of gangrene which result from direct injury to the skin will not be considered here, since their treatment properly belongs within the domain of surgery; the dermatologist has to do chiefly with those which are the result of disease.

DERMATITIS GANGRÆNOSA INFANTUM.

Synonyms.—Varicella gangrænosa; Pemphigus gangrænosus; Multiple cachectic gangrene of the skin; Infantile gangrenous ecthyma; Ecthyma terabrant.

Definition.—An inflammatory disease characterized by an eruption of vesico-pustules which become sharp-cut, more or less deeply-penetrating, gangrenous ulcers.

This form of dermatitis was first described by Mr. Jonathan Hutchinson, who regarded it as a rare complication or sequel of varicella, and gave it the name varicella gangrænosa. Since the publication of Hutchinson's cases similar ones have been reported by Crocker, Elliot, and other observers in which there was no association with either varicella or vaccinia. Since, therefore, the disease has been ascertained to occur independently of varicella, the name given it by Mr. Hutchinson is no longer appropriate, and that suggested by Crocker, dermatitis gangrænosa infantum, is preferable.

Symptoms.—In cases in which the gangrenous process is associated with varicella the eruptive lesions of this latter disease, instead of drying up in the usual manner, become covered with dark crusts, beneath which ulceration takes place. Around this crust a bright-red areola forms; the ulceration extends in depth and circumference until a grayish or blackish eschar is produced, which after a variable time is cast off, leaving an oval or circular, sharp-cut ulcer varying in size from a pea to a dime and even larger, usually shallow, but not infrequently extending quite deeply into, or sometimes through, the skin. While these ulcers are usually small, they may reach considerable dimensions through the coalescence of two or more contiguous lesions; they are then no longer circular, but have irregular or serpiginous borders. Like the eruption of varicella, these lesions are most abundant upon the head and upper part of the trunk; if associated with or following vaccinia, the eruption begins upon the arm, but not at the place of

vaccination. When, however, the disease occurs independently of any previous eruption, it usually first appears upon the buttocks and thighs as small papulo-pustules, which soon rupture and become covered with a brownish crust surrounded by an inflammatory areola: beneath this crust ulceration takes place in the manner described above. The number of the lesions upon the buttocks may be considerable, but those upon the trunk are comparatively few. There is usually more or less constitutional disturbance, the amount varying according to the number and extent of the lesions; there may be considerable elevation of temperature, amounting in severe cases to 105° F., and complications of various kinds, usually pyemic or septic in character, are not unusual, contributing to the gravity of the malady, and in many instances leading to a fatal termination. In exceptional cases the contents of the vesicles may become hemorrhagic, as noted by Crocker, and the constitutional symptoms may be, from the very first, of the gravest character; or the lesions may be bullous, their contents becoming purulent. On the other hand, many of the cases are mild in character, the lesions being few in number and the ulceration quite superficial.

Etiology.—Among the causes which predispose to the affection, age and sex occupy a prominent place: all the cases thus far reported have been in children between three months and three years of age, the greater number occurring within the first year of life. According to Crocker, in 21 cases in which the sex of the patients was noted 15 were girls, and 10 out of 12 of his own cases were likewise girls; it is not likely, however, that this preponderance of the female sex will hold good for any very large number of cases. In many varicella or vaccination immediately preceded or accompanied the cutaneous gangrene, but this association is by no means invariable. Barlow has called attention to the fact that tuberculosis is present in a considerable number of cases—too many to have been merely accidental. While the above-mentioned causes undoubtedly contribute indirectly to the production of the disease, it is more than likely that micro-organisms are immediately concerned in its causation.

Pathology.—It is probable that the disease is due to the invasion of the skin, already damaged by previous disease, general or local, by some special micro-organism. Ehlers found the bacillus pyocyaneus in two cases, and other investigators have reported the presence of various micrococci in the lesions, but no one micro-organism has been found to be constantly present.

Diagnosis.—This, as a rule, is readily made: the circular or oval, sharply circumscribed ulcers which begin as vesicles or vesico-pustules, the age of the patient, the frequent association with varicella or vaccinia, are features which are sufficiently characteristic of the affection to prevent mistakes.

Prognosis.—When the disease occurs in a very young child, when the ulcers are numerous, large, and deep, when the constitutional symptoms are severe, or when there are pulmonary complications, the prognosis is very grave. On the other hand, if the lesions are few and superficial, with little or no constitutional disturbance, recovery always take place.

Treatment.—The treatment should be both local and constitutional. Internally such remedies as quinine, tincture of the chloride of iron, wine, should be given with the view of maintaining the patient's strength, and an abundance of easily digested, nutritious food should be given. Crocker has found the sulphocarbolate of zinc, in five-grain doses, useful in some of his cases. Locally, non-irritant antiseptic dressings should be applied until the

sloughs separate; a saturated aqueous solution of boric acid applied on lint makes a cleanly and effective dressing. When the sloughs have been cast off the ulcers may be dressed with iodoform, iodol, aristol, or europhen, either in powder or ointment. Elliott speaks favorably of a 5 per cent. ointment of ichthyol, to be applied after the sloughs have separated.

MULTIPLE GANGRENE OF ADULTS.

Under this title are included forms of cutaneous gangrene which differ greatly as to their etiology and clinical course. The most interesting, by far, are the cases which have been reported by Doutrelepont, Bayet, Kaposi, Quinquaud, Joseph, and others under various names, such as *acute multiple gangrene of the skin*, *disseminated gangrene*, *gangrenous urticaria*, *hysterical gangrenous zoster*. With very few exceptions these have occurred in hysterical young women, and in most of them there was a history of traumatism preceding the appearance of the gangrenous lesions by a period varying from a few days to several months. It is a curious fact, to which attention has not heretofore been called, that in many, if not in most, of these cases this traumatism was a burn or a cauterization with a mineral acid. Until recently it was thought that this affection was confined exclusively to the female sex, but Quinquaud and Joseph have each published a case occurring in a man which differed in no respect from the cases seen in women. It begins either as erythematous patches or flaccid vesicles and blebs, which within a short time are transformed into eschars which may be moist or dry, superficial or deep. The lesions are not confined to any special region, but are commonly most numerous upon the extremities, and their appearance is often preceded by sensations of pricking or burning. The disease is apt to pursue a protracted course, new lesions appearing as the old ones heal.

Crocker has reported two cases of multiple gangrene in adults resembling the gangrenous dermatitis of infants. One occurred in a woman who had suffered from some suppurative affection of the vagina; the lesions came out in crops, and in a second attack were accompanied by elevation of temperature. The second case was observed in a man convalescent from scarlatina.

Quite recently Rotter and Waelsch have reported cases of multiple cutaneous gangrene in which pathogenic bacilli were present.

Prognosis.—This is favorable as to ultimate recovery, but the neurotic cases are apt to be of long duration.

Treatment.—In the hysterical forms the treatment must be addressed to the cure of the underlying neurosis. In the cases in which there is no discoverable cause such remedies as arsenic in tonic doses, quinine, iron, phosphorus, and cod-liver oil should be given.

RAYNAUD'S DISEASE.

Synonyms.—Local asphyxia; Symmetrical gangrene.

Definition.—A vaso-motor disease of the extremities, characterized by paroxysmal attacks of symmetrically disposed local syncope and asphyxia, which usually, but not invariably, terminate in gangrene of the skin and subjacent tissues.

This curious, infrequent, and but little understood affection was first carefully studied by Raynaud, although it had been previously described by other observers. Since the publication of Raynaud's cases a considerable number have been reported by Weiss, Lauer, Southey, and others; the whole number, however, is yet far from large.

Symptoms.—It usually begins with the arrest, more or less complete, of the arterial blood-supply of a part, or it may be the whole, of an extremity. The parts usually attacked are the fingers and toes, but other peripheral regions, such as the nose and ears, may be the seat of the disease; these become dead white or yellowish white in color, cold, and numb (local syncope). After a variable period lasting from a few hours to several weeks this pallor gives place to a dusky, livid, or even blackish color (local asphyxia); severe burning or shooting pains occur; vesicles and blebs filled with cloudy or bloody fluid form, and death of the part takes place. A line of demarcation now forms; the gangrenous portion is slowly separated from the healthy tissues and is in time cast off. The gangrene may be either moist or dry, may be quite superficial or may extend deeply, or even involve the entire extremity.

From the foregoing it is seen that the malady presents three fairly-well defined stages: first, local syncope, in which the parts are white and bloodless; second, local asphyxia, in which the pallor and anemia of the first stage are replaced by lividity and intense venous congestion, accompanied by severe burning pain; third, local gangrene. Not all cases, however, pass through these three stages: in some the local syncope, after lasting for some hours, disappears and the parts return to the normal condition; or it may pass into the stage of asphyxia, but stop short of the final one of gangrene. Local asphyxia may occur without the usual precedent syncope, terminating in gangrene or in the restoration of the parts to the normal. In the cases in which the process stops short of gangrene the repeated disturbance of the circulation interferes with the nutrition of the tissues, and in the case of the fingers and toes these become atrophied from insufficient supply of arterial blood, being slender and tapering, or thick and club-shaped from the repeated and long-continued venous stasis. In some instances, after repeated attacks which have vanished without leaving any trace, the disease finally terminates in gangrene in the usual manner. In others the asphyxia disappears and does not return; usually, however, the attacks are repeated at irregular intervals. The asphyxia may last from a few minutes to several hours or days; and even after lasting for days a complete return to the normal may take place. In a case reported by Shuboe, in which the asphyxia had lasted eight days, the hands (the parts affected) being quite black and covered with blebs, complete restoration of the skin occurred.

Although the prodromal symptoms are usually absent, in some cases loss of appetite, headache, abnormal sensations in various parts of the body, such as pricking, burning, numbness, are experienced some time before the appearance of the disease. Considerable elevation of temperature may precede the attack by some days or weeks, one case being reported by Smith-Shand in which a temperature of 104° F. existed for three weeks before the advent of the local symptoms. Eruptions of various kinds, usually erythematous in character, occasionally vesicular, may precede the appearance of the gangrene; and in some instances hemoglobinuria, intermittent albuminuria, drowsiness, amblyopia, have been noted.

Étiology.—It is probable that Raynaud's disease is not an independent affection, but one of the results of disease of the circulatory or nervous systems arising from a variety of causes. General disturbances of nutrition, affections of the central or peripheral nervous systems, anomalies of menstruation, hysteria, chlorosis, strong psychic impressions, intoxications of various kinds, infectious diseases, are a few of the conditions or diseases which have seemed to stand in a casual relation to the malady. In a considerable pro-

portion of cases exposure to cold appears to have been the immediate exciting cause.

Pathology.—Pathologically, symmetrical gangrene is a vaso-motor disturbance of nutrition; the blood-supply of the parts affected is greatly diminished or entirely suspended, and death of the tissues results in consequence. The marked ischemia which is the usual condition in the early stages was explained by Raynaud as the effect of a spastic contraction of the arterioles, which later gave place to a condition of paralysis of the vessel-wall, leading to blood-stasis, as indicated by the change in color from a dead white to blue or blackish. Weiss, on the contrary, regarded contraction of the veins as the immediate cause of the changes. That interference with the blood-supply is the direct cause of the gangrene is undoubted, but whether the alteration in the lumen of the vessels, which shuts off the circulation, is of central or peripheral origin has not yet been determined.

Diagnosis.—Raynaud's disease is to be distinguished from ordinary gangrene by its symmetrical distribution and by the occurrence of local syncope and asphyxia, either or both, before the gangrene appears. There are no other diseases with which it could readily be confounded.

Prognosis.—There may be but a single attack, with complete recovery, but this is scarcely to be hoped for, since recurrences are the rule. When gangrene has occurred the prognosis will depend largely upon its extent, the age and constitution of the patient; if it extend deeply or over extensive areas, or if the patient be old or debilitated from any cause, the prognosis is grave.

Treatment.—In the selection of internal remedies we must be guided by the nature of the cause when this can be ascertained. If there is a history of malaria, quinine should be given in appropriate doses; if the patient presents evidences of syphilis, past or present, mercury and iodide of potassium should be administered. Remedies which act directly upon the walls of the arterioles may be prescribed with the hope of relaxing the spasmodic contraction upon which the ischemia depends. For this purpose nitrite of amyl and nitro-glycerine have been employed, but, it must be said, with little or no favorable effect. Brocq advises the administration of quinine and belladonna, and in very nervous subjects valerian and the bromides. Besnier recommends inhalations of oxygen. More useful than any of these, however, is the local application of galvanism, as recommended by Raynaud. The positive pole should be applied to the spine, the negative to the affected parts, and a slowly interrupted current, as strong as the patient can bear, should be used once a day for fifteen or twenty minutes at a time. The faradic current has also been used with good results. Frictions with stimulating liniments may also be employed for the purpose of improving the circulation; heat should not be applied, cold applications seeming to act much better. For the relief of pain lotions containing opium or chloroform may be used, but if the pain is severe the internal administration of opium or morphia hypodermically may have to be resorted to. When gangrene has once occurred the treatment must be carried out according to the ordinary rules of surgical practice.

DIABETIC GANGRENE.

Gangrene of the skin may occur as a complication of diabetes mellitus. It may follow the slightest injury, such as an abrasion or a bruise; it may be the result of some one of the various forms of dermatitis which occur so frequently in those suffering from glycosuria; or it may take place spontaneously without any demonstrable direct cause.

Symptoms.—When it follows an injury it usually occurs at once, without the intervention of inflammation: the skin becomes bluish or blackish, its temperature falls, vesicles and blebs appear, and an eschar quickly forms which is usually of the moist variety. Or the injury may be followed by the inflammatory reaction usual after traumatism, but the inflammation, instead of undergoing resolution in time, ends in the death of the skin. The gangrene of diabetes is commonly moist, but it may assume the dry form in exceptional cases; and it is usually progressive in character, extending some distance beyond the place of origin. The extremities are the parts most frequently affected, the lower oftener than the upper, the toes often being first attacked, but any portion of the body may suffer. The lesions may be single or multiple, unilateral or upon both sides symmetrically. The inflammations which are especially apt to occur about the external genitalia of both sexes in diabetes are occasionally followed by gangrene, the prepuce in the male being particularly prone to suffer in this way.

Finally, it may appear without any injury or inflammation having preceded it. In the spontaneous form the lesions are variously sized, more or less circumscribed, often multiple, and sometimes symmetrically arranged, resembling in this respect the symmetrical gangrene of Raynaud. It is sometimes preceded by prodromata, such as neuralgic pains, livid discoloration of the skin, diminished sensibility, and local fall of temperature; and, unlike the variety which follows injury or inflammation, it is apt to develop slowly.

Kaposi has observed a case of diabetic gangrene characterized by an eruption of scattered bullæ seated upon an inflamed base, followed by eschars, the disease spreading in a serpiginous manner. In the course of some months the lesions healed, but death finally occurred upon the recurrence of the eruption.

Etiology.—Although the precise manner in which diabetes predisposes to inflammations and gangrene of the skin is not known, it is extremely likely that these are due to microbic invasion. Micro-organisms, having entered the skin through some slight breach of continuity, find in the sugar-impregnated tissues of the diabetic a soil specially suitable for their growth and development, and, owing to their greatly diminished power of resistance, the tissues succumb readily to the toxic effects of the bacterial products. The spontaneous form is due to secondary disease of the blood-vessels or nervous system (trophic).

Diagnosis.—Diabetic gangrene is to be distinguished from the senile variety and from Raynaud's disease. Gangrene occurring in diabetes is apt to be moist, rapid in its course, and is not confined to the extremities, while senile gangrene is usually dry, very slow in its progress, and limited to the peripheral parts. Diabetic gangrene differs from Raynaud's disease in not being preceded by attacks of local syncope and asphyxia, and in the usual absence of symmetry in its arrangement. The detection of sugar in the urine in any case of gangrene is, of course, an important diagnostic point, but it must not be forgotten that the glycosuria may temporarily disappear under the influence of intercurrent febrile disorders, and is sometimes absent in the final stages of diabetes.

Prognosis.—This is unfavorable, since the gangrene frequently extends, and the patient dies with symptoms of septicæmia. Recovery may take place, however, a favorable issue being most apt to occur in the spontaneous form.

Treatment.—The same general treatment, dietetic and medicinal, is to

be employed as in diabetes. The treatment of the gangrenous lesions themselves consists in the application of antiseptic dressings until the sloughs separate and the resultant ulcers heal.

DERMATITIS MEDICAMENTOSA. (JOSEPH GRINDON, M. D.)

Definition.—Circulatory disturbances of the skin, hyperemic or exudative, due to the local application of a drug or to its presence in the blood. They are for the most part erythematous, scarlatiniform, or urticarial, but may be papular, pustular, bullous, anthracoid, etc. Stains and discolorations due to the use of drugs, although not forms of dermatitis, will be also mentioned.

Lesions resulting from the topical use of a drug should perhaps be classed under *dermatitis venenata*, but inasmuch as a separate consideration of these effects would require much needless repetition—the more so since the effects of the internal use of a drug are in many instances similar to or identical with those following upon its external application—it was thought more practical, even though somewhat arbitrary, to include *all* the cutaneous lesions due to medical substances under one head, leaving those phenomena arising from contact with non-medicinal substances to be considered under the caption *dermatitis venenata*.

Etiology.—**Point of Access.**—A dermatitis may result from—(1) direct application of a drug to the surface affected; (2) it may extend from the surface exposed to the exciting agent by continuity; or (3) the drug may have entered the organism at a distance from the affected site, as (*a*) through the skin itself, (*b*) hypodermically, (*c*) through granulation tissue, (*d*) by way of the alimentary tract, (*e*) through some other mucous surface—*e. g.* the conjunctiva.

We are more apt to find a constant relation existing between the nature of the cause and the form of the effect in the first two classes of cases than in the third, probably on account of the greater simplicity of the attendant processes; thus we may with moral certainty predict the result of the use of a fly-blister or of a mustard-plaster.

There are other morbid phenomena due to immediate contact which, while of inconstant occurrence, are yet fairly uniform when they do appear, such as the lesions due to arnica. Here the determining factor is a special morbid aptitude of the tissue. This special aptitude plays a still more important rôle in those instances, few in number, in which one of several types of lesion may follow the application of a drug, such as tar, which may occasion a dermatitis, an acne, or a crop of boils, while in most cases it causes no disturbance whatsoever.

The topical application of drugs resulting in affections of the skin may be—(1) accidental; (2) incidental to the patient's calling; (3) purposeful, as (*a*) for a remedial end, (*b*) in order to fraudulently feign disease, (*c*) for the accomplishment of some foolish, fanatical, or insane purpose.

A study of phenomena falling into our third class—*i. e.* those in which the exciting agent has been introduced at a distance from the site of the lesion—leads to the arrangement of these agents into two natural groups.

The first of these groups is formed of a small number of substances whose administration in sufficient quantity brings about cutaneous consequences with fair regularity, these consequences similarly preserving a certain constancy of form, so that we habitually link in speech a descriptive word to the name of the drug, and speak of a belladonna erythema or of a measly antipyrine

rash. We may consider their production as the expression of the normal and physiological action of the drug, so constant is their conformity to each type.

The second group comprises the majority of drugs and exhibits a double inconstancy, inasmuch as the production of any form of dermatitis is exceptional, and again, when found, it may affect any one of several types.

In this group the nature of the exciting cause, the drug, is of much less moment in determining the result than are the *predisposing causes* resident in the individual.

Some of these causes we will enumerate :

Sex ; Age ; Complexion ; Temperament.—The writer believes that women are more subject to these aberrant symptoms than are men, children than adults, and blondes than brunettes. Morrow, who expresses the same opinion, also believes that the neurotic and scrofulous present more frequent examples than those of more stable constitution. It is certain, however, that individual predisposition exists beyond the limits of the above-named factors.

This less tangible predisposition is designated by the term *idiosyncrasy*, which, while it explains nothing, serves conveniently to designate this phenomenon of variability in susceptibility to medicinal action. It is of frequent applicability. Thus, while quinine will remain without effect on the skin in the great majority of persons, yet it may in one call forth a rash like that of scarlet fever, like it followed by scaling off ; in another it may bring out a crop of hives ; in still another, eczematous patches of papules or vesicles ; or, again, the lesions may differ from all these.

Idiosyncrasy is not necessarily permanent for each individual. It may be first developed after years of use of a drug, and again may disappear after a time.

Idiosyncrasies of this sort are often found, as one might expect, in several members of one family. The writer knows of a family in which this is true of the urticarial quinine eruption. Here heredity would seem to be a factor.

Pathology.—The *elimination theory* seeks to account for the phenomena observed by supposing that the drug acts as an irritant to the sebaceous or coil-glands, which bear the brunt of its effects, on account either (1) of an "elective affinity" or (2) of deficient elimination elsewhere, as by the kidneys. Facts in support of either view are few and ill-attested, while they are opposed by other anatomical and clinical findings. While the elimination theory is at first sight most plausible, careful study has shown—first, that those affections which seemed to furnish its most striking illustrations—namely, bromine and iodine "acne"—offer only a deceptive resemblance to inflammation of the sebaceous glands, and that the alleged finding of these substances in the lesions themselves (Adamkiewicz, Guttmann) has been negatived by later observers (Pellizzari, Ducrey, Veiel). The histological evidence (Thin, Duckworth, De Amicis, Colecott Fox and Gibbes, Seguin, Stephen Mackenzie, and others) is overwhelmingly that the site of the lesions is not in or about the glandular apparatus. This is also shown clinically by the finding of pustules in regions from which sebaceous glands are absent (palms, soles, scar-tissue). The terms bromide acne, iodide acne, are therefore misnomers. Second. The clinical evidence of any connection between renal incompetence and medicamentous dermatitis is inconclusive.

The Angio-neurotic or Tropho-neurotic Theory.—Morrow's view that the induction of drug-eruptions occurs through the intermediary of the nervous system, whether the application of the drug be mediate or immediate, is sustained by the preponderance of clinical evidence. The effect may be exerted either reflexly, as in *urticaria ab ingestis*, or, the drug being absorbed

may act either on the vaso-motor centers or on peripheral nerves. Whether on vaso-constrictors or on vaso-dilators, the result is a dilatation.

In other cases, again, there may be, in addition to the vascular changes or in consequence of them, "trophic" disturbances.

In support of the angio-neurotic theory it is urged—first, that most forms of *dermatitis medicamentosa* are unmistakably of vaso-motor origin; second, that most dermato-pathogenic drugs are such as exercise a marked influence on the nervous system; third, that idiosyncrasy is best interpreted by referring it to the nervous system; fourth, that a similar explanation best fits the fact that minute quantities of a drug will occasion an outbreak in those obnoxious to its influence, as in the case of Koster-Syke, who reports that merely handling a bottle containing carbolic acid would bring about an eczema in his own person. Similar examples furnished by the poison-ivy are familiar to all.

Diagnosis.—That the study of drug-eruptions is of comparatively recent date is due to the fact that their very existence long went unrecognized, and that they were attributed to other causes than the true one. And even to-day the chief importance of the study of this subject arises from the facility with which many forms of medicamentous dermatitis may be confounded with the exanthemata or with other skin-diseases. So common, indeed, are drug-eruptions that the practitioner should never attempt the diagnosis of any dermatosis without bearing in mind the possibility of his having to do with one of these adventitious manifestations.

It seems best not to lay down general laws for the diagnosis of these affections. The pointing out their "family resemblances" would be but a repetition of much of what has been said above.

Prognosis.—Drug-lesions tend to disappear rapidly upon the withdrawal of the drug, bromide dermatitis occasionally furnishing an exception. Under continued use of the morbid agent the lesions may assume a more intense grade or new eruptive elements may appear.

THE DRUGS AND RESULTANT LESIONS.

In order to avoid useless repetition of the same phrases we will merely give an enumeration of lesions observed after use of each drug, with occasionally a few words of amplification. Lesions observed after the *external* use of the drug will be mentioned first, and then those following upon its *internal* administration. The less rare forms are grouped together and separated from those seen only in a few cases:

Acidum Benzoicum.—*Internally.*—Chiefly urticaria; rarely maculopapular lesions. Erythema has been caused by *sodii benzoas* internally, and purpura urticans by inhaling friar's balsam (T. C. Fox).

Acidum Boracicum.—As *wash* for pleural cavity (2 cases) and as *enema* (once) has caused erythema. Erythema, papules, and bullæ, with conjunctival injection, headache, and fever, observed once.

Sodii Boras.—*Internally.*—Chiefly a diffuse measy, an eczematous, or an impetiginous rash. Psoriasiform lesions after long use (in 3 cases).

Acidum Carbolicum.—*Externally.*—Erythema, sometimes spreading from point of application. Occasional vesiculation. The pure acid may cause gangrene.

Carbolized Dressings.—Erythema, a scarlatinal rash, urticaria.

Absorption from Cavities, etc.—Erythema or eczema, with vomiting, headache, and scanty dark-green urine.

Acidum Hydrocyanicum, Cherry-Laurel, Bitter Almonds, etc.—*Internally*.—Chiefly urticaria, rarely erythema.

Acidum Nitricum.—*Externally*.—Yellow stain and vesiculation (sometimes purposely self-inflicted). *Internally*.—Fine pustules.

Acidum Salicylicum.—*Externally*.—Vesicles at site of contact. *Internally* (the acid or its salts).—Chiefly, erythema, scarlatinal rash, urticaria; rarely, vesicles, bullæ, pustules, petechiæ, gangrene.

Salol.—*Internally*.—Rarely, urticaria.

Acidum Tannicum.—*Internally*.—Rarely, erythema. *Applied to pharyngeal or nasal membrane*.—Rarely, urticaria.

Aconitum.—*Externally*.—Vesicles, erysipelatos inflammation. *Internally*.—Chiefly, vesicles; rarely, bullæ or pustules.

Alcohol.—Generalized erythema and urticaria.

Anacardium (cashew-nut).—*Externally*.—(Oil of the rind.) Papules, vesicles, pustules, and bullæ, with edema and infiltration. *Internally*.—Urticaria, vesicles, bullæ.

Antimonium, **Antim. et Potas. Tartrat**.—*Externally*.—Varioliform pustules; may form away from site of application.—*Internally*.—Urticaria and vesico-pustules.

Antipyrine.—*Internally*.—Usually, measly papular, on chest, abdomen, back, flexures, occasionally face, with itching, profuse sweating, and, as a rule, scaling; occasionally, scarlatinal rash, urticaria; rarely, bullæ, furuncles, purpura, vesico-pustules.

Antitoxine of Diphtheria.—Antitoxine rashes are *oftenest* erythematous or urticarial, sometimes scarlatinal or measly, rarely a multiform exudative erythema with pain and swelling at joints, fever, and a threatening general condition. Petechiæ (seen in severe cases) are probably due to the disease, and not to the remedy.

Figures furnished by sixteen St. Louis physicians gave the following: 224 injections of Behring's serum yielded rashes 11 times; 148 injections of various American makes yielded 101 rashes. The eruption appeared oftenest on the seventh to tenth day, but showed itself once on the second, once on the third, and once as late as the eighteenth day. It lasted from two days to a week, rarely desquamated. In some case it first showed itself at the site of injection. Itching varied from *nil* to ferocious.

Argenti Nitras.—*Externally*.—Brownish-black stain. *Internally*.—Chiefly, a grayish-black discoloration; one case of erythemato-papular eruption.

Arnica.—*Externally*.—Common, violent dermatitis, much like that of rhus-poisoning; rare, purpura.

Arsenicum.—*Externally* (used for complexion-powders, escharotic pastes; in the industries, for artificial flowers, wall-papers, dyes, and in carpets, bed-tiekings, etc.).—Erythema, vesicles, pustules, deep destructions. The genital surfaces are especially vulnerable. Ulceration, edema, and gangrene of the serotum are frequently seen. *Internally*.—Erythema, papules, urticaria, vesicles, pustules, erysipelatos inflammation, petechiæ, boils, carbuncles, grayish or brownish discoloration after long use of the drug (sometimes at old psoriatic patches), thickening of skin at palms, soles, knees, and elbows.

Hutchinson believes that zoster may be due to arsenic, and that epithelioma is sometimes caused by its long use.

Balsamum Gurjunicum.—*Internally*.—Unique. Eruption like copaivara-rash (T. C. Fox).

Balsamum Peruvianum.—*Externally.*—Chiefly, erythema; rarely, urticaria.

Belladonna, Atropia.—*Externally.*—(Bellad.)—Erythema, one case of dermatitis with vesicles and bullæ.—*Internally, or as collyrium.*—Common, scarlatinal erythema, “a patchy flushing;” rare, erythema and gangrene of the scrotum, herpes, eczema, erysipelatoid inflammation with vesicles and bullæ.

Benzole.—*Externally.*—Erythema.

Bromide and Compounds (Bromides, HBr, hydrobromate of quinia, bromoform, “bromo-caffeine,” “bromidia,” etc.).—Common, papulo-pustules on face, scalp, back, and chest, sometimes palms and soles; mis-called bromic “acne.” They show a tendency to grouping and confluence. Also, erythema, urticaria, boils, and carbuncles; rare, vesicles, bullæ. In children and young adults hypertrophied papillomatous lesions resembling condylomata, greatly elevated, firm, with depressed crateriform centers often on outer aspects of arms and legs. These are very persistent and are variously described as “anthracoid,” “tuberosa,” or “verruccosa” forms, “ulcus elevatum,” or “epithelial ulcer.”

Bromide-lesions occasionally appear several days after discontinuance of the drug, and may persist for weeks after stopping it.

Calcei Sulphidum.—*Internally.*—Furuncles; rare, vesicles, pustules; unique, petechiæ (Morrow).

Cannabis Indica.—Unique. Generally distributed pinhead- to pea-sized vesicles, with itching (Hyde).

Cantharides.—*Externally.*—Regular, bullæ, sometimes followed by pustulation; sometimes, boils, gangrene, ulcers; rare, vesicles, pustules, and bullæ over entire body after use of blister. *Internally.*—Erythema, papules.

Capsicum.—*Externally.*—Erythema, vesicles, bullæ. *Internally.*—Erythema; rare, papulo-vesicles with itching.

Chinolin.—Erythema in 6 typhoid patients out of 20 (T. C. Fox).

Chloral.—*Externally.*—Vesicant. *Internally.*—Erythema (much like scarlatina), with injection of ocular and buccal membranes, fever, and desquamation. Rare, urticaria, papules, vesicles, ulcers; boils and carbuncles, with ulcers of cornea and tongue in children.

The rashes occasionally following the use of “bromidia” are oftenest chloral exanthems, although sometimes due to some other ingredient.

Chloralamide.—*Internally.*—Unique. Punctate hyperemia over general surface, with vesiculation, injection of nasal and oral membranes, coryza, fever, desquamation (T. C. Fox).

Chloroform.—*Inhalation,* punctate or patchy erythema; rare, purpura, hematogenous jaundice.

Chrysarobin.—*Externally.*—Usual. Coppery erythematous or erysipelatous dermatitis spreading beyond site of application; occasional, papules, pustules, and furuncles. Two cases of exfoliative dermatitis lasting for weeks (Morrow).

Condurango.—*Internally.*—Rare, acne-like lesions, furuncles.

Conium.—*Internally.*—Erythema, papules, erysipelatoid rash.

Copaiba and Cubeba.—*Internally.*—Measly or roscolar rash about wrists, ankles, hands, feet, breast, and abdomen. Once observed; vesicles (Rayer).

Copaiba (alone).—*Internally.*—Chiefly, wheals, often large, with hemorrhagic centers; occasionally, papules, petechiæ; rarely, bullæ.

Creasotum.—Mentioned by Van Harlingen; details not given.

Digitalis.—*Externally.*—Erythema, papules. *Internally.*—Rare, scarlatiniform and papular erythema, erysipelatoid of face, urticaria.

Dulcamara.—*Internally.*—Erythema, sometimes desquamating; rare, urticaria.

Duboisia.—Mentioned by Van Harlingen; no details given.

Ergota.—Hypodermically, local phlegmons. *Internally* (usually after long use).—Vesicles and petechiæ, pustules and furuncles, circumscribed gangrene. (Successful treatment with nitro-glycerine is reported).

Euphorbium.—*Externally.*—Constant, vesication.

Guarana.—*Internally.*—Rare, wheals.

Guaiacum.—*Internally.*—Unique, miliary erythema (Fox).

Hydrargyrum.—*Externally* (ointments and sublimate solutions).—Chiefly, erythema, vesicles, “mercurial eczema;” rarely, sloughing; unique, universal exfoliative dermatitis (Morrow). *Internally.*—Rarely, erythema, urticaria, herpes, bullæ, purpura, impetigo, furuncles, ulceration. (It is hardly necessary to remind the reader that the existence of the relation of cause and effect in some of these instances is, to say the least, not proved. The true morbid agent may be free fatty acid in a rancid ointment.)

Hyoscyamus.—*Internally.*—Chiefly, erythema and urticaria with edema; rarely, scarlatinal rash, pustules, purpura.

Iodinum.—*Externally.*—Constant, brown discoloration, followed by redness and scaling; occasional, papules, pustules, and bullæ at a distance.

Iodides.—*Internally.*—Frequent, papulo-pustules (miscalled iodic “acne”) on face, shoulders, back, sometimes other regions. An infiltrated base shows at the surface or through its mass small pus-foci, later confluent. The severer forms may be an index of heart or kidney trouble. Less frequent, erythema, papules, wheals, petechiæ, polymorphous eruptions; rare, vesicles, bullæ, anthracoid and nodular lesions.

Iodoform.—*Externally.*—Usually, at site of application; rarely, at a distance, erythema, papules, vesicles, bullæ, wheals, purpura. Nephritis and death have been reported.

Ipecacuanha.—*Externally.*—Constant when action is prolonged; papules, vesicles, and pustules. *Internally.*—Unique. Erysipelatoid disks (Turner).

Jaborandi, Pilocarpine.—*Internally.*—Rare, macules, erythema, papules, wheals.

Mezereum.—*Externally.*—Constant, erythema and vesicles.

Nux Vomica, Strychnia.—*Internally.*—Rare, scarlatinal rash, miliaria with pruritus.

Oleum Cadini.—*Externally.*—Frequent, erythemato-papular or erysipelatoid lesions.

Oleum Morrhuæ.—*Internally.*—Rare, vesicles, acneiform lesions.

Oleum Ricini.—*Internally.*—Rare, erythema with itching.

Oleum Santali.—*Internally.*—Rare, petechiæ.

Oleum Terebinthinæ.—*Externally.*—Constant, redness and vesicles; occasionally, lesions at a distance. *Internally.*—Occasional, erythema, scarlatini-form rash, wheals, papules, vesicles, pustules.

Terebene.—*Internally.*—Pruritic papular lesions.

Oleum Tiglii.—*Externally.*—Constant, dermatitis with umbilicated pustules.

Opium, Morphine, etc.—*Internally.*—Frequent, pruritus, eczema; less frequent, scarlatinal and morbiliform rashes, wheals; rare, vesicles, pustules, furuncles, carbuncles. Hypodermic-needle abscesses and phlegmons are due to pus-germs.

Phenacetine.—*Internally.*—Generalized erythema, once (T. C. Fox).
Urticaria (Mahmert).

Phosphorus, Acidum Phosphoricum.—*Internally.*—Common, transitory flushing; occasional, bullæ, purpura.

Piper Methysticum.—Morrow describes the occurrence in the Hawaiian Islands of redness and dryness of the skin, with scaling, due to kava.

Pix Burgundica.—*Externally.*—Chiefly, vesico-pustules, eczematous lesions; rarely, papular erythema.

Pix Liquida.—*Externally.*—Erythema, papules, vesicles, pustules, acne. *Internally.*—Rare, erythema.

Plumbi Acetas, Carbonas.—*Externally.*—Brown or black discoloration. *Internally.*—Erythema; rare, purpura.

Podophyllum.—*Externally.*—Erythema, vesicles, often about genitals of workmen handling the drug.

Potassii Chloras.—*Internally.*—Rare, maculæ, erythema papulatum, bluish spots and cyanosis after prolonged use.

Pyrogallol.—*Externally.*—Common, erythema and vesicles; rarely, sloughing.

Quinina.—*Externally or internally.*—Commonly, scarlatinal erythema, with pruritus and scaling urticaria; rarely, purpura, vesicles and bullæ, gangrene.

Rheum.—*Internally.*—Unique, recurrent desquamative scarlatiniform erythema.

Ruta Graveolens.—*Externally.*—Common, erythema and vesicles.

Santoninum.—*Internally.*—Unique, erythema and urticaria with edema and scaling (Sieveking).

Sodii Santonas.—*Internally.*—Single case of vesiculation (Hubert).

Stramonium.—*Internally.*—Rare, scarlatiniform, erysipelatous, and purpuric rashes.

Sulphonal.—*Internally.*—Measly, purpuric, and scarlatinal rashes; later, itching and scaling.

Sulphur.—*Externally.*—Common, papules and vesicles.

Tanacetum.—*Internally.*—Varioliform lesions.

Thapsia.—*Externally.*—Constant, redness, vesicles, and pustules, resembling croton-oil lesions; once witnessed at a distance from site of application.

Tuberculin.—*Hypodermically.*—Erythema, scarlatinal and measly rashes. In leprosy subjects, frequently, generalized psoriasis.

Valeriana.—*Internally.*—Unique, urticaria (T. C. Fox).

Veratrina.—*Externally.*—Constantly, erythema, vesicles; occasionally, pustules, petechiæ.

Veratrum Viride.—*Externally.*—Erythema. *Internally.*—Erythema; in one case pustules (Forecke).

Viburnum Prunifolium.—*Internally.*—One case of scarlatiniform erythema followed by scaling, observed by the writer.

DERMATITIS VENENATA. (JOSEPH GRINDON, M. D.)

Under this head is grouped a somewhat heterogeneous collection of hyperemias and inflammations, varying in intensity from a light erythema to deep gangrene, due to a wide range of causes, all, however, chemical in nature.

The consideration of some of these causes is arbitrarily excluded from this article, and will be found under *Dermatitis Medicamentosa* for reasons there set forth.

The agents here treated of may be arranged as follows:

Mineral substances chiefly met with—(1) in the industries, (2) in wearing apparel, (3) in toilet articles.

Vegetable substances : (1) plants, (2) their products.

Animal substances : (1) poisons of insects, jelly-fish, etc. ; (2) secretions of one's own body—(a) normal, (b) pathological.

Mineral Substances.—*Chromium Compounds.*—B. W. Richardson describes a destructive inflammation with suppuration and ulceration, extending at times to the bone, in those engaged in the manufacture of *potassium bichromate*. Crocker reports areolated pustules on the palms of a french-polisher, and eruptions resembling eczema, pityriasis, or psoriasis have been observed in autotype photographers from the use of the same salt. Dr. Fry of this city observed a dermatitis on the forearms of an undertaker, due to handling a black cloth containing a chrome salt which was used to line the interior of coffins.

Cases are reported from the use of *picric acid* in dyes.

Aniline eruptions are really due to arsenic present as an impurity (see *Dermatitis Medicamentosa*). These dyes are used for stockings, gloves, veils, hat-bands, ribbons, artificial flowers, etc. The red is oftenest noxious. The eruption is pruritic and generally papular, but may be vesicular or pustular. It may spread from the exposed site, and is apt to recur, so that while the first attack may last but a few days, the entire process may extend over months.

Toilet Articles.—Whether used for the toilet or in the laundry, *soaps* are often a cause of skin-disease. The noxious ingredient may be an excess of alkali, as in green soap, impurity or rancidity of the fatty constituent, or some coloring matter or scent. Perfumes are often used in cheap toilet soaps to conceal a rancid or putrid odor. Unscented soaps are, as a rule, to be preferred. That eczemas are frequently perpetuated for months by the injudicious use of soaps, even of good quality, is well known to all dermatologists.

Triple extract of heliotrope has caused a dermatitis.

Many cosmetics, such as *face-powders* containing lead or arsenic, and *rouge*, are productive of mischief.

Hydrochlorate of paraphenylene dianin as a bleaching-agent for the hair has caused erythema with edema and vesiculation, spreading to the face.

Lime, flour, sugar, and many ordinarily inert substances are capable of exciting inflammation after repeated contact, as seen in the so-called grocer's itch.

Vegetable Substances.—*Rhus*, the only genus of *Anacardaceæ* (cashew family) in our range, furnishes several venomous species. The flowers are small and greenish-white with five-parted calyx, five petals, and five stamens. The fruit is a small dry drupe and the leaves compound.

The botanical descriptions of the poisonous species of *Rhus* are almost inextricably confused in some of our treatises on dermatology. Thus in a recent volume we find *Rhus toxicodendron* called *Rhus venenata*, and *vice versa*. Again, the fact that "poison oak" and "poison ivy" are merely two names for the same species, *Rhus toxicodendron*, does not seem to be clear to all.

Rhus toxicodendron (very poisonous) is usually found climbing on walls, fences, trees, etc., when it is called poison ivy. If no support be near at hand, it will sometimes grow erect in the form of a shrub or low tree, when it receives the name of poison oak. The leaves present three pinnately disposed, rhombic-ovate leaflets variously cut-lobed, notched, and sinuate. A striking characteristic is their inconstancy of form and asymmetry. Thus one-half of a leaflet may be deeply cut and the other entire, and the widest differences in notching may be observed between neighboring leaflets. In

the early fall the leaves turn a bright crimson. In this and in general outline the plant resembles the Virginia creeper, for which it is sometimes taken. The latter has a *palmate* leaf of *five* leaflets.

Rhus venenata, poison sumach, poison dogwood, poison elder (very poisonous), a shrub from 6 to 18 feet high, is found in swamps and has an odd-pinnate leaf of seven to thirteen entire leaflets. It is more poisonous than the preceding.

Franz Pfaff has shown that toxicodendric acid (Maisch) is identical with acetic acid, and that the true irritant principle is a fixed oil which he calls *toxicodendrol*.

Rhus diversiloba (very poisonous) is a struggling or climbing shrub of the Pacific coast. The leaves present three- or five-lobed and pinnatifid leaflets.

Rhus punila (the most poisonous of all the species) is a procumbent shrub of Western South Carolina, has odd-pinnate leaves, with about eleven oval or oblong, coarsely-toothed, somewhat acuminate leaflets.

Rhus vernix occurs in China and Japan, and furnishes the varnish used in lacquered work.

Susceptibility to poisoning by the various species of *Rhus* varies from a high grade to absolute immunity. The dermatitis excited generally presents multitudinous pinhead-sized vesicles or pustules seated on an intensely red base, attended with itching and burning and sometimes great edema. Certain milder cases present only erythema or papules. The tendency to recurrence for several successive years is a remarkable phenomenon which remains without satisfactory explanation, although White attributes it to renewed exposure. The irritant principle is presumably toxicodendric acid.

White and Cantrell have reported cases in which the disease was communicated by individuals who had handled the plant, but themselves remained unaffected. The auto-inoculability of the disease receives frequent demonstration from its communication to the genitals. The part should be thoroughly washed with soap and warm water as soon as possible.

Treatment.—A number of topical applications have been recommended. Those which have been most successful in the hands of the writer are—liquor plumbi subacetatis, one part to three of water, the officinal dilute liquor being too weak (this is not to be used when the epidermis is broken), black-wash, tr. sanguinarie and water, equal parts, and the following:

R _y . Acidi carbolicæ,	ʒj ;
Glycerini,	ʒss ;
Pulv. zinci oxidi,	ʒiv ;
Liquoris calcis,	Oj.

Later, when the inflammation has subsided, Piffard's unguentum diachyli (equal parts by weight of lead plaster and vaseline, mixed when melted) is excellent. It may be used from the first in milder cases, with the addition of morphine, 1 to 50, if there be much pain. Van Harlingen has obtained good results from ext. grindeliæ robustæ fl., 1 part to 30 of water, and Hardaway recommends zinc sulphate, 1 to 16 of water.

Many other plants possess irritant properties capable of exciting cutaneous inflammation. The proportion of individuals possessing immunity is much greater for some of these than for others.

We may mention among American and domesticated species: Indian turnip, *ariscema triphyllum* (not *psoralea esculenta*); skunk cabbage, *symplocarpus fetidus*; bitter orange, *citrus vulgaris*; catalpa, several species;

feabane, *erigeron Philadelphicum* and *heterophyllum*; burdock, *arctium lappa*; spurge, *euphorbia corollata* and others; poke, *phytolacca decandra*; smartweed, *polygonum* of several species; wood anemone, wind-flower, *anemone nemorosa*; clematis, including leather-flower, *c. viorna*, common virgin's bower; *c. Virginiana*, and *c. crispa*; larkspur, *delphinium consolida*; buttercup, crowfoot, *ranunculus repens*, *sceleratus*, *acris*, and *bulbosus*; nettle, *urtica doica*; dog chamomile, *anthenis cotula*; vanilla plant, deer's tongue, *liatris odoratissima*; primrose (of conservatories), *primula obconica*; oleander, *nerium oleander*; parsnip, *pastinaca sativa*; balm of Gilead, *balsamum Gilcadense*. White enumerates some sixty native species.

The manchineel of the West Indies and its congener, the sand-box tree, as well as the upas of Java, are celebrated for the acrid properties of their juice.

Animal Substances.—Contact with *jelly-fish* and the poisons deposited in the stings of many *insects* causes lesions, usually wheals. *Caterpillars*, when crawling over the skin, often deposit a secretion which causes intense burning and redness. Usually a long streak can be seen, as though a hot iron had been drawn over the surface. Alkalies and carbolic washes give relief.

Prolonged contact of *urine* is a cause of chafing in infants, or in adults afflicted with fistula or incontinence, especially when the secretion is ammoniacal.

Intertrigo finds its chief factor in the retention of sweat between opposed surfaces in infants or fat adults.

Purulent secretions are an evident source of auto-infection, but the process here being rather biological than chemical, should be discussed under another head.

DERMATITIS CALORICA. (JOSEPH GRINDON, M. D.)

High temperatures produce inflammation of the skin through the agency of heated solids, liquids, gas (steam), flame, or of the electric current, artificial or accompanying lightning. Strong acids and caustic alkalies cause similar lesions. Impact of the sun's rays produces its effects (*eczema solare*) in part through the action of actinic rays in the ultra-violet spectrum. These play a more important part in the production of dermatitis from exposure to the electric light.

Burns are of three degrees: The first, or erythematous, presents the four cardinal signs of inflammation, although swelling may be slight. The second, that of vesication, is marked by serous exudation, with formation of vesicles or bullæ. The third, or escharotic degree, extends to the cutis vera or deeper. There is death of tissue and consequent scarring.

Burns due to lightning often present streaks and lines with quaint arborizations, which have given rise to the mistaken notion that branches of neighboring trees had been "photographed" on the skin by the lightning.

Length of contact is as important as degree of heat in determining the depth of attendant destruction. This fact finds frequent illustration in anesthetic leprosy and in epileptic and alcoholic coma. Excess of zeal in the therapeutic application of heat has occasioned severe and even fatal burns and scalds.

The constitutional **symptoms** attending extensive burns are alarming. Within twenty-four to thirty-six hours there appear restlessness, delirium, and, particularly in children, convulsions; or, again, sopor with a small

pulse and subnormal temperature, soon followed by death. Among complications are hemorrhages from the alimentary, respiratory, and urinary tracts or into serous cavities, the retina, etc.; serous cerebral effusion and retention of urine. Patients surviving more than thirty-six hours present ulcerations, opening joints and attacking the walls of vessels, thus causing secondary hemorrhages. Ulceration of the duodenum, sometimes with perforation, may occur as early as the third day or be delayed many weeks.

Inflammation of the lungs, pleuræ, meninges, and kidneys often occurs. Protracted suppuration exhausts the patient's strength, and may lead to amyloid visceral disease.

Among later complications are tetanus, pyemia, and erysipelas.

Other conditions noted are—decrease in number of leukocytes and breaking down of erythrocytes; emboli and thrombi, consisting of Bizzozero's plaques, and found oftenest in small branches of the pulmonary artery, thus embarrassing the right heart and causing anasarca; thrombi are also found in the lungs, kidneys, stomach, intestines, spleen, liver, skin, and brain. Masses of degenerated epithelium and hemoglobin are found in the convoluted tubules of the kidneys and loops of Henle.

Exuberant granulations mark the building of new tissue. The resultant scars are dense, ridged, puckered, and bridled, and often cause distortion of natural orifices and fixation of joints. They may become the seat of epithelioma.

Prognosis.—This depends on the degree, depth, extent, and location of the lesion. The first two circumstances are of less import than the last two. Burns involving half the surface are with rare exceptions fatal, and those covering one-third are generally so. Those situated about the abdomen, thorax, neck, or head, and those occurring at either extreme of life, present the highest mortality. When severe constitutional symptoms are delayed for over thirty-six hours the prognosis is favorable.

Treatment.—**Local.**—The chief indications are for the exclusion of air and relief of pain, and in the severer degrees the absorption and removal of pus, antiseptis, and economy of the body-heat. Dressings should be changed as often as necessary.

Burns of the *first degree* may be dredged over with a protective powder, such as flour, bismuth, or, better, sodium bicarbonate. Lead-wash and Caron oil give good results. Glycerine or cold cream may be used in sun-burn, as well as for the prevention of this condition. In the second degree the blistered epidermis should not be cut away, but the blisters opened and gently drained. When the surface is extensive it should be dressed in successive portions, so as to avoid too rapid loss of heat and painful exposure to the air. The best dressing is that which is nearest at hand. Good results have been obtained with flour, cotton, molasses, white-lead paint, varnish, and mashed potatoes. Sodium bicarbonate in powder or saturated solution, 3 per cent. carbolic solutions (watching the urine, for fear of poisoning when the surface is extensive), fluid extract of hamamelis, and 5 to 15 per cent. solutions of cocaine hydrochlorate, may be mentioned. Lister covers the surface with lint soaked in carbolized oil, 1:30. Over this is placed carbolized gauze covered with sheet rubber or mackintosh, and a moderately firm bandage over the whole. When the gauze becomes soaked or the odor is noticeable, the gauze is changed, but the lint is left in place. Or the lint may be wet with a 4 per cent. borax solution and dressed with salicylated cotton. It is always well to use some pressure in bandaging. For burns of the *third degree* similar antiseptic dressings may be used, or Hebra's continuous bath, a sheet

being fastened to the edge of the bath-tub and the patient suspended as in a hammock in water at 90° to 100° C. Antiseptics may be added to the water, which must be frequently changed, and the patient left undisturbed for weeks or months.

Healing of the large granulating surfaces is hastened by skin-grafting or even transplantation. Exuberant granulations require pressure, trimming off, or the solid stick. Opposed surfaces must be kept apart, the patency of orifices maintained by plugs, bougies, etc., and the neck and limbs so dressed as to overcome cicatricial contraction. In spite of these measures considerable deformity will result at times, when recourse may be had to surgical methods.

The constitutional treatment may be summed up as follows: rest, stimulation, nutrition. Alcohol is usually indicated, and opium always. Hot bottles and bricks should be used to maintain the body temperature. Often there is intense thirst, calling for ice and carbonated water. The diarrhea of the suppurative stage is best treated with bismuth and opium.

X-RAY DERMATITIS. (JOSEPH GRINDON, M. D.)

The dermatitis due to impact of the *x*-ray is most apt to follow frequent and protracted exposures, and is peculiarly painful and rebellious. A period of delay lasting from a few hours to several weeks, but oftenest four or five days, is followed by the appearance of an erythema with infiltration and pain, or in severer grades by the usual signs of an active inflammation or even gangrene, with deep destruction, involving muscles, tendons, and nerves. Periostitis and osteitis have been observed, with much thickening, as well as severe neuralgic pain and paralysis due to involvement of nerve-trunks. In a case of Gilchrist's exposures of the hand, wrist, and the lower part of the forearm were made for four hours daily during three weeks, when painless swelling and redness appeared. Three weeks later the pain was sufficient to prevent sleep, and there were deep pigmentation and exfoliation. Ten days later the skin was stretched and glossy and the first and second phalanges of all the fingers were distinctly thickened, as shown by a skiagraph.

In contrast to the lateness of the manifestations in this case is one of Crocker's, in which redness and irritation developed on the day following exposure. The tube was at a distance of five inches. Six days later the skin felt stiff on motion, and a few days later vesicles were seen. After a week the epidermis detached, leaving a slowly-healing surface.

It is believed by some that minute particles of platinum or aluminum are carried from the electrodes through the glass bulb into the tissues. This might explain the inveterate character of the graver cases, and the fact that complete removal of the affected tissues is often necessary to a cure. Others hold that a specific action of the ray itself is responsible for the reaction of the tissues.

Milder cases presenting the usual features of dermatitis or of eczema demand ordinary soothing applications.

Temporary baldness of exposed hairy surfaces and loss of nails have been recorded. Frederick S. Kollé reports the case of a twelve-year-old boy whose scalp was exposed for forty minutes, the tube being at a distance of eighteen inches. Three weeks later (at night) the hair suddenly fell out, leaving a large bald patch on the side of his head at the site exposed to the ray. The denuded scalp was slightly edematous. There was neither redness, scaling, itching, nor impairment of sensibility.

DERMATITIS CONGELATIONIS. (JOSEPH GRINDON, M. D.)

This term includes all alterations of the skin produced by cold, even when above the freezing-point. They affect by preference the extremities, ears, nose, and cheeks, and present three degrees.

The first or erythematous degree is accompanied by redness, heat, tumefaction, and itching, burning, or pain. The nutrition of the skin being disturbed, it is apt to "chape."

The second degree is characterized by flattish bullæ with blood-tinged contents seated on a livid skin. They are oftenest seen on the fingers, toes, and heels. If the blisters be allowed to rupture, the exposed surfaces take on a pale, pultaceous, painful, slow-healing ulceration.

In the third or gangrenous degree the affected parts are cold, insensible, immobile, brittle, at first pale and later livid, and often of a woody hardness. A line of demarkation is after a time established between the quick and the dead, and the latter cast off. Suppuration, fever, and occasionally septicæmia or phlebitis, accompany the condition.

Rigors, pallor, a subnormal temperature, and small pulse, precordial anxiety, sopor, and death may supervene if the cold be intense or its action prolonged.

Chilblain (pernio) is usually a variety of the first degree, but may pass into the second. It particularly affects weak-hearted, low-toned, anemic subjects, although the robust may develop it, especially in early life, by too rapid a transition from a low to a high temperature. Recurrence is frequent. It is classed by some with the exudative erythemas.

Prophylaxis.—Tight shoes and gloves are powerful predisponents. As soon as the existence of the vascular spasm which precedes the condition just detailed is recognized the part should be bathed in cold water, or, better, rubbed with snow, heated rooms or the proximity of fire being avoided. Certain writers, however, have claimed the best results from an opposite course—*i. e.* the immediate use of the hot bath.

Treatment.—**First Degree.**—Among applications recommended for chilblains are tincture of iodine, collodion, dilute mineral acids, turpentine, lead-wash, solution of silver nitrate, 1:50, and balsam Peru. The internal use of iron, arsenic, cinchona, or cod-liver oil will at times be indicated.

In the **second degree** we should open the blebs and canterize their bases with the solid stick, dressing with a mildly stimulating ointment. Woollen stockings and mittens should be worn during several next succeeding winters.

The treatment of the **third degree**, when once established, is mainly surgical, and need not be entered into here. Vertical elevation of the limb and the continuous bath are recommended. Local tepid baths are of use in all degrees after the first spasm has passed off.

DERMATITIS TRAUMATICA. (JOSEPH GRINDON, M. D.)

Inflammation of the skin may result from any form of mechanical injury, whether this involves a loss of substance, a solution of continuity, or leaves the surface unbroken.

Thus we have as exciting causes—

Pressure, from tight shoes, bandages, the dorsal decubitus, etc.

Friction, from wearing apparel, surgical appliances, tools, and as a cause

of at least some cases of "neurotic excoriations" and "stigmata." Long-continued pressure and friction result in epidermal thickening, either physiological (callositas) or pathological (clavus.)

The ravages of insects in or on the skin are discussed elsewhere.

Nail-lesions, as a rule, extend no deeper than the tops of the papillæ, and hence leave no scars. They are an index not only to the existence of pruritus, but to its degree, distribution, and mode. Thus in pediculosis corporis we find long parallel scratches, whereas in scabies we see numerous dug-out points. The severity of the scratching is not the only factor, however, in determining the extent of the lesions. This is largely dependent on the resistance of the integument, which varies for individuals as well as for diseases. Thus in senile pruritus the lesions are often insignificant as compared to the ferocity of onslaught suffered by the skin. Brocq holds that scratching is the main factor in the production of many chronic papular affections, determining a process of "lichenification." The resultant inflammation may be simple (dermatitis) or catarrhal (eczema). A concomitant pus-infection gives us ecthyma and lymphadenitis. When the condition is of long standing we have much thickening and pigmentation.

The reaction excited by traumatism varies from mere hyperemia to extensive death of tissue. Besides the severity of the original injury, the following factors here come into play:

Circulatory Conditions.—*Local*: as seen on the legs of old laboring-men and multiparæ with varicose veins.

General: dropsy, heart disease, arterial sclerosis, atheroma.

Malnutrition, anemia, cachexia, scorbutus, senility.

Innervation.—When the nerve-supply is interfered with, slight traumatisms may lead to tremendous consequences, as seen in the swiftly excavated bed-sores of paraplegia and cerebral abscess (Charcot), the hand-and-foot lesions of leprosy, and the perforating ulcer of tabetics.

Infection.—*General*: syphilis, tuberculosis, leprosy, etc. *Local*: purulent, etc.

VACCINAL RASHES. (JOSEPH GRINDON, M. D.)

The vaccinal rashes present nothing specific or characteristic in their appearance, their production, as is the case with drug-eruptions, seeming to depend rather on the tissues than on the substance introduced. They are transitory, and more common with bovine than with humanized virus.

All eruptions occurring after vaccination are not vaccinal. Eruptions may follow vaccination or revaccination—

1st. By auto-intoxication or auto-infection with the virus itself—generalized vaccinia.

2d. By angio-neurotic disturbance due to the virus—adventitious rashes: roseola, urticaria, erythema multiforme.

3d. By mixed infection—syphilis, tuberculosis (?), leprosy (Beaven Rake). erysipelas, pus-infections,¹ dermatitis gangrænosa infantum.

4th. By excitement of a latent tendency—eczema, psoriasis.

5th. By coincidence—the eruptive fevers, zoster, etc.

Urticarial, bullous, or herpeticiform eruptions of a chronic and recurrent character cannot, as yet, be assigned a definite position.

Some of the above-mentioned conditions may deserve description.

¹ The writer has never observed the often alleged relation between vaccination and true impetigo contagiosa, which he does not regard as primarily a pus-disease.

Generalized vaccinia, while rare, is well attested. It appears at the height of the process. Gaucher's fatal case appeared on the eleventh day. It is merely an extension of the often-witnessed cropping up of accessory vesicles (vaccinola) in the neighborhood of the original lesion.

Urticaria is rather common as an early rash (second, third, or fourth day). The late recurrent type is rare.

Erythema, not infrequent, may take the form of a finger-nail roseola or occur in large patches, or, again, be diffuse and scarlatinal. It generally commences on the arm, thence spreads over the whole surface, often with some rise of temperature. There may be papules or papulo-vesicles on the limbs. It appears as early as the third day or as late as the eighteenth day, oftenest about the tenth.

Behrend's morbiliform type is more common in the writer's experience. The eruption much resembles that of measles, is dark, sometimes livid, with a hemorrhagic tendency, very profuse, pruritic, and appears about the eighth or tenth day.

Crocker has oftenest seen a papular, papulo-vesicular, pustular, or rarely bullous rash appearing between the fourth and eighteenth day, and spreading over the whole body. The papules are areolated, crowned with a vesicle, and often arranged in rings.

Erythema multiforme has been observed in the first week.

True purpura is rare.

Dermatitis gangrenosa of infants and young children may appear as early as the third day. Sometimes on the vaccinated arm, or on the buttocks or thighs, there appear pinhead-sized papulo-pustules, which spread, rupture, and scab over, leaving a pustular border with red areola. These give place to various-sized ulcers. The lesions may be bullous or their contents hemorrhagic. There are a high temperature, severe constitutional symptoms, and often a fatal issue. A majority of the subjects are tuberculous. The treatment consists in nutrition and antiseptics. Quinine, sodium sulphocarbolate, and opium have been recommended.

CLASS II.—HEMORRHAGES.

PURPURA. (JOHN T. BOWEN, M. D.)

THE term "purpura" denotes a cutaneous condition in which larger or smaller hemorrhages are present in the skin, not due to traumatism. Strictly speaking, therefore, purpura is a symptom occurring in the course of various affections and from various causes. As in the case of urticaria and multiform erythema, with which purpura is often allied, numerous cases and groups of cases occur where the pathological process has received the name of its most apparent symptom, in default of a clearer understanding of its mechanism and etiology. In this way we have come to speak of purpura simplex, purpura hæmorrhagica, etc., according as the lesions are confined to the skin or are accompanied by internal hemorrhage and more or less grave symptoms. It should be distinctly understood that the different

disorders in which cutaneous hemorrhages occur are as yet in great part imperfectly understood, and that therefore an exact division of the purpuras is at the present time impossible. For clinical convenience, however, and for the sake of affording a greater opportunity for study, the purpuras may be divided into several groups, some of which are as yet ill defined, the lines of demarkation from one another not being sharply drawn.

Before considering these various groups of purpura it will be well to enumerate the conditions in which cutaneous hemorrhage occurs purely as a symptom, in connection with certain more or less well-defined pathological processes.

Certain names have been given to purpura based upon the form or extent in which it shows itself clinically. Thus, *petechiæ* are small punctate or lenticular spots of hemorrhage, at first of a deep-red color, later becoming dark brown or violet, and possessing the feature, common to all forms of purpura, of not disappearing under pressure. Later still, the spots fade in the center, the color changing to shades of yellow and green, until finally the skin presents its normal appearance. Sometimes the petechiæ are seated at the mouth of the hair-follicles. *Ecchymoses* are collections of blood of greater extent and more irregular shape, sometimes occupying the whole or a great part of a limb. *Vibices* is a name given to elongated, thread-like bands of ecchymosis. The evolution of all these forms is the same.

Purpuric eruptions occur in the course of many of the specific fevers. In variola a hemorrhagic eruption may be an early symptom, and in these cases there is usually a fatal termination. It may occur in scarlet fever, measles, typhus, typhoid, and epidemic cerebro-spinal meningitis. It often occurs as a so-called drug-eruption, following the use of iodide of potassium, quinine, copaiba, belladonna, chloral, phosphorus, and arsenic, and in the early stage of chloroform inhalation. Alcoholism seems to predispose to purpuric eruptions, but the connection is not a close one. A purpuric eruption occurs from the venom of snakes, due in this case probably to the effects of the leuko-maïnes. There are a number of general diseases in the course of which purpura may occur, as Bright's disease, pernicious anemia, leukocythemia, tuberculosis, and cachectic diseases generally. Purpura in the new-born is probably due to the sudden change in the circulation at this time. Occurring in pregnancy, purpura is of grave import both to mother and child. In certain diseases of the nervous system, both functional and organic, we may meet with purpuric eruptions. Under the functional may be cited intense grief, shock, neuralgias, etc. Tubercular meningitis, posterior myelitis, and injuries to nerves are occasional causes.

Purpura Simplex.—Under this title it has been the custom to class those cases of cutaneous hemorrhage which appear suddenly and, as a rule, without previous symptoms. They are more likely to appear first on the lower extremities, and they usually come in crops. Their form is rounded or oval and occasionally circinate. They may last for two or three weeks, and rarely are accompanied by constitutional symptoms. The eruption from the ingestion of iodide of potassium and other drugs may be of this nature, and there is no sharp boundary from purpura hæmorrhagica. The class purpura simplex has therefore slight ground for existence, and is mentioned here solely for the sake of completeness.

Purpura Rheumatica.—It is by no means proved that this class of cases has any connection with rheumatism, and the term arthritic purpura, as proposed by Osler, would be much more appropriate. Arthritic purpura must be looked upon as a broad term, embracing apparently many dissimilar

types. It comprises cases of so-called purpura simplex with lesions limited to the lower limbs and associated with slight arthritic manifestations, as well as those where the joint-symptoms are so intense as to simulate acute rheumatism very closely.

A very common type of arthritic purpura is that known as Schönlein's disease, which is characterized by multiple arthritis and an eruption of a purpuric nature associated often with urticaria and erythema multiforme. Erythema nodosum also is a frequent symptom. The constitutional disturbance is usually slight, although Osler says the temperature may rise to 101–103° F., and there may be some gastric symptoms and sore throat. The purpuric eruption makes its first appearance on the lower limbs, as a rule. There is often a combination of urticaria with purpura, the so-called purpura urticans, and not infrequently there is eczema about the lower limbs. In ten or fifteen days usually the patient is well, although there may be recurrences. Sometimes the eruption may persist at intervals for years.

In cases higher in the scale that we are considering the eruption is not confined to the lower limbs, but makes its appearance on the upper portion of the body, and in this case the general symptoms are usually more pronounced. Outbreaks of localized edema, sometimes of vast extent, may occur at the same time or alternately with the purpuric eruption. In other cases there may be gastro-intestinal symptoms, attacks of vomiting and diarrhea, of greater or less prominence in comparison with the other symptoms. Osler emphasizes the throat-lesions, and says that in two instances he has seen necrosis and sloughing of a portion of the uvula.

In these cases, so varied in their manifestations, three groups of symptoms are to be noted: 1. The arthritic symptoms; 2. The gastro-intestinal symptoms; 3. The cutaneous symptoms, which comprise purpuric and urticarial eruptions, papular erythemata of the multiform type, and cutaneous edema. Schönlein's disease comprises simply the cases of mild course where the predominating symptoms are arthritis and purpura. This is the most common form. In other cases the gastro-intestinal element may be most apparent, or again the outbreaks of cutaneous edema may predominate. It is seldom that these three groups of symptoms are equally developed.

1. The *arthritic symptoms* are very variable, and may sometimes consist only of feeble pains in the joints of the lower limbs. Besnier and Lailler think that the articular pains are more likely to show themselves in the joints of the upper limbs in persons who fatigue their arms. Mathieu considers that the articular pains are less movable than those of acute articular rheumatism, and that there is less exudation in and around the joint; also, the temperature is not so high as in the latter disease.

2. The *gastro-intestinal symptoms* may be very slight or exceedingly pronounced. They may be of paroxysmal character, and resemble the gastric crises in locomotor ataxia. Oftentimes there is blood in the stools.

3. The *cutaneous manifestations* should, as before said, be considered as a group comprising purpuric eruptions, multiform erythema, urticaria, and circumscribed or diffuse edema. Sometimes one only, sometimes all, of these cutaneous symptoms may be present, the purpuric tendency, as Mathieu puts it, predominating. So, too, with the three groups of symptoms: rarely all are present to an equal degree in the same case; sometimes one group and sometimes another predominates, and sometimes an entire group may be wanting. In this way it is seen that a great many combinations of symptoms may be produced, which may represent the same pathological process. Whether the etiology is the same in all cases we do not as yet know, for it

may be that the future will show that these cases that we are considering belong in different categories. Further complications in purpura rheumatica are hemorrhages from the mucous membranes and great elevation of temperature—symptoms which serve still more to embarrass our diagnosis. In fact, there is so great diversity in different cases that we must consider purpura rheumatica at present as simply a general term convenient for covering a number of very varied clinical symptoms which in many cases seem to represent the same disease.

Henoch and Couty have described a form of purpura characterized by recurrent attacks of cutaneous hemorrhage, associated with acute edema of the skin and gastro-intestinal disturbances. Pains in the joints, extra-articular edema, and articular effusion were sometimes present. Couty thought it should be separated from all varieties of purpura. It is characterized by a rapid onset, and there are usually distinct attacks. Couty makes four subdivisions of this form: 1. The purpura is complicated with cutaneous edema and gastro-intestinal crises; 2. The purpura is complicated with edema; 3. The purpura is accompanied by intestinal troubles only; 4. The purpura exists alone. Osler considers that these cases belong under purpura rheumatica, of which they constitute the most aggravated and serious forms. From what has been said it will be seen that this form is simply another combination of the three symptom-groups that have been referred to above. Mathieu, the most prominent French writer on the subject of purpura, includes the form of Henoch and Couty under his purpura exanthématique rhumatoïde, a type that ranges from purpura simplex, limited to the lower limbs and accompanied perhaps with slight articular pains, to the cases of general purpuric eruption with internal hemorrhage and severe articular symptoms. Mathieu's purpura exanthématique rhumatoïde we would put in the class of purpura rheumatica, agreeing to his grouping of the clinical symptoms, but not to his name.

The relationship of acute circumscribed or angioneurotic edema to the purpuras is interesting. As has been shown, the association of angioneurotic edema with purpura in the forms we have been considering is a frequent one. In a case seen by the writer the patient, a boy one and a half years old, presented extensive areas of edema in various parts of the body, which quickly subsided, to be rapidly followed by similar outbreaks in other localities. In most places a few purpuric patches could be seen over the edematous areas. The whole of the leg and arm was sometimes occupied by the edema. There was some indication of intestinal hemorrhage, but gastric symptoms were absent. In this case the cutaneous edema was the predominating symptom, and the purpuric eruption quite insignificant by comparison. There are other instances recorded of the association of angioneurotic edema with hemorrhage in various places, as in a case reported by Joseph, where the former symptom was accompanied by paroxysmal hemoglobinuria. It seems to the writer most probable that many of the cases of acute edema complicated with gastro-intestinal troubles belong in the same category and may have the same etiology as the various types described above under Purpura Rheumatica. It has been shown that cutaneous hemorrhage and cutaneous edema are to be regarded as symptoms merely, and that they are often combined in the cutaneous manifestations of so-called purpura rheumatica. It has been further shown that the symptoms of purpura rheumatica are very capricious in their occurrence, and that the articular, the cutaneous, or the gastro-intestinal group of symptoms may be wanting. Hence it seems probable that acute edema, when accompanied by gastro-intestinal

crises, may sometimes belong in this same group even if the purpuric eruption be wanting.

Purpura Hæmorrhagica.—Under the name “*purpura hæmorrhagica*” it is customary to consider the cases of more severe purpuric eruption accompanied by bleeding from the mucous membranes. In this class is to be arranged the type described by Werlhof, the so-called *morbus maculosus Werlhofii*. It begins abruptly, with few if any prodromal symptoms, by hemorrhage from the gums or epistaxis, closely followed by a purpuric eruption, beginning usually on the lower limbs and extending upward, but never occupying the face. The eruption is in the form of small lesions more or less confluent, but later on the lesions increase in size, while the hemorrhages from the mucous surfaces continue, and there may be a slight amount of fever, loss of appetite, and malaise. The improvement, when once it has appeared, is rapid, and in eight or ten days the patient is well without after-symptoms. Such, according to Lasèque, is the typical *morbus maculosus* of Werlhof—a name which has come to be extended to almost all purpuras that are accompanied by internal hemorrhages.

In many cases the affection presents a much more serious aspect than in the pure type of Werlhof, and may be accompanied by pronounced fever. To these cases Mathieu gives the name *purpuras infectieux primitifs*, believing that we here have to deal with an acute infectious process as yet non-classified. They may begin either by the appearance of typhoidal symptoms or by moderate cutaneous hemorrhages, which precede the grave general phenomena. Oftentimes when the typhoidal symptoms are the earliest manifestations it may be difficult to distinguish the affection from typhoid fever. Vomiting, diarrhea, epistaxis, hematemesis, hematuria, and hemorrhages from the intestine accompany this form to a greater or less extent. The duration is variable and the outcome uncertain.

Cases of still greater severity occur to which the name of *purpura fulminans* has been given. Here there is usually a preceding chill and malaise, often intense pain in the back, followed by high fever. A purpuric eruption soon shows itself, and death may occur in a few days after hemorrhage from the intestinal organs. In some of these cases there may be pain and swelling of the joints. Albuminuria and enlargement of the spleen are not uncommon. Endocarditis and pericarditis sometimes occur, and gangrene of the skin has been observed. There is good reason for believing that this class of cases represents an acute infectious process. In the acute, rapid cases the diagnosis from variola or scarlatina hæmorrhagica may present some difficulties, and before the eruption appears typhoid fever is simulated.

Etiology.—Holding fast to the conception that purpura, properly speaking, is a symptom merely, and that the affections classed as purpura rheumatica, purpura hæmorrhagica, etc. represent groups of cases, probably of very varied origin, in which purpuric eruptions are a leading symptom, it is evident that many separate factors may enter into the etiology. We have already referred to the purpuras occurring in the course of the specific fevers, and here it is the infectious process that causes them. The toxic purpuras caused by the ingestion of drugs, notably iodide of potassium, have also been mentioned. The rôle of the nervous system is a prominent one in the etiology of purpuras, so far as our present knowledge extends. Almost all the cases that we have classed under purpura rheumatica are probably produced through the agency of the nerves. The recurrent gastric crises, taken in connection with the arthritic symptoms and divers cutaneous eruptions, make that view the most plausible. Many believe, however, that Schönlein's dis-

ease is of rheumatic origin; and support is given to this view, as Osler remarks, by the sore throat that so frequently precedes the eruption and by the occasional occurrence of endocarditis and pericarditis.

The form described by Henoch and Couty suggests a nervous origin much more strongly than do the groups lower down in the scale, and yet it has been shown that there is good ground for combining all these cases in the same class, as one runs imperceptibly into another. Osler observes: "Are these cases truly rheumatic, or is not the articular affection on which so much stress is laid analogous to what we see in hemophilia and scurvy? It is difficult to escape from the former view in the presence of characteristic cases of peliosis rheumatica with endocarditis and pericarditis, and yet the close relationship and even interchangeability of certain of these cases of purpura with urticaria, with erythema nodosum, and with the angio-neurotic edema favor the suggestion that the entire group may depend upon some poison—an alkaloid, possibly the result of faulty chylipoietic metabolism, which in varying doses in different constitutions excites in one urticaria, in a second peliosis rheumatica, and in a third a fatal form of purpura."

Certain other facts bear out the theory of a nervous origin of many forms of purpura. Thus it is on record that purpura hæmorrhagica has occurred after strong emotion, violent anger, and severe attacks of neuralgia.

Hartmann has reported a case where a severe attack of purpura hæmorrhagica followed a fall from a bench, and Lancereaux a similar case occurring after a violent fright. Over-exertion, as in hunting, has been known to bring on an attack, also excesses in alcohol.

With regard to the cases that we have described under Purpura Hæmorrhagica, a certain number at least must be regarded as of infectious origin. The typhoidal and acute fulminating varieties belong here especially, as well as those cases that follow an acute infectious disease, as pneumonia and scarlet fever.

Frequent attempts have been made to demonstrate micro-organisms in purpura hæmorrhagica. Petrone found micrococci and bacilli in the blood taken from a vein. This blood was injected into rabbits, with the result of producing cutaneous hemorrhages and the same micro-organisms in the blood. Gimard also found micrococci in the blood in two cases of purpura hæmorrhagica, and the injection of bouillon cultures into rabbits produced purpura. Claisse, in a case of rheumatic endocarditis with nephritis and numerous cutaneous hemorrhages, found pneumococci in the vegetations of the mitral valve, in the spleen, kidney, and in sections through the cutaneous lesions. Tizzoni and Giovannini cultivated a bacillus from three children in one family who were attacked with purpura following impetigo contagiosa. This bacillus, a peculiarity of which was its rounded ends, produced, when inoculated into the subcutaneous tissue of dogs, rabbits, and guinea-pigs, the characteristic symptoms, including the hemorrhages into the skin. They consider that the bacillus is the cause of purpura, and that it affects the organism by the poison produced by it.

Kolb's work in Berlin upon three fatal cases of purpura fulminans demonstrated a bacillus, possibly the same as that cultivated by Tizzoni and Giovannini, which was inoculated in pure culture on a large number of animals and produced cutaneous and internal hemorrhages. Finger examined a case of purpura associated with atheroma of the aorta and parenchymatous nephritis, and found cocci in the blood-vessels and tissue of the skin. He also found numerous polynuclear leukocytes and other signs of inflammation, so

that he considered the affection in this instance to be a hemorrhagic dermatitis of metastatic bacterial character.

From this evidence it will be seen that there is good ground for believing that some of the forms and groups of purpura are of bacterial origin, and, in addition to those mentioned, the staphylococci and the streptococci have been shown to be capable of producing cutaneous hemorrhage. So far as the subject has been investigated, it would seem probable that cutaneous hemorrhages may be caused by a variety of micro-organisms, and that the more acute typhoidal and hemorrhagic varieties of what we know as purpura may be dependent on one or more specific organisms not yet classified.

Pathological Anatomy.—The important lesions found in the skin histologically are collections of red blood-globules situated in the corium. In most cases, especially in those in which signs of inflammation are present clinically, the vessels in the papillary layer are very much distended, and migratory cells are found in their vicinity. There is also an edematous exudation. Leloir has noted a proliferation of the endothelium of the capillaries of the papillæ, which were also much dilated. Hayem also has met with four cases of purpura where there was endarteritis, and Wilson and Fox have observed an amyloid degeneration of the capillaries.

The results of an examination of the blood in purpura have been varied and rather unsatisfactory. Thus a diminution of the number of red globules and of the solids; variations in the amount of fibrine—sometimes an increase, sometimes a decrease; a frequent increase in the number of white corpuscles; an alteration in the form of the red globules; the presence of abnormal elements, as bacteria, etc.,—all these changes have been described (Du Castel).

Thrombosis and embolism of the cutaneous vessels have been noted by some observers. Hayem experimented on animals by injecting blood-serum, taken from the blood of an animal of the same or of a different species, into the vessels directly, and found that small fibrinous granulations were formed in the blood-vessels of the various organs and mucous surfaces. He concludes that the adulteration of the blood by material of cellular origin may produce granular concretions, and in consequence emboli, which are the cause of hemorrhagic lesions. Leloir in one case of purpura discovered masses of coagulated fibrine adherent to the walls in a large number of cutaneous vessels. Furthermore, masses of micro-organisms have been found occluding the vessels in the hemorrhagic area in a number of cases of purpura.

Diagnosis.—As has been stated, the boundary-line between purpura simplex and purpura hæmorrhagica is not sharply drawn, and many cases that begin as the former variety end in the latter. In purpura hæmorrhagica, however, there is, as a rule, more prodromal depression and more pronounced constitutional symptoms and fever at the onset.

Flea-bites resemble a purpuric eruption closely, and the name purpura pulicosa has been applied to the lesions caused by the insects. When closely examined, however, flea-bites may always be distinguished by the presence of a dark point at the center of the lesion, which indicates the point of puncture. Regarding purpura as a symptom merely, it is important to separate those cases due to a known cause from the types of purpura rheumatica, purpura hæmorrhagica, etc. The exhibition of some of the drugs that may cause purpuric eruptions, such as iodide of potassium, quinine, copaiba, etc., should be inquired into in all cases of purpura simplex. Its association with a number of general diseases, such as Bright's disease, pernicious anemia, leukocythemia, etc., should be borne in mind. Hemophilia may be detected from the patient's history.

Scurvy is closely related to purpura, and the differential diagnosis may often be perplexing. In well-marked cases of scurvy the hemorrhages are larger in extent, and there is great swelling of the gums, with fever and loosening of the teeth. Brawny induration of the tissues of the legs is also a feature, and there is usually greater general prostration. Privation, and especially the lack of vegetable food, are important factors. There may, however, be sporadic cases of scurvy, when a differential diagnosis is almost impossible. Lasèque and Legroux relate that they saw in the Seine prison during the siege of Paris cases that in ordinary times would have passed for purpura simplex or purpura rheumatica.

When the purpuric eruption occurs in association with a recognized infectious disease, such as scarlet fever, small-pox, etc., it is evidently symptomatic: oftentimes, however, the acute fulminating form may be very difficult to distinguish from hemorrhagic small-pox, where death may occur without other cutaneous lesions having declared themselves. The possibility of infection and the existence or not of an epidemic may be of much importance here.

Typhoid fever may be thought of in these acute forms, where intense fever and prostration occur before the appearance of the hemorrhagic lesions. These practically decide the question, as purpuric eruptions, although occasionally seen, are rare in typhoid fever. Cerebro-spinal or spotted fever and typhus are to be borne in mind as diseases that may present a purpuric eruption.

Prognosis.—This varies according to the form that we have to deal with. Cases of purpura simplex, where there are no other symptoms than hemorrhages limited to the skin, are seldom serious. It should be remembered, however, that they may merge into the hemorrhagic variety. When there are hemorrhages from the mucous surfaces the gravity is greatly increased, and the presence of severe constitutional symptoms and fever adds another unfavorable element. The acute fulminating forms are of the gravest nature. The age and constitution of the patient are naturally important factors in the prognosis. When occurring in the new-born and in pregnancy the affection is more serious. Hemorrhage into the internal organs may be the cause of sudden death.

Treatment.—The first principle in the treatment of purpura is a search for and removal of any possible cause of the disorder. Many cases occur that pursue so mild a course that little if any treatment is necessary. Yet it should be remembered that these light cases sometimes terminate in a more serious form. Rest in bed is imperative in the severe forms, and is in any case an important principle of treatment. Elevation of the limbs with light compression is advocated by Besnier. Bandaging the limbs is important where there is edema or articular effusion. Styptics may become necessary where there is bleeding from mucous membranes, and in these cases the persulphate of iron and solutions of cocaine are indicated. Ice both internally and locally is often of value in checking these hemorrhages.

Hygienic measures are of great importance. The patient's surroundings should be carefully examined, and a change of habitation ordered if they are not satisfactory. Out-of-door air, and perhaps change of climate, may be recommended.

There is a short list of internal remedies that have been recommended and are usually employed in cases of purpura. Turpentine is regarded by Crocker as by far the best, given internally in capsule or in emulsion or by inhalation. It is valuable in hemorrhages from the mucous surfaces. Ergot

may be given in the form of ergotine by the mouth or by hypodermic injection. Iron is valuable, from both its hemostatic and tonic properties, and the tincture of the chloride is to be preferred. The mineral acids, quinine, and nitrate of silver have been advocated. Faradization of the whole surface of the body has also been regarded as effective. As the eruption is very apt to recur when patients who have been resting in bed begin to stand and walk, bandaging the lower limbs at this period is wise as a precautionary measure.

CLASS III.—HYPERTROPHIES.

LENTIGO. (J. ABBOTT CANTRELL, M. D., and E. J. STOUT, M. D.)

Derivation.—Lat. *lens*, a lentil.

Synonyms.—Freckles; Ephelides; Fr. Lentigo, Lentilles, Tâches de rons-seur; Ger. Sommersprossen, Linsenflecken.

Definition.—An affection of the skin in which brown, lenticular, circumscribed macules of pigment, pinhead- to pea-sized, occur principally on the face and hands.

Symptoms.—The disorder is characterized by spots of pigment, of roundish or irregular shape, varying in size from a pinhead to a pea; in color they are yellowish, yellowish-brown, or black. It is a quite common affection. The spots may be only few in number, isolated and irregular in distribution, or certain parts of the skin may be thickly covered with them. Their favorite seat is the face, particularly the nose and cheeks, neck, and back of the hands. They are also encountered—less frequently, however—on regions which are not exposed, as the forearms, the back, buttocks, and genital regions, in males as well as females. Lentigines may make their appearance at any age; in those of very tender years, however, they are rarely observed. As a rule, they are not observed before the eighth year of life. The name “cold freckles” has been given to those permanent spots occurring in winter upon unexposed places.

Etiology.—Freckles occur in both sexes, and are perhaps due to an in-born idiosyncrasy of the skin; they are usually seen in persons of a light complexion, particularly those having red hair; they are, however, observed in dark-complexioned people and at times in mulattoes. They are attributed to the action of sunlight and to moist atmospheric conditions in the summer; and, as suggested by Crocker, are more prevalent during this season, perhaps because activity of pigment is usually greatest in strong sunlight. They appear commonly during the summer, and at times very suddenly; in some instances they fade entirely during the winter, to become noticeable again in the summer. In some cases they persist throughout both seasons. The occasional appearance of freckles on parts not exposed to the sun, as already mentioned, would make it appear that they are not always caused by the conditions referred to above. The affection appears occasionally symptomatically as a part of atrophoderma pigmentosum, and is also stated to occur in senile atrophy of the skin and to supervene after eczema in old people.

Pathology.—Freckles are to be regarded as a circumscribed excessive deposit of pigment in the epidermis.

Diagnosis.—Lentigo differs from chloasma by the pigment deposit being limited to circumscribed puncta or maculæ.

Prognosis.—These deposits can generally be removed by treatment, but usually return.

Treatment.—The treatment of freckles is the same as that of Chloasma (*q. v.*). Hardaway employs electrolysis for removing decidedly black lentiginæ, using the negative pole of a galvanic battery, and has obtained good results. Blistering of the surface should not be resorted to, as it is apt to increase the pigmentation ultimately.

CHLOASMA. (J. ABBOTT CANTRELL, M. D., and E. J. STOUT, M. D.)

Derivation.—*χλωδίζω*, "I am pale green."

Synonyms.—Fr. Chloasme, Pannehépatique, Tâches hépatiques, Chaleur du foi, Masque; Ger. Pigmentfleck, Leberfleck; Eng. Liver-spot, Moth-patch, Mask.

Definition.—A pigmentary affection of the skin, characterized by the presence of smooth patches, irregular in size and shape, and of a yellowish, brownish, or blackish discoloration.

Symptoms.—The only change encountered in this disease is the alteration of the color of the skin. It generally manifests itself in patches with fairly well-defined margins: they are, as a rule, arranged symmetrically on the face, although they may be present over the entire body-surface. Their contour is frequently round or oval, although they may vary exceedingly in shape. As a rule, they are of a yellowish-brown or brownish, dirty tint, but may assume a black or bronze color, when the condition is known as melanoderma. When diffused over a larger area the margins usually fade imperceptibly into the surrounding healthy skin, and those localities which are pigmented in health take on a deeper shade of discoloration, as the axillæ, nipples, umbilicus, the ano-genital region, and the joints on the flexor surfaces; at times the hair may also assume a darker color.

Etiology.—The forms of chloasma may be divided into the idiopathic and the symptomatic. To the former category belong all those cases in which pigmentation, due to external irritants, occurs. Thus it is apt to follow diseases accompanied by marked itching, as chronic pediculosis, which gives rise to the conditions known as pityriasis nigra, eczema, lichen ruber planus, scabies, prurigo, and urticaria. It is likely to be produced by the application of sinapisms and blisters, and, when their use is long persisted in, is apt to become permanent. Exposure to the sun's rays and to heat, as occurs in workers in foundries, stokers, soldiers, coachmen, etc., also pressure and friction from surgical appliances, may give rise to marked pigmentation.

Symptomatic Chloasma.—Under this head is embraced that form of discoloration attributable to affections of the internal organs or to a cachectic condition supervening upon certain affections, as tuberculosis, malaria, cancer, syphilides, and particularly Addison's disease. In those atrophic changes occurring in old age and during the evolution of such diseases as leprosy, scleroderma, morphea, pellagra, lichen planus, and very exceptionally after psoriasis, pigmentation, more or less pronounced, occurs; also in eczema, particularly when associated with varicose veins. Chloasma has also been observed to follow the prolonged administration of arsenic.

Chloasma uterinum (seu *hepaticum*) is the most frequent form of symptomatic chloasma, and, as the name implies, is due to pregnancy or to pathological conditions of the genital apparatus in females, and is frequently observed in sterile or single women. It consists of single or multiple patches of yellowish-brown pigmentation, which are usually but slightly defined, and

generally make their appearance upon the region of the face in females, and particularly the forehead. The eyelids, the angles of the eye, the cheeks, upper lip, and chin may also be attacked. Chloasma may vary in extent, at times covering only a small area, and at other times almost the entire face, assuming the so-called mask-like appearance. Other regions of the body may also be discolored. Slight pigment deposit, transient or at times permanent in character, is of frequent occurrence during menstruation. The disease is stated to occur in the great majority of cases in married women between the twenty-fifth and thirtieth years, and in single women between the ages of thirty and forty. After the menopause it generally disappears. Similar pigmentation is also observed during pregnancy in the areola of the nipples, along the linea alba, and in the genital region, and is attributable to uterine conditions, and disappears after childbirth.

Etiology.—It will be seen from the preceding words that the causes giving rise to this affection are numerous and quite different. They embrace, as we have already remarked, all those external influences which give rise to an engorged condition of the capillaries superficially, and the blood giving off its coloring matter produces the discoloration. We have already mentioned the most frequent causes. The disease, although of much more frequent occurrence in females, is also seen in males. Other etiological factors are disturbance of the nervous system and marked mental excitement.

Pathology.—The deposit of pigment is situated in the mucous layer of the epidermis and is increased in quantity.

Diagnosis.—The diagnosis is usually devoid of difficulty. The patches are characteristic in color, do not disappear under pressure, cannot be removed with the finger-nail, and do not exhibit inflammatory symptoms or desquamation. The only disease with which it might be confounded is tinea versicolor (chromophytosis), owing to the resemblance in color. In chloasma the face and forehead are most usually involved, whereas in tinea versicolor the face is exceedingly rarely affected. The furfuraceous tendency and the presence of the parasite (*microsporon furfur*) under the microscope in the latter affection render the diagnosis absolute. Artificial discoloration of the skin can easily be discovered by washing. Chromidrosis occurs rarely, and can be also removed with chloroform or ether. In vitiligo the spots are of a whitish color and the surrounding area is pigmented, whereas in chloasma they are yellowish or brownish, and there is total absence of any whiteness.

Prognosis.—This is decidedly unsatisfactory. Sometimes it is possible to remove the pigmentation when treated properly. At times it tends to disappear when the exciting cause is removed. Often, in spite of the greatest care and persistence, it remains or is very apt to return.

Treatment.—The first step in the treatment is discovery, if possible, of the *fons et origo morbi*. As the affection often gives rise to much annoyance, particularly in females, owing to the disfigurement, the physician is frequently called upon to prescribe. Treatment should be directed to the destruction of the hyperpigmentation in the epidermis. To accomplish this remedies must be employed which will remove the upper layer of the epidermis. Blistering with croton oil, cantharides, etc., which is apt to be followed by increased pigmentation, must be avoided. The remedies most suitable to remove the discoloration are the following: bichloride of mercury, from gr. $\frac{1}{2}$ to gr. $\frac{4}{10}$ to the ounce of water or oleum amygdalarum or alcohol, may be applied frequently or kept in contact with the part for several hours. Care, however, should be exercised in its use, and it is well to commence with a weak solution. A safer remedy is salicylic acid, which can be used as ointment, plaster,

or paste in 10–15 per cent. strength; this can be left in contact with the parts for twenty-four hours. A saturated solution of the acid in alcohol, applied continuously on lint for several hours and kept well moistened, may also be employed. The application of hydrogen peroxide at times causes temporary disappearance of the discoloration; its efficacy is, however, decidedly doubtful. A treatment devised by the elder Hebra consists of applying perchloride of mercury, 1 per cent. strength, on lint, which is kept constantly moist and is allowed to remain for several hours, which causes vesiculation. After removing the epidermis the part is dusted with starch-powder. This process is decidedly severe and not devoid of danger, and improvement is not always apt to be permanent. Among other remedies may be mentioned boric acid, acetic acid, ammoniated mercury, sulphur, *sapo viridis*, tincture of iodine, and hydrochloric acid. A solution of citric acid in the strength of ʒss to ʒj is well spoken of. Local applications of pure carbolic acid to the spots with a probe is at times serviceable.

ANOMALOUS DISCOLORATION OF THE SKIN AND MUCOUS MEMBRANE.

(J. ABBOTT CANTRELL, M. D., and E. J. STOUT, M. D.)

Under this title Marshall Bruce¹ has described the case of a man in whom there existed discoloration of the surface of the face, hands, and feet. A number of the mucous membranes were also discolored. According to the patient's history, he had contracted syphilis previously, and was subject to pains of a burning and shooting nature, intermittent in character, which he referred to the epigastrium and lumbar regions. The discoloration resembled in a marked degree that due to argyria or as seen in cyanosis.

ACANTHOSIS NIGRICANS. (J. ABBOTT CANTRELL, M. D., and E. J. STOUT, M. D.)

Synonym.—*Dystrophie papillaire et pigmentaire* (J. Darier).

Two cases are reported by Pollitzer and Janovsky² which presented the same symptoms to a marked degree. The regions involved in these two patients were the face, mucous membrane of the mouth, neck, dorsal surface of the hands (particularly the fingers), the axillæ, the inguinal and anogenital regions, and abdomen. These localities showed discoloration of a bluish-gray or dark-brown color. A papillary outgrowth, more or less marked, was present in places; notably in the armpits and groins. The symptoms disappeared spontaneously in the one case, and the patient succumbed shortly after to a supposed cancer. In the other case the disease attained its full development rather suddenly, although partial discoloration had existed some time before. Crocker³ reports the case of a Swedish sailor, resembling the two cases above to some extent, in whom almost the identical localities showed a similar pigmentation varying from yellowish-brown to black, the discolored parts showing no definite line of demarkation. Papillary masses, projecting over the surrounding area, small, fleshy, pear-shaped, and closely seated, were present on the neck and armpits. The natural lines of the skin were deepened over the entire pigmented area. Scaliness existed nowhere. In this case the mucous membranes and hands were not involved, and the thickness of the horny layer was almost normal. Crocker is of the opinion that this condition was probably produced by extreme cold. Treat-

¹ *Internat. Atl. of Rare Skin Diseases*, vol. vi., 1891, No. 2, No. 7.

² *Ibid.*, vol. iv., 1892.

³ "General Bronzing without Constitutional Symptoms," *Clin. Soc. Trans.*, vol. xiv., 1881, p. 152.

ment was unsuccessful. J. Darier¹ expresses the belief that there exists an undoubted relationship between this disease and malignant affections in the abdomen.

TATTOOING. (J. ABBOTT CANTRELL, M. D., and E. J. STOUT, M. D.)

The process of tattooing, in which coloring matter is introduced into the skin by means of needles, produces indelible staining. For this purpose vermilion, charcoal, indigo, or gunpowder is rubbed into the skin after a drawing has been previously made, and needles are inserted into the skin sufficiently deep to produce slight hemorrhage. A very extensive case of tattooing covering the entire body was exhibited in public in this country for several years. Bluish discoloration, bearing resemblance to that of tattooing and due to the presence of grains of gunpowder in the skin caused by premature explosion of blasts, as seen in miners, etc., and also resulting from accidents with firearms, also leaves indelible marks. The face of a friend of the authors, formerly a lieutenant in the U. S. Navy, was frightfully disfigured by the explosion of a cannon.

Treatment.—Papain has been recommended for the removal of tattoo-marks. The authors, after having given this remedy a thorough trial in a number of cases, failed to derive any success from its use. We are forced to admit that all attempts to remove these discolorations have proved abortive, and that treatment is useless. The best method of treatment in recent cases of gunpowder-staining consists in carefully picking out the grains of powder, observing strict antiseptic precautions.

ARGYRIA. (J. ABBOTT CANTRELL, M. D., and E. J. STOUT, M. D.)

This name has been given to that condition in which there exists discoloration, varying in shade from bluish-black or grayish-black to slate or bronze, of the skin and mucous membranes due to the prolonged ingestion of silver nitrate. Some authors also state that the local application of this salt to the mucous membranes of the eye and oral cavity produces the same effect. Gamberine² has reported the case of a woman whose skin became partially discolored from the use of a hair-dye containing arsenic in pomatum form. Numerous cases of discoloration of the skin due to the prolonged ingestion of this drug are on record, especially in former times, when silver nitrate was more generally used in the treatment of epilepsy. This condition may exist over the general surface, but is more marked in parts exposed to the light. The discoloration is thought to be due to the presence of the reduced metal, principally in the rete mucosum, sweat-glands, and cells of the stratum mucosum of the epidermis. In some instances the deposit has been found even in the investing membranes of certain viscera. A localized form of argyria has been frequently observed among workers in silver, which is stated to be due to minute quantities of the metal in the corium. We would also briefly refer to a discoloration, similar in character, produced by the long-continued ingestion of arsenic in individuals having a peculiar idiosyncrasy toward the drug. This staining, however, gradually disappears after discontinuing the remedy. The discoloration in the first form described is permanent. The treatment of this condition is of no avail. Duhring³ refers to two cases reported by Dr. L. P. Yandell,⁴ successfully treated by

¹ *Ann. de Derm. et Syph.*, 1895, vi. p. 97.

² *Prager Viertelj.*, lxxiv., Anal. p. 49.

³ *Diseases of the Skin.*

⁴ *American Practitioner*, Sept., 1872.

potassium iodide and vapor baths; in one of these a slight staining remained, in the other it disappeared completely.

KERATOSIS PILARIS. (J. ABBOTT CANTRELL, M. D., and E. J. STOUT, M. D.)

Derivation.—*κέρως*, a horn.

Synonyms.—Pityriasis pilaris; Lichen pilaris.

Definition.—A hypertrophic affection of the skin in which an accumulation of horny cells is seated about the orifices of the hair-follicles and occludes the openings of the latter.

Symptoms.—The lesions are pinhead-sized, whitish, grayish, or black (due to foreign matter), more or less conical papules, and consist of an accumulation of epidermic cells and sebaceous matter about the orifices of the hair-follicles; frequently the elevations are so marked as to feel like a nutmeg-grater to the examining hand. Their favorite seat are the extensor surfaces of the thighs and arms. A hair is seen to pierce each papule, or is either twisted and confined within the accumulation of sebum or it may be broken off at the top of the papule, and then appears as a dark point at the center of the papule. The elevations at the aperture of the hair-follicle, when removed with the finger-nail, are marked by a depression. The neighboring skin may be perfectly healthy in appearance; usually it is rough and scaly, resembling ichthyosis. The affection varies as to the surface involved and to development, usually being very slight; at times, however, it may be very pronounced.

Etiology.—It is usually attributed to lack of bathing, but also occurs in individuals who observe the proper hygienic rules. It is most often seen in young adults, and is often very marked in ichthyosis. As a rule, it does not give rise to subjective symptoms; at times, however, it may become quite itchy, and pursues a sluggish and chronic course.

Diagnosis.—Keratosis pilaris differs from goose-flesh (*cutis anserina*) in being permanent, whereas the latter is of a transitory character and due to influences of temperature. It may be confounded with the miliary papular syphiloderm during the stage of desquamation. The color of the latter lesions, however, is dusky or coppery, and they are inflammatory; their distribution is usually generalized; they tend to form groups, do not itch, and are more firm and deep-seated. Further, they are less scaly, and there are usually other symptoms of syphilis present. Lichen scrofulosus is characterized by firmer and less scaly lesions, circular or crescentic in shape, showing a tendency to group, and appearing in individuals having a strumous diathesis, and is very rarely found on the external and extensor surfaces of the extremities.

Prognosis.—The prognosis is favorable, and the disease is usually improved by treatment.

Treatment.—The treatment consists of a course of bathing extended over a long period, and the use of *sapo viridis* or toilet soap. Alkaline baths, Turkish or vapor baths; will also be found useful. In more pronounced cases the parts may be thoroughly rubbed with oily preparations. In these cases the same treatment as in ichthyosis is indicated.

KERATOSIS SENILIS. (J. ABBOTT CANTRELL, M. D., and E. J. STOUT, M. D.)

This condition, as the name denotes, occurs during old age and in two forms.

The first form is characterized by verrucous concave plate-like elevations,

principally seen on the back and arms, especially in individuals of advanced years. They may be single or occur in numbers, are flat and disk-like in shape, and may vary in color from a yellowish to blackish tint. They may project more or less over the level of the surrounding skin, and present wart-like follicular openings at their summit. Frequently they become the starting-point of epitheliomatous degeneration.

In the second form, known as the moist type, in which a condition resembling seborrhea exists, the skin presents a greasy appearance, due to the accumulation of fatty scales, beneath which, when removed, the epidermis shows a congested appearance. The skin may also become dry, harsh, and leathery, and this condition may be limited to the face or the dorsal surfaces of the hand or feet or involve different areas of the extremities. Exceptionally, the skin becomes darkly discolored over the entire body surface, feels dry to the touch, and furfuraceous corneous scales are present. In addition pigmented maculæ are scattered here and there, and verrucous patches varying from yellowish to dark-brown in color. At times there is noticeable a hypertrophy of the skin of the dorsal surface of the hand.

Prognosis.—The liability of these senile keratoses to become cancerous at times should never be overlooked in giving a prognosis.

Keratosis senilis may be treated on the same principles as keratosis pilaris.

KERATOSIS PALMARIS ET PLANTARIS. (J. ABBOTT CANTRELL, M. D., and E. J. STOUT, M. D.)

Synonyms.—Tylosis palmæ et plantæ; Keratoma; Ichthyosis palmaris et plantaris.

Definition.—This condition is characterized by the corneous layer of the palms and soles being hypertrophied into a hard, dense plate.

Symptoms.—This affection is rare, and, although generally congenital, may be acquired; it is, as a rule, symmetrical, and usually involves both palmar and plantar surfaces. Its favorite seat is the palmar and plantar region, although the dorsal surface may be partially involved over the articulations. In a typical case the epidermis of the palm and sole is seen to be of a light-yellowish color and covered with a very firm, thick, and horny plate, like leather. When hyperidrosis coexists, the skin appears moist. The surface affected varies in appearance, being smooth or worm-eaten. The entire surface of the palms is covered uniformly with this plate, is sharply defined, and is devoid of any inflammatory symptoms. On the plantar aspect that part alone is affected which comes in contact with the ground during locomotion.

The subjective symptoms are not marked, with the exception of interference with free locomotion when the plantar surfaces are affected, and sensitiveness to pressure.

Pathology and Morbid Anatomy.—In general, the pathological and anatomical features may be stated to be identical with those occurring in callosities.

Etiology.—The etiology is obscure. It has been attributed to prolonged ingestion of arsenic; hyperidrosis probably may be an etiological factor. The great majority of cases are of congenital origin and both sexes may be affected. It may attack but one sex in a family of several children. It can frequently be traced through several generations. Diseases of an inflammatory character, as eczema, psoriasis, syphilis, etc., may also give rise to thickening of the palms and soles, although in a less marked degree.

Diagnosis.—Keratosis palmaris et plantaris is to be differentiated from

the thickenings occurring in eezema, psoriasis, syphilis, etc. by the total absence of inflammatory symptoms and of any signs of ulceration. The affections known as keratoderma symmetrica erythematosa (Besnier) and erythema keratodes (Brooke) may be regarded as varieties of keratosis palmaris et plantaris.

Prognosis.—The prognosis is, as a rule, favorable, although persevering and long-continued treatment is required to effect a cure. The affection, however, is of a very rebellious and obstinate character.

Treatment.—Salicylic acid, a 10 per cent. solution in ether, with the addition of some fat, perseveringly applied, has proved curative in Unna's hands. The more aggravated forms yielded to the application of salicylic-acid plaster, 20 per cent. strength. Ichthyol in doses of three minims, in conjunction with an ointment of ichthyol and salicylic acid, constantly applied, appeared to be successful in one of Brooke's cases.

ANGIOKERATOMA. (J. ABBOTT CANTRELL, M. D., and E. J. STOUT, M. D.)

Derivation.—ἀγγεῖον, a vessel; κέρας, horn.

Definition.—A disease affecting the extremities, as the hands, feet, and ears, in which the characteristic features consist of growths resembling warts in character which form on dilated blood-vessels.

This affection is of very infrequent occurrence. According to Mibelli,¹ who describes the case of a girl æt. 14, the lesions consist of small transparent tumors, the size of a hempseed, situated on the dorsal surface of the fingers, particularly on the middle and terminal phalanges, and ranging in color from a lead shade to dark red. They felt rough and at times prickly to the examining hand. These tumors were of a corneous consistency—were well defined from the neighboring cutis, which was free of any inflammatory condition. Between the tumors there existed small scattered spots about the size of a grain of corn, showing in their centers a darker red color than at the periphery. The epidermis covering them was hard, but smooth, and showed no signs of scaling. Transitional forms between the spots and tumors were also observed. On being subjected to pressure this color disappeared entirely. Spots of a like character, but less numerous, were also on the toes. The tumors were found to consist of cavernous blood-spaces and hypertrophy of the epithelium.

Etiology.—It appears from the literature² that the disease develops in individuals having the chilblain habitus and makes its appearance in childhood. With few exceptions the cases reported have been girls, and the lesions developed directly after exposure to cold.

Pathology and Anatomy.—Recurrent attacks of chilblains give rise to inflammation and capillary dilatation in the papillæ. Thickening of the epidermis occurs, and the spaces between the cells contain blood and their contour is irregular.

Diagnosis.—The diagnosis rests on the presence of growths resembling warts situated on a telangiectatic base, and of dots purplish in color on the extremities and ears of individuals having the chilblain habitus. Angiokeratoma is distinguished from verruca vulgaris by the peculiar color of the former affection disappearing when subjected to pressure and reappearing at once when pressure is discontinued, and also by the changes in color when exposed to cold.

¹ *Int. Atlas of Rare Skin Dis.*, 1889, ii.

² *Vide* Wyndham Cottle: *St. George's Hospital Rep.*, vol. ix., for 1877-78, p. 758; *Brit. Journ. Dermat.*, 1891, vol. iii. p. 237.

Prognosis.—If left untreated the disease remains unchanged indefinitely, and becomes aggravated each winter.

Treatment.—Treatment by electrolysis is reported as being the most successful. Stimulating applications to the skin, followed by soothing local remedies and exercise in the open air, are stated to be advantageous.

CALLOSITAS. (J. ABBOTT CANTRELL, M. D., and E. J. STOUT, M. D.)

Derivation.—*Callus*, hardened skin.

Synonyms.—Tylosis; Keratoma; Callus; Callosity; Ger. Verhärtung; Fr. Durillon.

Definition.—A hard, thickened, horny patch of the epidermis due to hypertrophy of the corneous layer of the skin.

Symptoms.—Callosities consist of patches of flat, horny thickening of the skin, varying in size and shape, of a dirty-white to yellowish-brown color. They are firm, dry, or brittle, and may, when they become very thick, interfere with the sense of touch, and the normal lines of the skin are more or less obliterated. In the great majority of instances they are acquired, but may also be congenital. They usually occur on parts subjected to pressure or friction, as the palmar and plantar surfaces, are somewhat elevated, particularly in the center, and fade by degrees into the surrounding skin. The area affected by callus varies: the whole palmar and plantar surface may be involved. These thickenings are very frequently seen on the hands of tin-smiths, blacksmiths, oarsmen, and among mechanics or laborers whose hands are exposed to more or less pressure. Musicians, as harpists, violinists, zither-players, at times show the same condition on their fingers; it also occurs in individuals who are in the habit of going barefooted and in those wearing badly-fitting shoes. The wearing of surgical appliances for the relief of hernia or some other deformity at times gives rise to callosities. It would appear that they occasionally occur spontaneously. Crocker calls attention to the callosities seen on the ischial tuberosities of baboons and certain monkeys, which are attributed to the pressure upon these parts when the animals walk. Usually, no inflammatory symptoms exist in callositas, and when all pressure is removed the parts regain their normal appearance. Rarely, however, inflammation of the underlying corium and suppuration occur, and the hypertrophied epidermic accumulation falls off.

Pathology.—When subjected to examination callosities are seen to be made up of thickened accumulations of layers of the epidermis, which alone is involved, the deeper layers of the epidermis and corium remaining normal.

Prognosis.—This is favorable. Removal of the cause is generally followed by a gradual disappearance of the accumulation.

Treatment.—When it is deemed proper to treat this condition the parts are soaked in warm water and pared down with the knife, and a plaster of salicylic acid, 20 per cent. strength, or salicylic acid, 10–20 per cent., dissolved in collodion, is applied; or ether, kept in contact with the parts for several days, will cause the hypertrophied tissue to become macerated and render its removal easy. All causes relating to the production of this condition must be removed if a permanent cure is desired.

CLAVUS. (J. ABBOTT CANTRELL, M. D., and E. J. STOUT, M. D.)

Derivation.—Lat. *clavus*, a nail.

Synonyms.—Corn; Ger. Leichdorn, Hühnerauge; Fr. Cor, Tylosis gompeux, Œil de perdrix.

Definition.—Corns are hyperplasias of the horny layers of the epidermis, consisting of usually circumscribed horny formation, tender and painful upon pressure, generally occurring about the toes.

Symptoms.—A corn resembles a callosity in appearance, and, like it, is produced by pressure, but differs from the latter in having a central prolongation or so-called core or horny peg (hence *clavus*, or nail) extending to the corium, which gives rise to pressure and irritation of the papillary nerve-filaments. The corn may be single or multiple. Corns are divided into the soft and hard varieties: the former is most usually found on the external aspect of the little and dorsal surface of the toes or on the sole of the foot; it may, however, occur upon the hands—in fact, anywhere where the parts are exposed to long-continued pressure or friction, which may also lead to inflammation and suppuration. When situated on parts having more or less moisture, as the region between the toes, the corn becomes macerated and we have the condition known as soft corn. This variety may at times discharge some fluid and become more painful than the hard corn, and may go on to suppuration and an ulcerated condition. Corns are very apt to become quite painful before the onset of damp weather. The term “bunion” is applied to a corn when situated over a bursa and the latter becomes inflamed; when near a joint of the foot, particularly the metatarso-phalangeal articulation, a painful swelling occurs which may lead to distortion and enlargement of the bones.

Etiology.—As already stated, corns are the result of pressure or friction, and usually are caused by badly-fitting or tight shoes.

Pathology.—A corn is a thickening of the horny layer of the skin, shaped like a cone whose base extends outward and its apex projects inward into the papillæ of the corium. Slight hemorrhages take place beneath the corns, and occasionally a bursa is seen beneath them; the hemorrhage is produced by the pressure of the corn on the papillæ and rupture of a capillary. At the end of the corn atrophy or a total absence of the papillæ exists.

Treatment.—The first step is to remove all pressure and friction and advise the wearing of well-fitting shoes. The next step is to remove the hardened mass. For this purpose the corn should be thoroughly soaked in hot water and the callosity pared down with a sharp knife or razor; the core should then be picked out with the forceps. Should the patient object to the pain of cutting, salicylic acid may be applied until the thickened layer becomes macerated and can be removed.

The following formula is quite useful:

℞. Acidi salicylici,	ʒss;
Ung. aquæ rosæ,	ʒss.

This should be applied twice daily for five or six days; the feet should then be soaked in hot water, when the corn may be picked out. When corns show an inflammatory condition, they must be looked after carefully or they may become quite troublesome. Such cases require perfect rest and soothing applications, as aquæ plumbi dil. When permissible soft corns may be excised or touched with the silver-nitrate stick after removing the thickened skin, and cotton placed between the toes. They should be washed daily with soap and warm water, and spirits of camphor applied at night, and the daily ablutions should be faithfully persisted in after removal of the corn to prevent the recurrence of the horny growth.

CORNU CUTANEUM. (J. ABBOTT CANTRELL, M. D., and E. J. STOUT, M. D.)

Derivation.—Lat. *cornu*, a horn.

Synonyms.—Cornu humanum; Cutaneous horn; Horny excrescence; Horny tumor; Ger. Haulthorn, Hornauswuchs; Fr. Corne de la peau.

Definition.—Cornu cutaneum is a true horny excrescence of the skin, of variable size and shape, closely resembling in its general structure that of an animal.

Horns are of decidedly rare occurrence, and are generally situated upon the face and scalp, although they may occur upon any part of the body. They are usually solitary, but may be multiple, and at times are quite numerous. Their shape and size vary considerably, from a pinhead to several inches in length. They are solid, dry, rough, wrinkled, or laminated on their surface, and may be cylindrical, pointed, conical, straight, or twisted. Their base, which is broader than the apex, is either concave or flattened, and is situated immediately upon or in a depression of the skin, which may be normal or more or less inflamed. Their development is quite slow, and they usually do not give rise to pain unless injured or knocked off.

Etiology.—Their causes are obscure. As a rule, they develop from sebaceous cysts, at times from acuminated warts, and also from scars. They usually occur during old age, although they have been observed in the very young, and, according to statistics, are of more frequent occurrence in females than in males.

Pathology.—These growths are to be regarded as acuminated warts, and are due to cornification and hypertrophy of the cells of the epidermis, and commence in the rete mucosum, and dilated blood-vessels are seen to extend around the base, and sometimes to some distance into the substance of the horn.

Prognosis.—If thoroughly removed, they seldom form again; their tendency in some instances to take on epitheliomatous degeneration should, however, be borne in mind.

Treatment.—The growth is to be dissected out carefully or torn or twisted off, preferably under anesthesia, and the base thoroughly cauterized with caustic potash or chloride of zinc, curetted, or the galvano-cautery applied. Care should be used to remove the base completely, to prevent the redevelopment. The possibility of horns developing into epithelial cancer renders their removal imperative.

VERRUCA. (J. ABBOTT CANTRELL, M. D., and E. J. STOUT, M. D.)

Derivation.—*Verruca*, a wart.

Synonyms.—Wart; Fr. Verrue; Ger. Warze.

Definition.—Warts are flat, rounded, or acuminated circumscribed excrescences of the skin. Different names have been given to the several varieties of warts, as their appearance and development is very apt to vary. We shall first take up the description of *verruca vulgaris*, or common wart, appearing so frequently upon the hands of young children. While it usually occurs in this locality, it may, however, appear anywhere. Its shape is rounded, elevated, circumscribed, hard and horny or soft to the touch; it is seated upon a broad base and varies in size from a pinhead to a pea. Superficially, it is seen to be either smooth or rough and exhibiting numerous small projections, which are the points of the hypertrophied papillæ. Its color varies considerably, partaking of that of the neighboring skin or varying from yellowish to brownish black. It may be single or present in large num-

bers; it may appear isolated or in groups, and generally closely approximated. As they become older verrucæ assume a more rugous and discolored appearance.

Verruca acquisita, as the name signifies, applies to warts that have been acquired, in contradistinction to *verruca congenita*, occurring on newly-born infants. *Verruca perstans* denotes a wart that persists for a long time and shows no tendency to spontaneous disappearance, in contradistinction to *verruca caduca*, or transitory wart.

Verruca plana, or flat wart, is not of infrequent occurrence. It is raised but little above the surrounding skin, and varies in size from a pinhead to that of a pea or finger-nail. Its favorite seat in young adults are the regions of the face and dorsal surface of the hands. In color these warts may be whitish or somewhat pigmented, and may be scattered or irregularly grouped. In individuals of advanced years they usually occur on the back and arms, and, as a rule, show pigmentation (*verruca senilis*), and may give rise to epithelioma. While *verruca plana* in young people is but slightly sensitive to pressure, it may be the seat of decided itching in older people.

Verruca Glabra.—This is, as the name indicates, a smooth wart, the surface of which is not broken by clefts.

Verruca Filiformis.—This is a thread-like growth which has a thin, conical end about one-eighth of an inch long, and is seen either single or in small groups. It is due to one or a number of the papillæ becoming hypertrophied. Its favorite seat is the face, eyelids, and neck.

Verruca Digitala.—This variety consists of a finger-like, elevated growth which is marked by digitations. It usually is seen upon the scalp; it may, however, occur in large patches upon the back or shoulders.

Verruca Acuminata or *Condyloma Acuminatum*.

Synonyms.—Pointed wart; Moist wart; Fig wart; Cauliflower excrescence; *Verruca elevata*; Venereal wart; Ger. Spitzenecondylom, Spitzenzwarze; Fr. Végétations dermiques.

This form of wart is usually termed venereal wart, as it is very often encountered in individuals affected with gonorrhœa, and is frequently caused by the blennorrhagic secretion irritating the mucous membrane of the skin.

Verruca acuminata should never be regarded as a symptom of syphilis. Although gonorrhœal discharge is a frequent etiological factor of the production of this form of wart, it is often encountered in parts where opposing surfaces come in contact, and is due to heat, irritation, and moisture. Thus it is often seen at the anus, axillæ, umbilicus, and between the toes; we have often observed it in children, entirely free from gonorrhœal infection, in the region of the anus, etc. Its favorite seat is the region of the genitalia of both sexes, as the glans penis and the inner surface of the prepuce in the male; in the female, the entrance to the vagina, the external surfaces of the genitalia, the mucous membrane of the vagina, the perineum, and mucosa of the rectum. *Verrucæ acuminatæ* commence as a group or groups of acuminated elevations, which enlarge rapidly, and sometimes form masses having different shapes, which are described as mulberry, cauliflower, or cockseomb vegetations. They may be either sessile or pedunculated, and vary in color from pink to red according to the vascularity of the parts upon which they are situated. They grow very rapidly, and if neglected may assume enormous size. When situated in regions subjected to heat, friction, and moisture, they frequently secrete a yellowish, offensive discharge, and are at times more or less covered with crusts. It appears to the authors that it would be desirable to discontinue the name of *condyloma* for this form

of wart, as it is misleading and conveys an erroneous impression. This term should be entirely reserved for the syphilitic lesions known as condylomata lata.

Etiology.—Although not absolutely proven, it would appear probable that warts are contagious. A very striking example of contagion occurred in Payne's case: after having removed a wart with his nail, he noticed that later on there developed one under his nail and some on the dorsal surface of the thumb. At the present day the view that they are due to micro-organisms is gaining ground.

Diagnosis.—There is generally very little difficulty encountered in recognizing warts: the moist form must be carefully distinguished from syphilitic condylomata.

Anatomy.—Anatomically, the papillæ of the corium are seen to be hypertrophied in a marked degree, and the vascular loops enlarged; above these the epidermis is thickened and cornified to a greater or less extent. The pointed variety is provided with a large supply of connective tissue, and is exceedingly vascular; the cells of the rete are in a high state of development, whereas the horny cells are scant in comparison.

Prognosis.—The prognosis is favorable; it should not be forgotten, however, that in advanced age warts frequently are the starting-point of epitheliomatous degeneration. Occasionally they show a tendency to recur as fast as removed.

Treatment.—Different caustics may be employed for the removal of warts, as nitric, hydrochloric, acetic, and chromic acid; also caustic potash, acid nitrate of mercury, zinc chloride, and silver nitrate. When employing caustics it is well to protect the surrounding skin with a ring of wax. The filiform or digitated variety can be snipped off with curved scissors and the base cauterized. Removal with the dermal curette by scraping is a good and efficient method. Salicylic acid in the form of a rubber plaster or as in the following prescription may be advantageously applied:

Ry. Acidi salicylici,	ʒss;
Ung. aquæ rosæ,	ʒss;
M. ft. ungu.	

This is applied for three or four days, when the wart becomes soft and can be scraped off with the dermal curette.

The removal of the larger, vascular variety of warts is best accomplished by the ligature, galvano-caustic wire, or *écraseur*; to stop the bleeding which follows perchloride or persulphate of iron and pressure may be used. Condylomata of larger size may be removed with Paquelin's cautery. Liquor sodæ chloratæ, known as Labarraque's solution, diluted, may be used in the treatment of venereal warts occurring about the labia, to be followed by the application of calomel in powder, resorcin, or burnt alum and savin, *partes æquales*.

Internal treatment can also be resorted to. Thus magnesium sulphate, in doses of gr. ij-v for children, and ʒss for adults, *t. d.*, acts well at times.

POROKERATOSIS (MIBELLI). (JOSEPH GRINDON, M. D.)

Synonym.—Hyperkeratosis excentrica (Respighi).

This rare disease has been observed only in Italy and the United States. Mibelli reported the first case in 1893, and since then 5 more. Respighi has

reported 10 cases, Hutchins 1, and Gilchrist 11, these being the entire number known. It is a non-inflammatory hypertrophy of the epithelial structures of the skin, characterized by lesions which begin as warty points, which soon become depressed at the center while slowly spreading at the periphery, until there results a sinuous "seam" or "dike" enclosing an area of varying extent. This "dike" is unlike any other known lesion. A narrow, sinuous, firm, slightly raised strip of a dirty-white or yellowish color presents, where well developed, a row of small black plugs or a continuous line like a black thread let in along its crest. The comparison to a seam is most apt. This ridge is at times uninterrupted for considerable distances, and again broken in places; sometimes it shows occasional conical elevations along its crest. The enclosed area may be a centimeter or less in diameter (when it is apt to be circular), while in Mibelli's first case it extended along the length of the forearm as an irregular band. The enclosed surface is at times atrophic and bald (Mibelli), and again of normal thickness and supplied with hairs (Hutchins). In some instances no sweating occurred within the "dike." The larger areas often show scattered horny semi-globular points (Mibelli, Gilchrist).

Imperfectly developed patches may show themselves on the face and elsewhere (Mibelli, Hutchins) as dry, horny, flat-topped disks varying from a few mm. to 3 cm. in diameter, showing telangiectases and surrounded with a fringe of loosened epidermis.

The disease shows itself first on the extremities, sometimes simultaneously on the face and neck, and spreads very slowly, so that in most cases it has remained limited to these parts even after many years. The first manifestation generally occurs between the second and eighth years of life, but Respighi's first case developed at twenty-six.

The cases observed have for the most part been in family groups of parents and children and brothers and sisters. Gilchrist's 11 cases occurred in four generations of one family.

Anatomy.—Sections of the raised border show the horny layer in the form of a truncated cone, its axis being occupied by a central plug corresponding to a section of the black line running along the crest. The sweat-ducts are dilated and show epithelial proliferation and hyperkeratinization. In addition to the above changes, noted by Mibelli, Respighi found epithelial accumulation in the sebaceous glands, and Gilchrist, involvement of hair-follicles.

PAPILLOMA CUTIS. (J. ABBOTT CANTRELL, M. D., and E. J. STOUT, M. D.)

Derivation.—Lat. *papilla*, a papule.

This term is generally used to signify a papillary excrescence from the skin. Examples of this kind are warts, eczema verrucosum, horns, etc. The term, however, is too vague to be descriptive. True papillomata have been described by some recent writers, which are characterized by an inflammatory growth exceeding a tubercle in size and made up of a warty cauliflower outgrowth of a reddish or bluish color, resembling *verruca acuminata*. Their shape and size vary; fissures and sinuses may exist, from which a mucopurulent and sometimes ill-smelling discharge is secreted. These growths may occur upon any part of the body and at any age. Hardaway has reported a case of general idiopathic papilloma in a child seven months old. Papillomata occur in mycosis fungoides; they also supervene upon syphilis, lupus, dermatitis papillaris capillitii, ichthyosis, elephantiasis, etc., when they

are known as secondary papillomata. The internal administration of medicaments, particularly the iodine and bromine compounds, gives rise to papillomata. The case described by Reigel as papilloma area elevatum is regarded as being due to the ingestion of bromide. The form described as neuropathic papilloma occurs in ichthyosis hystrix. It may be stated that the pathology of these growths is due to the connective and vascular tissue becoming hypertrophied.

NÆVUS PIGMENTOSUS. (J. ABBOTT CANTRELL, M. D., and E. J. STOUT, M. D.)

Synonyms.—Pigmentary mole ; Nævus spilus ; Fr. Nævus pigmentaire ; Ger. Fleckenmal ; Pigmentmal ; Nævus verrucosus ; Linsenmal.

Definition.—Nævus pigmentosus is characterized by a circumscribed congenital hyperpigmentation of the skin, without hypertrophy of the connective tissues and hair ; or the pigment deposit may be accompanied by hypertrophy of all the cutaneous structures and hypertrichosis.

Symptoms.—Pigmentary nevi differ much in size and shape. They usually range from the size of a pinhead, split pea, or bean, or may be larger, the size of a dollar-piece or the palm of the hand, or extend over entire regions of the body. They are flat on a niveau with the surrounding part, or more or less elevated. Their contour is generally round ; it may, however, be quite irregular in the larger growths. Their color varies from a light brown to black. While usually occurring on the face, neck, and back, they may be found on any part of the body ; they may be few in number or exceedingly numerous, and are met with in both sexes. At times they are distributed along the tracts of nerves (nævus unius lateris ; papilla neuropathicum). They may increase in growth until the individual has attained his full development, and then cease growing. The several varieties of moles have received different names, referring more or less to their appearance. Thus the form known as nævus spilus, or smooth nevus, possesses a smooth surface, is on a level with the surrounding skin, and consists of increased pigment alone, and is generally acquired. Another variety, described as nævus pilosus, or hairy mole, is covered with a growth of hair which may be stiff, thick, and dark or more rarely lanugo-like in character. Nævus verrucosus, or warty mole, exhibits a rough and irregular surface, due to hypertrophy of the papillæ—is protuberant and wart-like in appearance. Nævus lipomatodes may be regarded as a congenital lipoma, is characterized by increase of adipose and connective tissue, and is soft and flabby. Nævus papillomatosus is that variety in which soft, papillary growths occur on the surface, the elevations being separated by deep furrows ; the papillary mole may at times secrete an offensive discharge. White moles are growths similar to raised moles, are entirely devoid of pigment, or are only very slightly pigmented. The smooth mole is usually regarded as being acquired, whereas the other forms referred to above are generally congenital and permanent in character. The pigmented mole very rarely undergoes evolution, and is unaccompanied by subjective symptoms.

Etiology.—The etiology is decidedly obscure. In some instances the pigmentary nevi would appear to be connected with disturbance of the nervous system. This theory appears plausible when we consider that they are frequently distributed along the course of cutaneous nerves (nævus unius lateris).

Pathology and Morbid Anatomy.—Moles consist of pigment situated in the deeper layer of the rete mucosum of the epidermis and corium, and more or less hypertrophy of the connective tissues.

Prognosis.—Nevi are generally permanent growths, and seldom disappear spontaneously. Their removal at times becomes imperative, as they may in advanced years develop a tendency to melanotic sarcoma, especially when subjected to irritation.

Treatment.—For the removal of the smaller moles the dermal curette and such caustics as caustic potash, glacial acetic acid, or sodium ethylate, applied with a glass rod, may be employed. Electrolysis is undoubtedly the best and most satisfactory procedure, particularly when the moles are studded with hairs. When the nevus is only small in size it is best not to interfere with it, as the resulting scarring is more disfiguring than the growth.

ICHTHYOSIS. (J. ABBOTT CANTRELL, M. D., and E. J. STOUT, M. D.)

Derivation.—*ἰχθύς*, fish.

Synonyms.—Xeroderma; Xeroderma ichthyoides; Ichthyosis vera; Ichthyosis congenita; Sauriasis; Fishskin disease; Fr. Ichthyose; Ger. Fischschuppenkrankheit; Fischschuppenausschlag; Fischschuppenaussatz.

Definition.—Ichthyosis is a congenital chronic cutaneous affection, characterized by excessive proliferation of the epidermic cells, dryness, harshness or scalliness of the epidermis, and more or less hypertrophy of the papillæ.

According to the amount of changes present in the various layers of the epidermis, three forms of ichthyosis may be recognized: Xerosis or xeroderma; ichthyosis simplex, and ichthyosis hystrix (hystricismus), the former term referring to the mild and the latter to the severe types of the disease. The aggravated forms are of rare occurrence; the milder types are tolerably common. Xeroderma and ichthyosis simplex usually involve the entire body-surface, whereas ichthyosis hystrix is apt to be confined to a limited area. Ichthyosis, although congenital, does not develop fully before the second year. In some cases but very slight inconvenience or disfigurement exists—merely a harsh and dry condition of the skin—whereas in others it becomes a source of great annoyance and discomfort, and proves fatal (ichthyosis congenita).

Symptoms.—Xeroderma is the variety generally encountered, and is the mildest form of the affection. The skin is thickened, dry, and harsh, wrinkled in appearance, and slightly scaly; has a grayish or dirty look, and the natural lines are more prominent. The extensor surfaces of the limbs and the trunk show pinhead-sized nodules, covered in the center with scales, and due to excessive epidermal collections in and directly around the follicles; this condition is known as keratosis pilaris, and is always found in ichthyosis (see Keratosis Pilaris). The amount of scaling varies with the age of the patient, and is influenced by the season, becoming more aggravated during the winter and decidedly improved during the summer months. During more advanced years the condition generally becomes more pronounced, and may develop into the severe form of the disease. The color of the scales depends on the quality and duration of the disease, and in mild forms is generally light and pearly; in other instances green, brown, and black.

Ichthyosis Simplex.—In this variety the entire surface is usually covered with tessellated papery scales, with adherent centers and loose edges, and of polygonal shape, resembling fish-scales, thus giving rise to the name ichthyosis or "fishskin disease." This condition appears soon after birth, and is generally most developed on the extensor surfaces, particularly about the elbows and knees, the buttocks and shoulders. The flexor surfaces of these joints, as a rule, are not involved. When the scalp and face are the seat of

the affection, which is very rarely marked in these regions, these parts are very scaly and the hair is harsh and brittle. The palmar and plantar surfaces are of a dirty brownish tint, and are found to be much thickened, dry, and wrinkled. Frequently eezema may coexist on the face. Ectropion and an atrophic condition of the ear-lobes may also be present in very aggravated cases. Ichthyotic patients at times experience itching, and the skin during cold weather is very apt to become fissured. When the disease is well marked, sensible perspiration is generally only observed in certain localities, as the flexures, axillæ, face, palms, and soles. The secretion of sebum is also impaired, although not entirely suppressed. Warm weather exerts a beneficial influence on the ichthyotic skin, as the sweat-glands are more active. The affection pursues a chronic course and persists during lifetime; the individual usually enjoys good health. The disease occurs in all races, among males and females, and in every grade of society.

Ichthyosis Hystrix.—This variety is encountered but rarely, and is never general in distribution, but apt to be localized. At times it follows the course of the nerves. It is characterized by scalliness and marked hypertrophy of the papillæ, which form verrucous, spiny patches. They may be met with on any part of the body. At times the papillary projections are so marked as to resemble the quills of the porcupine (porcupine-men). While certain localities may show this condition, the skin on other parts of the body may be entirely normal. The distribution of this form is seldom as symmetrical as the foregoing varieties, and is frequently unilateral. The face is seldom involved or slightly. The affection does not give rise to inconvenience, except in localities where the mobility of the joints is interfered with by the accumulation of scales, and in such regions as the palms and soles. The condition known as *ichthyosis linguæ* or *plaques des fumeurs* does not belong in this category, being due to excessive smoking, and is known as “smoker’s patch.” *Ichthyosis congenita*, described by Lebert as *keratosis diffusa epidermica intra-uterina*, and known as “harlequin fetus,” is already noticeable to some extent at birth. In this form there exists a diffuse keratosis of the skin at birth, owing to the malformation of the epidermis during intra-uterine life. The skin is seen to be covered with thick, horny, firmly adherent plates, usually symmetrically arranged upon the two halves of the body, and separated by furrows or intervals of thin, red, and often fissured epidermis. These fissures may extend into the corium and render movement quite painful. The rigidity of the skin interferes with the motion of the eyelids and lips, thus rendering nursing impossible. Congenital malformations, as ectropion, absence of the ears, contraction and deformity of the feet, are also present. Such children are either stillborn or premature, or perish very shortly after birth, death being due to inanition and marked cutaneous modifications. There exists a difference of opinion among authors as to the proper classification of *ichthyosis congenita*. Thus, Hebra and Kaposi regard this form as a general seborrhea, whereas other authors consider it as belonging to *ichthyosis*.

Etiology.—It attacks both sexes with equal frequency, and is congenital and hereditary in many cases. Some cases have been observed in which one or two children of the same sex in the same family have been affected, whereas the other children had escaped. Other cases are recorded in which the ancestors (parents or grandparents) were entirely free from the disease. At times the offspring of parents affected with *ichthyosis* develop the disease; sometimes it is confined to the female descendants. It is stated that ichthyotic parents,

as a rule, enjoy good health, and this applies generally to the children of ichthyotic individuals.

Pathology and Anatomy.—The main feature of the disorder consists of hypertrophy of the epidermis and the papillæ of the corium to a more or less extent. In ichthyosis hystrix, according to Kaposi, the papillæ are enormously elongated, above which the horny layer is deposited in thick cones. The latter are arranged like the coats of an onion. Dilatation of the vessels and moderate infiltration of the cells in the papillæ and corium, and connective-tissue sclerosis, are also seen to be present.

Diagnosis.—The disease, owing to its peculiar features, presents no marked diagnostic difficulty; the history of the case, dating from infancy, will afford material aid in arriving at a diagnosis.

Prognosis.—The prognosis regarding the general health is good; the affection, however, is incurable. Temporary improvement can be obtained by judicious and persistent external treatment. Ichthyosis pursues a chronic course and persists during life. A case has been reported by Hebra which disappeared after an attack of small-pox. The severer forms, however, are very hopeless.

Treatment.—Local applications and baths are indicated for the purpose of macerating and removing the epidermic scales. Internal therapeutics have all proven valueless. Thus, vapor-baths are quite useful, or alkaline baths to which bicarbonate of soda or potassium has been added in proportion of ʒij-ʒviij to the bath are beneficial. It is well to anoint the parts after the bath with some bland substance, as lanoline, vaseline, olive oil, cocoa-butter, etc. In the more aggravated forms of the disease green soap is rubbed into the parts night and morning for six days. At the expiration of four days after the last inunction the patient should bathe, and then apply one of the remedies mentioned above. In the more advanced variety (ichthyosis hystrix) the growth may be removed with the dermal curette or excised. Salicylic acid is also recommended for this purpose after the horny covering has been removed; this remedy may be used in plaster form (20 per cent.) or dissolved in alcohol (saturated solution).

SCLEREMA NEONATORUM. (F. J. SHEPHERD, M. D.)

Synonyms.—Scleroderma neonatorum; Sclerema of the new-born; Induration of the cellular tissue of the new-born; Fr. Algidité progressive (Hervieux), L'endurcissement arthrespique (Parrot); Ger. Das sclerem der neugeborenen.

Definition.—Induration of the skin and subcutaneous tissues occurring congenitally or soon after birth.

Sclerema neonatorum is a comparatively rare disease, which was first described by Underwood and Denman over a hundred years ago. For many years this disease was confounded with œdema neonatorum, and it was not until Parrot, in 1877, clearly differentiated these diseases that the confusion ceased to exist amongst observers.

Symptoms.—Sclerema may be present at birth or come on within a few weeks of birth. Some authorities say it never comes on later than the tenth day of life, but cases occurring much later are reported.

The induration is always most marked on the back; it, however, usually commences in the lower limbs or lower part of the body, spreads to the back, chest, and then extends over the rest of the body, often involving the whole surface. In rare instances the induration commences in the face and extends

downward. The edges of the indurated area are always sharply defined. At first the skin is yellowish-white and dirty-looking, feeling like leather, and cannot be pinched up between finger and thumb, and pressure produces no pitting. Later the skin becomes livid and has the appearance of marble—is devoid of wrinkles, smooth, hard, and cold.

The induration of the skin renders movement difficult or impossible; the child lies rigid and motionless with its eyes closed. So stiff is the body that it can be lifted with one hand and still keep the horizontal position. The temperature is subnormal, as is also the pulse; respirations are feeble and the child cannot cry lustily; owing to the fixity of the lips and jaw it is unable to suck or swallow. At the end of the first week or before the child dies of inanition.

Congenital cases are stillborn or die within a day or two. Cases of recovery are reported by Barlow, Barrs, Money, Garrod, and others. The recovery has been attributed to the inunction of cod-liver oil, blue ointment, or the administration of gray powder; it is possible that these cases form a separate group tending to recovery.

Etiology.—Anything which weakens the circulation and leads to malnutrition would predispose to this disease. Parrot looks upon poor feeding and defective hygiene as strongly predisposing causes. No doubt lack of proper care, overcrowding, want of proper food would tend to produce this disease. It would naturally occur more often in the prematurely born. Syphilis is said to predispose to this disease.

Pathology.—Langer says that in young infants nearly all the fat is concentrated into the panniculus adiposus, and states that this fat does not melt completely below 40° C. This much higher melting-point of fat in infants is due to its containing a larger proportion of stearin and palmitin and less olein. He argues that any cause which will lower the temperature so that the fat solidifies will produce this disease.

Parrot found that the greatest changes in cases examined after death were atrophy of the skin and subcutaneous fat, and in consequence the fibrous trabeculae appeared abnormally numerous.

J. W. Ballantyne,¹ however, holds that the increase of fibrous tissue is real, and that the atrophy of the fat-cells is secondary to this change.

EDEMA NEONATORUM. (F. J. SHEPHERD, M. D.)

Synonym.—Edema of the new-born.

Symptoms.—This affection, which was for a long time confounded with sclerema neonatorum, is said to be most common in France and Germany. It has been rarely noticed in America or Great Britain. It commences very soon after birth; sometimes the child is born prematurely, showing symptoms of edema; unlike sclerema, the edema begins in the feet, then invades the legs and thighs, abdomen, and the scrotum or labia. The hands also are early affected. The edematous parts are cold, livid, and pit on pressure. The pitting persists longer than ordinary edema and there is more induration. The induration may be so great that it is difficult to distinguish it from sclerema. The edema is particularly well seen in the most dependent parts, such as the buttocks, backs of thighs, and calves of legs. The whole surface of the body is rarely affected with this disease; when it is, respiration is impeded, the pulse becomes slow, the temperature is subnormal, and the child becomes drowsy and dies in a few days of exhaustion or of some pulmonary or intestinal complication.

¹ *Brit. Med. Journ.*, Feb. 22, 1890.

Cases are on record of death from nephritis. In the less severe cases, where the edema is incomplete, the child may recover, the skin gradually becomes softer, and finally the child is restored to perfect health.

In some cases the edema may commence in the back, hands, or even the face, and the temperature may be high instead of subnormal. Cases are reported where the skin becomes jaundiced before death.

Etiology.—This disease is most likely to occur in the feebly nourished and badly fed and prematurely born. Exposure to cold or any other cause which reduces the vitality of the child predisposes to edema.

Pathology.—This is not well understood. The circulation of the child is always weak and the blood is imperfectly aërated. It may be due to thrombosis or be associated with renal, pulmonary, or cardiac complications. The liver is enlarged and the spleen and lungs are congested. There is always a serous effusion into the cellular tissue. The fat of the child has a greater density than usual.

Diagnosis.—Edema is chiefly confounded with sclerema. In the latter disease there is no pitting on pressure and the skin cannot be pinched up. As a rule, this hardness is more general in sclerema. In edema the affection is most apparent on the dependent parts of the body, as the feet, lower part of abdomen, back of thighs, etc. Sclerema is most markedly seen on the back.

In sclerema the skin is waxy or yellowish white; in edema the skin is cold and livid and may be soft and boggy. In sclerema the joints and jaws are stiffer than in edema.

Prognosis.—When complete, edema as well as sclerema is a fatal affection. When partial the case is more hopeful. The duration of the disease is longer than in sclerema.

Treatment.—The body heat if possible should be raised by hot-water bottles and wrapping in cotton wool and by using an incubator. At the same time nourishment should be given either by subcutaneous injection of milk or introducing such food as peptonized milk, white wine, whey, etc. into the stomach by means of a tube passed through the nostrils. French authorities advise frictions with camphorated alcohol, rubbing from below upward. Rubbing the limbs with oil may be of service.

SCLERODERMA. (F. J. SHEPHERD, M. D.)

Derivation.—*σκληρός*, hard, and *δέρμα*, the skin.

Synonyms.—Hide-bound disease; Sclerema; Scleroderma adutorum; Chorionitis; Sclerostenosis; Scleriasis; Elephantiasis sclerosa; Addison's keloid; Dermato-sclerosis; Fr. *Sclérème des adults*, *Sclérodermie*; Ger. *Hautsclerom*.

Definition.—A chronic affection of the skin characterized by hardness and rigidity.

According to Arning, Curzio of Naples first described this disease in 1752, and Henke in 1809. Thirial published an account of two cases in 1845 under the title "Du Sclerème chez les Adults." Since Thirial's paper directed attention to this disease numerous cases have been recorded, and the subject has been extensively treated by Hebra, Kaposi, and others.

There are two recognized varieties: (1) Diffuse symmetrical scleroderma; (2) Circumscribed scleroderma, which is usually called morphea.

DIFFUSE SYMMETRICAL SCLERODERMA.

This disease, which is a very rare one, is characterized by a remarkable rigidity and induration of the skin. At first the skin appears thicker than

normal, raised, swollen, and edematous; then it becomes rigid and board-like, or it may be hard from the first. This is called the stage of infiltration. The next stage is one of atrophy. Owing to atrophy of the subcutaneous cellular tissue and the fatty layer, and perhaps of the muscles, the skin becomes thin and parchment-like and contracted, and seems to be bound down to the bones it covers.

It is said that this disease follows exposure to cold and wet, and is accompanied by pains in the joints and by chills. In many cases, however, no such symptoms precede the hardening of the skin, and it is probable that such conditions are accidental accompaniments. When once the hardening of the skin commences, it may rapidly spread over the body, or the changes may proceed so slowly that after months hardly any appreciable difference is noticed.

No inflammatory symptoms accompany the disease, and there is no disturbance of the general health. The upper parts of the body are more affected than the lower. It usually commences on the chest, neck, shoulders, and arms as a circumscribed patch of hard skin, but does not remain localized long, for it gradually invades the neighboring parts until almost the entire skin is affected.

The skin is hard, rigid, white, and contracted. It cannot be pinched up between the finger and thumb, nor is there pitting on pressure; the muscles may become affected and a condition resembling rigor mortis ensue. The skin is cold, and Thirial not inaptly compares the sensation produced by contact to that felt on touching a frozen corpse. When the integument of the face is involved there is a fixed expression; the mouth is moved with difficulty; the eyelids, when affected, are either partly closed or wide open and immovable. When the disease extends to the neck, rotation of the head is limited, and when the skin of the thorax and abdomen is involved, then respiration is seriously interfered with; and finally, when the disease spreads to the extremities, the joints become semiflexed and fixed and the movements of the limbs are much impaired. The fingers are in a state of semiflexion; the toes are also flexed, and complete extension of any joint over which the skin is sclerosed is impossible; the patient in consequence has an uncertain and tottering gait; the skin is everywhere shortened and too tight for its contents, and the word *hide-bound* admirably expresses the condition.

In the slight cases tactile sensation is not impaired, but as the disease advances and becomes more pronounced there are a decided diminution of sensation, a lowering of the temperature, and a lessening of the amount of sweat and sebum. When the sclerema occurs at any of the orifices where the skin and mucous membrane meet, such as mouth, nose, vagina, etc., the function of the mucous membrane is interfered with. The mucous membrane of the tongue, gums, soft palate, etc. may exhibit hard, ribbon-like bands of sclerosis, and swallowing is sometimes difficult. The soles of the feet and the palms of the hands are the parts most rarely involved in this disease. This condition of the skin does not exempt it from diseases such as aene, herpes, erysipelas, etc.

After the disease has lasted some time the skin becomes darker. Sometimes the whole surface has a bronzed appearance, and at other times it looks mottled and striated. Subcutaneous nodules have been described as occurring, especially over bones; they disappear spontaneously (Hutchinson, Gascoïn, Crocker).

The **course** of the disease is always slow; when it reaches a certain point there may be complete resolution of the induration or the elevated edematous patches may undergo atrophy.

In the first case the skin becomes softer and more mobile and regains its elasticity, the induration gradually disappears, the normal color returns, and the skin after many months, and even years, becomes supple. It is rare, however, that the skin regains altogether its previous condition. More frequently atrophy, such as described above, ensues: this atrophy, which is usually preceded by edema, does not involve so much of the surface, and is more confined to the face and the limbs, especially the upper. The limb is reduced much in size; the joints are fixed by immovable skin which has become thinned and more tense, so much so that the circulation is impeded, so that death of localized spots may ensue followed by ulceration; the nostrils are compressed, the mouth lessened in size, the gums recede from the teeth, and the skin generally over the face appears to be adherent to the bones. The eyes often cannot be closed; the whole appearance of the face is corpse-like. After a number of years, the disease still continuing to advance, a fatal termination cannot be avoided. Occasionally improvement may take place in apparently hopeless cases, and the induration may disappear, but, of course, if the tissues have undergone actual atrophy, they are never restored to a normal condition, and the joints which have become ankylosed remain so.

Acute rheumatism may exist with this disease as a complication. In some cases it precedes it.

Etiology.—It is found in the young as well as in the old, and is apparently more common in women than men. The middle-aged are more liable to develop this disease than younger people, although no age is exempt from it. The majority of authors mention that this disease is preceded by rheumatism, pains, and chills, and, in fact, a history of acute rheumatism is often given by the patient. Erysipelas also is looked upon as a predisposing cause. Privation, exposure to cold and exhausting emotional conditions, traumatism, and exposure to the sun, have all been cited as causes which have predisposed to this remarkable disease. Anything which induces a condition of anemia may predispose (Kaposi). Schwimmer looks upon sclerema as a disease of a tropho-neurotic nature.

Anatomy.—There is an increase in the connective-tissue fibers, and the elastic fibers and accumulation of newly-formed cells are seen extending throughout the skin, and the vessels are narrowed by the pressure of these layers of cells, which surround them like a sheath (Kaposi). The coats of the vessels have in some cases been noticed to be thickened (Schwimmer). The sebaceous and sudoriferous glands are not altered at first, but at a later stage, being surrounded by masses of these cells, they shrivel up and disappear.

Kaposi looks upon scleroderma as due to diffuse stasis and thickening of lymph in the cutis. It is probable, however, that the changes causing narrowing of the blood-vessels is the primary cause to which the anatomical lesions are secondary, such as increase of the elastic fibers and connective tissue of the corium, and a great narrowing of the meshes, which were formerly large and contained lobules of fat, and hypertrophy of organic muscular fibers.

Where the skin is attached to the bones the corium and subcutaneous periosteum are closely united together—in fact, so blended as to appear as one uniform mass; the epidermic layers are not affected.

Pathology.—But little is known of the pathology of scleroderma. It is supposed by many that the disease has a trophoneurotic origin; this is to be inferred, for the actual connection of the nervous system with scleroderma

has never been satisfactorily demonstrated. Schultz in one case found extensive lesions of the anterior roots of the spinal cord; Westphal found pathological changes in the brain; Schwimmer, disease of the peripheral nerves; and Eulenberg found progressive facial atrophy.

The narrowed condition of the arteries plays an important part in the causation of this disease.

Diagnosis.—There is no difficulty in recognizing scleroderma, for the hard, white, rigid, immobile skin would serve to distinguish it from any other affection; also its symmetrical distribution, the age of the patient, and the coldness of the surface are very significant.

The atrophic cancer seen rarely in the chest of women, and called by the French *cancer en cuirasse*, somewhat resembles this affection, but the symmetrical distribution, with the involvement of the deeper structures and the occurrence of cancerous nodules which break down and ulcerate, and the well-defined, dull reddish line of the advancing disease, would serve to differentiate it from scleroderma. Cancer en cuirasse is a painful affection, and has a more rapid course, being attended by a distinct cachexia.

Sclerema neonatorum occurs within a few days or weeks of birth, and need not be mistaken for this disease.

Prognosis.—This is very unsatisfactory, and in general the disease must be regarded as incurable when it has reached the more advanced atrophic condition. However, it is not now regarded as so grave a disease as formerly, and many cases tend to recover, for not infrequently the connective tissue becomes absorbed. The recovery is very slow, rarely taking place in less than a year.

The edematous cases are much more favorable than the atrophic. Crocker holds that those cases which are indurated from the first are more favorable than the edematous, as they are less likely to become atrophic. The atrophic cases, if there is any after-complication, such as disease of any of the internal organs, are likely to terminate fatally. In any case, general inanition will eventually set in and the patient will die of exhaustion.

Treatment.—The most varied remedies have been used in the treatment of scleroderma, but any remedy which improves nutrition is to be commended; such an one we have in cod-liver oil. Arsenic, iron, quinine, and bitter tonics are strongly recommended and are of great service. Extract of malt, maltine, and hypophosphites often prove of value.

The hygienic treatment of the case is of the utmost importance—change of climate, especially where an equitable temperature may be obtained, as at the seaside. The patient should be guarded as much as possible against cold. He should wear woollen under-garments and never be exposed to cold winds or draughts.

To improve the circulation in the atrophic areas shampooing should be regularly employed after a warm salt bath or a Turkish bath. The surface should be rubbed with some fatty substance, such as neat's-foot oil, olive oil, lanoline, simple ointment, cod-liver oil. Ointments of iodine and mercury are strongly recommended by some, but, although they have been tried thoroughly, they have never been found of benefit, and sometimes they have done harm. The same may be said of tar oils. Schwimmer says the constant current is one of the most reliable remedies for the treatment of scleroderma. Galvanism applied to the spine sometimes stimulates the circulation and promotes nutrition. Some recommend galvanism of the sympathetic.

CIRCUMSCRIBED SCLERODERMA (MORPHEA).

Derivation.—*μορφή*, form, a blotch.

The most common name for this affection is morphea, and many yet regard it as a disease quite distinct from scleroderma.

Dermatologists now, however, look upon morphea as a variety of the generalized scleroderma. Although not so uncommon as the diffuse form, still it is a rare disease.

Symptoms.—Morphea occurs in patches or bands which are not usually symmetrical. The patches are commonly round or oval, and may be seen in the course of some of the superficial nerves, such as the infraorbital or other branch of the fifth, or perhaps one of the spinal nerves. The patches are not elevated, are smooth to the touch, firm, and of a dead-white color;



FIG. 243.—Morphea of the breast.

each patch is somewhat irregular, and is surrounded by a narrow violet, lilac, or pink areola; this is made up of minute dilated blood-vessels. In some cases the patch looks yellowish and polished like old ivory, and is surrounded by a reddish or purplish zone.

In some cases, where the patch is very white, the name *morphea alba* has been given, and, when much pigmented, *morphea nigra*. When in the later stages the skin assumes a parchment-like look, the term *morphea atrophica* has been used; it is commonly seen on the limbs, trunk, head, and face. The breasts are most liable to be affected when the trunk is attacked (Fig. 243).

The disease sets in very gradually, growing slowly, many months passing by before it reaches its full development. The surface of the affected skin is dry, and can be pinched up from the tissues beneath; the surface is perfectly smooth and devoid of hair. When once fully developed it may last for years without change, and then the skin may resume its normal condition. Again, it may continue to increase, several patches coalescing; the disease may last many years. There is no special sensation about the affected part except slight itching and absence of sweating; sensibility is normal.

When morphea occurs in bands or lines, these are generally single and attached to the tissues beneath. The linear patch has the appearance of a scar, and is on a lower level than the surrounding skin. It is sometimes associated with *lineæ atrophicæ*, especially when this latter comes on without cause. Also maculæ and telangiectases may be seen in combination with circumscribed scleroderma. In rare cases Alibert's keloid accompanies this affection. The variations are very numerous; there may be no areola of blood-vessels around the patch, and the color may be pink, lilac, or red instead of white; some cases develop slowly, others rapidly. Sometimes the onset of the disease is preceded by pain, itehiness, and tingling. The patch may be depressed below the surface or raised above it.

Mr. Jonathan Hutchinson¹ has lately reported a number of cases of what he calls "morphœa herpetiformis," where patches or bands of scleroderma are found in the course of such nerves as the fifth, branches of the cervical plexus, brachial plexus, dorsal nerves of one side, bilateral patches arranged in zones, and branches of the lumbar and sacral nerves. In some cases the patches were arranged symmetrically.

Etiology.—Females are more subject to this disease than males. It occurs most commonly in early adult life or middle age, but no age is exempt. It is more frequently met with in the lower classes and in persons of neurotic temperament. Worry and trouble are said to predispose—in fact, anything which depresses the nervous system. Local irritation is an exciting cause, and cases are recorded where the patches of scleroderma occurred at the spot where garters pressed or a shoe rubbed. The writer saw one case produced by the pressure of a collar-button. Recurring attacks of erysipelas are said to predispose to scleroderma. Traumatism has been suggested as a cause, cases being reported which have followed blows or the application of a blister. Crocker thinks exposure to cold is a predisposing cause. In many cases, however, no predisposing or exciting cause can be found.

Anatomy.—Crocker has carefully studied the pathological anatomy of this disease.

The epidermis is unaltered. In the corium the papillæ are less prominent. Thrombi are found blocking the vessels of the superficial longitudinal plexus and papillary branches.

Numerous irregularly branched masses of cells are present about the size of leukocytes. Blood-vessels surrounded by cells can be traced to this mass. Branching from the cell-mass is a reticulum consisting of fine fibrils with well-defined borders and cells at intervals upon them like knots in a net (Crocker). The cells are crowded together around the vessels, especially the superficial longitudinal ones, and by their pressure obstruct them; the deeper plexuses are not affected. The groups of cells are more abundant around the sebaceous glands and follicles. On account of the great depth of the sweat-glands the cells are less abundant about them. If the exuded cells

¹ *Brit. Med. Journ.*, vol. i., 1895.

are not absorbed, they are transformed into fibers, and these contracting produce atrophy.

Pathology.—The cell-exudation probably occurs from some defect of innervation; from pressure of the cells the lumen of the vessels is narrowed and the blood-flow is arrested; hence the formation of thrombi. There is a lymph- as well as a blood-stasis.

The atrophy is due to the deprivation of blood; the violet areola is due to "collateral hyperemia over an anemic area." Morphea differs from the diffuse form in that the atrophic changes are entirely superficial.

Diagnosis.—This is not difficult; the circumscribed, flat, white dense patch surrounded by a violet areola is very distinctive. When the patch is raised it has some resemblance to keloid, but the greater vascularity, density, and elevation, as well as its claw-like prolongations, would enable one to distinguish keloid from scleroderma. Sometimes a localized eczema may simulate scleroderma, but the itchiness and the fact that eczema occurs in other parts would prevent a mistake.

In *leukoderma* there is merely absence of pigment; the skin is perfectly white, but otherwise normal.

Crocker says that some cases described as hemiatrophia facialis are doubtless examples of fifth-nerve morphea, but others, which affect all the tissues and are due to defective innervation, seem to be an independent condition. Cases are reported where lingual hemiatrophy accompanies morphea.

Prognosis.—This is more favorable than was formerly supposed, for the majority of cases tend to recovery. When the affection occurs as bands the prognosis is much more favorable. Many cases take several years to get well. Some cases have been known to recover after twenty years; in others, again, the improvement is very rapid, the patches disappear, and the skin becomes perfectly normal.

Treatment.—Not very much can be accomplished in the way of treatment. The general health should be improved and the circulation stimulated. Cod-liver oil and tonics, such as strychnine, arsenic, etc., are indicated.

Local treatment in the shape of massage, galvanism, etc. may be tried, but at the best it is unsatisfactory.

Brocq reports good results in two cases from the employment of electrolysis. Some recommend the application of iodine and blistering as a means of local stimulation.

ELEPHANTIASIS. (F. J. SHEPHERD, M. D.)

Derivation.—*ἐλέφας*, an elephant.

Synonyms.—Elephantiasis Arabum; Elephant leg; Barbadoes leg; Cochin-China leg; Morbus elephas; Pachyderma; Elephantiasis Indica; Phlegmasia Malabarica; Ger. Elephantenaussatz, Knollbein.

Definition.—A non-contagious endemic or sporadic disease characterized by a chronic hypertrophy of the skin and subcutaneous tissues, due to blocking of the lymphatics by repeated inflammatory attacks and causing enormous enlargement of the affected parts.

The term elephantiasis has been for a long time generally employed to describe any hypertrophy of the skin, such as occurs in lepra (elephantiasis Græcorum), fibroma, syphilis, chronic eczema, dermatolysis, angioma, lipoma, pellagra (elephantiasis Italica), etc.

It is, however, better to restrict the term elephantiasis to the disease now about to be described.

Symptoms.—The disease is endemic in India and the West Indies, China, Egypt, and Arabia. It occurs sporadically in regions where the endemic forms do not exist. In North America it is only seen in its sporadic form, and is a very rare disease.

In those parts where the disease is endemic it usually commences with fever, resembling ague. There is often intense pain, especially in the lumbar region, and also in the groin, spermatic cords, and testes when the scrotum is affected, accompanied by nausea and vomiting, chills, high fever, and profuse sweating.

During the inflammatory stage acute hydroceles are apt to form. There



FIG. 241.—Rugose form of elephantiasis from the West Indies.

is an erythematous swelling of the external parts. If the disease commences in the extremities, the skin becomes red, tense, and swollen, and then vesicles appear which discharge a serous, chyle-like fluid. The great enlargement and tension of the spermatic cords so dilate the rings that when the disease has abated hernia is very apt to result. In some cases the integuments are also the seat of a dilated and turgid condition of the lymphatic vessels, and when a febrile attack comes on the vessels are liable to give way and discharge a chyle-like fluid (Fayrer).

After a time the fever and local inflammatory conditions disappear, but the limb is left larger than before; then, after a period of freedom, the fever returns, accompanied by an erysipelatous condition of the limbs. These recurrent attacks vary much in severity: sometimes the inflammation is very intense and the fever high, at other times comparatively mild, with no fever. The rapidity of the enlargement of the limb depends very much on the intensity and frequency of the febrile attacks.

After the first attack the limb appears as it does in a case of dropsy, and there is pitting on pressure; but after several attacks the tissues become dense and hard and unyielding, and the limb is permanently and uniformly swollen. The enlargement rarely reaches above the knee.

The skin may have a shiny, eczematous appearance or be formed into folds and ridges looking something like ichthyosis and having a rugose appearance (Fig. 244). In such cases the papillae are much increased in size.

The enlargement increases until the limb is of an enormous size and its natural shape is obliterated, the integument being formed into large folds, so that the whole limb has an appearance not unlike an elephant's leg. At the ankle especially the furrow is very deep, and the resulting fold often hides the greater portion of the foot (see Fig. 245).



FIG. 245.—A, Ichthyotic form of elephantiasis; B, elephantiasis.

When the leg has become greatly swollen the natural furrows and folds greatly increase, and where the two surfaces of skin come together an offensive ichorous fluid exudes, consisting of broken-down epithelium, sebum, and sweat.

In the form resembling ichthyosis the thickened epidermis is dirty-looking and often of a deep-brown color. Some forms are subject to frequent attacks of eczema, accompanied by much itching, and the skin is smooth and shiny. Occasionally deep, foul varicose ulcers occur, discharging an ichorous pus.

In many cases the general health does not suffer, and there is no pain or

other disturbance of sensation during the interval between the febrile attacks. The patient eats and sleeps well, and all his functions are normally performed, and, if it were not for the discomfort caused by the size and weight of limb, he would be to all intents and purposes well. When the febrile attacks are frequent and severe the patient is exhausted by the pain and high fever, and visceral complications, such as hepatic and splenic enlargements due to malarial poisoning, cause a very debilitated condition, so that removal of the affected part is inadvisable.

After a time, in some cases, the limb ceases to increase or increases very slowly; usually, however, about once or twice a month febrile attacks occur, and at these times the limb or affected part becomes tense, hot, red, and swollen, and serous lymph-like fluid is discharged; the loss of this fluid, which is clear or milky and coagulable, is often a serious drain on the patient, so that extreme exhaustion ensues and removal of the affected parts is demanded by the patient. When the febrile attacks have ceased to recur the limb may go on enlarging slowly and painlessly.

As to the duration and rapidity of the enlargement there is the greatest variety. When the genitals are affected they often increase to an enormous size, weighing many pounds. The scrotum has been known to weigh one hundred pounds or more, and the penis becomes lost in the general enlargement. In women the labia may be so enlarged as to hang between the lower extremities almost to the knees; these hypertrophied masses may weigh many pounds.

The lips may be affected, and also the ears, cheeks, nose, breast, forearm, and hand; in these cases the skin is smooth, but often very vascular. In the endemic forms the parts most commonly affected are the legs, and next the genitals. When the genitals are not affected there is no failure of generative power, unless the patient is the subject of exhausting discharges from the hypertrophied parts.

Virchow has applied the term *elephantiasis telangiectodes* to a rare form of vascular disorder which is congenital.

In elephantiasis of the scrotum, according to Pruner, the disease usually commences as a small hard kernel under the skin at the lower part of the scrotum, chiefly on the left side. As the scrotum grows the abdomen is altered in shape by the pulling down of skin. In certain forms, such as lymph-scrotum or nevoid elephantiasis, there is no extensive enlargement, but the lymphatic vessels are dilated and the surface of the skin irregular.

Etiology.—It occurs in all climates and countries, but is more common in humid, hot climates. It attacks both sexes, but is more common in men than women, and much more common in the dark races. Dwelling in malarial regions near the sea-coast seems to predispose to this disease. Manson thinks that the distribution of elephantiasis corresponds with that of the mosquito: it is a well-recognized fact that removal from the territory where the disease is endemic checks the growth of the elephantiasis, whilst return there reproduces it. It is said that eating fish predisposes to it. Certain climates and localities, combined with bad living, are no doubt the chief predisposing causes. Heredity is a doubtful predisposing cause. Richard found 73 per cent. of persons the subjects of this disease had one or both parents similarly affected. This, of course, might be explained on the ground that they were all subject to the same influences of locality, climate, and food. Monroe reports 4 cases¹ of congenital origin. In rarely begins in children or old people.

¹ *Virchow's Archiv*, Bd. cxxv.

Morbid Anatomy and Pathology.—The naked-eye appearance of a section of a limb affected with elephantiasis is that of “an almost uniformly yellowish-white, glistening, fibrous, fatty mass of dry consistence, or here and there swollen up and trembling like jelly” (Kaposi). Clear yellow-white lymph exudes, and this on exposure to the air coagulates. There is enormous thickening of the corium, subcutaneous tissue, fasciæ, and periosteum; the bones are hypertrophied and covered with stalactite-like exostoses; the tibia and fibula may be united by processes of bone; and from disuse and pressure the muscles are wasted. The various tissues, except bone, are difficult to distinguish, and appear to have been all converted into connective tissue. Blood-vessels, lymphatics, and nerves are greatly enlarged, and in old cases all the tissues are red and the muscles have undergone fatty degeneration.

In the endemic cases the disease is due to the occlusion of the lymphatic channels by the *filaria sanguinis hominis*. In the sporadic cases occurring in temperate climates frequent attacks of erysipelas, severe cellulitis, repeated attacks of eczema, phlegmasia dolens, cause obstruction of the lymphatic trunks as successfully as the filaria, and produce the same result.

In the endemic forms, as was said above, the blocking of the lymphatic trunks is produced by the *filaria sanguinis hominis*, and it is supposed that the embryos are carried by mosquitos. According to Manson: “The parent worms live in the lymphatic trunks, discharge their ova into the lymph-stream, by which they are carried to the glands and arrested there until they hatch; the embryos then enter the general circulation along the lymph-vessels, residing in some organ during the day and circulating in the blood at night. Mosquitos abstract them from the blood, and act as the intermediary hosts and transfer them to water, to reach man again when he drinks the contaminated fluid.”

In some cases the cause of the lymphatic obstruction cannot be discovered. No doubt the dependent position of parts favors the disease, and, in fact, anything obstructing not only the lymphatic but venous circulation.

Diagnosis.—When the disease is well advanced its diagnosis is easy. The great increase in size of the part, the appearance of the epidermis, smooth or tuberoso, the firmness of the enlargement, and the history of recurrent febrile attacks with erysipelatos manifestations, leave no room for doubt as to the nature of the malady. Where it is endemic attacks of malarial fever with local inflammation should arouse suspicion. In countries where the disease is sporadic an early diagnosis is not so easy. A leg subject to frequent attacks of erysipelas is always at first edematous, and sooner or later there will be hypertrophy of the connective tissue.

Course and Duration.—Vincent Richards says that the average duration of the disease is eleven and a half years; youngest person affected was nine years, and oldest eighty years. It is rarely a danger to life; people have been known to suffer with this affection for over fifty years.

Prognosis.—Great benefit almost universally follows change of climate if the disease be in its early stage. Removal of the affected part has been attended with good success of late years.

Treatment.—During the febrile stage much relief is afforded by salines and diaphoretics, combined with rest in bed and maintaining the affected limb in a raised position, with local application of hot lead lotion and careful bandaging. If there be much pain, opium may be given, and, if there be anemia after the paroxysm, iron and arsenic. Quinine also is often of benefit in the quiescent stage. Martin’s thin rubber bandage is of service in

the intervals, applied early from the foot upward. The hypertrophy is often much lessened by these means. Electricity as a mode of treatment has been much praised. Compression or ligature of the main artery has been often tried, but it has been rarely successful. Some recommend this treatment combined with a milk diet.

Change of climate, if the case be an early one, is the most important beneficial part of the treatment. It may completely avert the disease. Europeans suffering from elephantiasis, removing to Europe, after a time become much better, the hypertrophy disappearing gradually. It has been, however, noticed that if the disease be far advanced, the paroxysmal attacks still persist, though not with as great severity.

Surgical Treatment.—When practicable this is the surest way of relieving the patient from the fever and local condition. Scrotal tumors are removed with success and a comparatively low mortality. Before commencing the operation it is well to drain off the blood by placing the patient on his back and elevating the tumor for an hour or two, during which time the tumor is compressed with an elastic bandage. Incisions should be first made along the cords and root of the penis; the cords, testicles, and penis are turned out and the tumor rapidly removed by a few bold incisions (Fayrer). No attempt should be made to preserve flaps. In two to four months the patient is well. In 192 cases operated on in Calcutta Hospital, 18.2 per cent. were fatal (Fayrer).

Amputation of the leg is performed in the same way, the leg being emptied of blood before operation by bandaging with Martin's elastic bandage. When the lymphatics are very turgid relief is often afforded by incision: this diminishes tension and relieves pain.

ACROMEGALY. (F. J. SHEPHERD, M. D.)

Derivation.—*ἄκρον*, extremity; *μεγὰς*, great.

Synonyms.—Acromégalie; Pachyærie; Marié's disease.

Definition.—A somewhat rare disease characterized by an excessive symmetrical enlargement of the bones and soft tissues, especially of the hands and feet, and also the face.

This disease was first described by P. Marié in April, 1886. Since then many cases have been reported. In Great Britain the early cases were described by Hadden and Balance, Godlee, Wilks, and others.

Symptoms.—Enlargement of the hands and feet is first noticed; then the face is seen to be deformed and thickened; the disease progresses until the hands and feet look like paws. The lower part of the face is most enlarged, and the disease especially affects the lower jaw, nose, under lip, and tongue. The skin of the face becomes coarse and the sebaceous glands enlarged, and the shape of the face is altered so that it is broader below; the long bones are rarely involved, but the clavicles, ribs, patellæ, and iliac bones are greatly increased in size, and there is also a curving found forward of the spinal column; the joints are deformed and all natural bony prominences of the long bones exaggerated, owing, possibly, to wasting of the muscles; the fibro-cartilages of the ear, nose, and larynx become thickened; the voice becomes harsh and metallic. Smell is often impaired, and sight is disturbed and may be completely lost. The general sensibility is preserved, but spontaneous pains are noticed. There is often a well-marked cachexia, with increasing weakness, poor appetite, rapid pulse, and normal temperature.

Intelligence is perfect. In women cessation of the menses is an early

feature of the case, and in men impairment of sexual power. The thyroid gland is atrophied or diseased.

In a case reported by Wilks, a girl aged twenty-eight had been good-looking, but became so hideous that the boys shouted after her on the streets, her features had become so distorted and hypertrophied and her hands and feet so large and ungainly. In this case the malady lasted six years and there was amenorrhœa. She had lost the sight of both eyes, and finally died comatose, probably from a tumor involving the pituitary gland.

Etiology.—The cause of this disease is yet a mystery. Freund says it is an anomaly of growth, and believes that its immediate cause must be attributed to an increased flow of blood to the dilated vessels. In many of the cases an enlargement of the pituitary body has been found post-mortem, and this is supposed to be the cause of the blindness which occurs in some cases. The thyroid gland is either atrophied or diseased. Doubtless the trophic agency of the nervous system is in some way or other connected with the pathogeny of this disease. It occurs in females as frequently as in males, and at any age between fifteen and sixty, but is chiefly seen in middle or advanced life.

Diagnosis.—It must not be confounded with congenital giant growth which affects one limb. It is distinguished from *myxedema* by the absence of pallor and transparency of the skin, the absence of slowness of speech, the perfect intelligence, and the remarkably broad and spade-like shape of the hands and feet. The face in acromegaly is oblong, in *myxedema* round.

In osteitis deformans the long bones suffer to the greatest degree, and in it and leontiasis ossei the bones alone are enlarged.

The **prognosis** is always unfavorable, for the disease progresses steadily to a fatal termination.

Treatment.—Nothing as yet has proved of much avail. Thyroid extract is now being tried in these cases, and, it is said, with some success. Three to five grains of the powdered extract should be given three times a day. The fresh thyroid of the sheep, finely minced, may also be given.

MYXEDEMA. (F. J. SHEPHERD, M. D.)

Derivation.—*μύξα*, mucus; *οίδημα*, a swelling.

Definition.—A constitutional progressive disease in which the subcutaneous tissues of the body are infiltrated with large quantities of mucin, and accompanying this condition is failure of the mental faculties; at the same time there is atrophy of the thyroid gland.

In 1874, Sir William Gull described cases of what he called a "cretinoid condition," and four years later Ord described a new disease to which he gave the name "myxedema." Ord was the first to draw attention to the atrophy of the thyroid in this affection.

Symptoms.—The subjects of myxedema are nearly always women who have reached middle life. It may occur at all ages and in both sexes.

The appearance of the patient is very characteristic, owing to the swollen condition of the skin, particularly of the face and extremities. The physiognomy is altered, the features are coarse and stupid, the eyelids are swollen, and the eyes are seen through narrow, slit-like openings; the *alæ nasi* are broader and thickened, the lips much enlarged; there is often a dull-red flush on the cheeks, and the whole face is expressionless and immobile. The hands are enlarged, deformed, and shapeless. The swelling of the skin differs from ordinary renal edema in being resilient and not pitting on pressure, nor is the swelling influenced by position; the skin of the face looks

waxy and pale; over the body it is thickened, translucent, dry, and rough. Perspiration is lessened or absent. The intellect is dull and speech is slow and disturbed; the voice is monotonous. The gait becomes heavy and languid, and the patient cannot remain long in one position without great effort. All movements of the mind and body are performed slowly, but correctly, and it takes the patient an hour to do what he formerly accomplished in ten minutes. Later on there is mental aberration, and the patient loses his memory and becomes irritable. The temperature is subnormal, and the patient usually complains of chilliness. As the disease goes on the placidity of temper is replaced by moroseness. Albuminuria may now appear, and finally the patient, if not carried off by some intercurrent disease, dies comatose. The course of the disease is slow, but progressive, and may extend from six to fifteen years. In all cases the thyroid is atrophied, and may altogether disappear or be converted into a fibrous mass.

There is a form of myxedema called "cachexia strumapriva," which follows total extirpation of the thyroid gland. In these cases several months after operation the limbs become cold and weak, the speech slow, the memory impaired, and a general resilient edema affects the whole body, but is most marked in the face. The skin, as in myxedema, does not pit on pressure.

Etiology.—This is obscure, except when it occurs after total extirpation of the thyroid gland. The disease may affect several members of a family, and it is always transmitted by the mother. There is a congenital form which is described by some authorities called "sporadic cretinism;" the subject of this form is a dwarf with short legs and arms, thick neck, large abdomen, and weak intellect; there is a congenital absence of thyroid.

Treatment.—Remarkable results have lately been reported from the use internally of thyroid extract. This is given in the form of powder or juice expressed from the gland in doses of two to ten grains three times a day. Some have fed the patients with finely-chopped sheep's thyroid.

The improvement is rapid and remarkable, the mental and physical conditions being notably improved, but is not always permanent.

In cases of total extirpation of the thyroid gland cachexia strumapriva has been prevented by the implantation of sheep's thyroid; hypodermic injections of the juice of lambs' thyroids has also proved beneficial.

Ord has found the prolonged use of the extract of jaborandi of benefit in this disease.

CLASS IV.—ATROPHIES.

ALBINISM. (CONDUCT W. CUTLER, M. D.)

Definition.—A congenital absence of the normal pigment of the skin and certain other tissues.

Symptoms.—This condition may be partial or general; when general the subjects of it are known as albinos. It is a more frequent anomaly in the dark than in the lighter-colored races. The absence of pigment is not limited to the skin, but the hair, the iris, and the choroid are also involved. These unfortunate persons necessarily suffer from photophobia and also from constant movements of the eyeballs, lids, and iris. The lids are screwed up, brought as close together as possible in order to exclude the light. The

pupil looks red, owing to the absence of pigment in the choroid, and the iris is of a pinkish hue for a like reason. The hair is quite silky in texture and white or yellowish-white, and the skin is either perfectly white or, where the blood shows through in the thinner parts, it has a pinkish tone.

Albinos are usually weakly individuals both mentally and physically, and possess but little power of resistance. Albinism is not infrequent in the animal kingdom. The skin is in no way abnormal, except in the absence of pigment. Partial albinism is much more frequent, and especially so in negroes.

Etiology.—The cause of albinism is quite obscure. Heredity undoubtedly plays some part in its production, but certainly not in all cases. It is said to be endemic in some tropical countries.

LEUKODERMA. (CONDICT W. CUTLER, M. D.)

Synonyms.—Vitiligo; Piebald skin; White leprosy; Achroma.

Definition.—An acquired atrophic affection of the pigment of the skin, characterized by the formation of sharply-defined, smooth, whitish patches surrounded by a slightly pigmented border.

Symptoms.—The affection is entirely one of pigment distribution. In very many cases there is an increased deposit of pigment preceding the formation of the white patches. The affection begins with the formation of several roundish or oval spots, which are white in color and surrounded by normal skin darker in color, the line of demarkation being well formed. These spots differ in size, but are seldom larger than the palm of the hand. New ones may continue to form, and, uniting with the older ones, produce large and irregular patches of whitish skin. These patches may appear upon any portion of the body, but are more apt to form upon the trunk and backs of the hands. Hairs occurring in these spots usually turn white, but the glands, nerves, blood-vessels, and other structures of the skin remain normal. There are no subjective sensations present, and the secretions are normal. The disease runs a chronic course, the spots gradually increasing in size and number. The color seldom returns when once absent, but it is more conspicuous in summer, probably owing to the pigmented part being a deeper color then, and sometimes this excess permanently disappears.

Etiology.—The disease is most common in tropical countries. Thus in India 1 out of every 36 cases of skin-disease is leukoderma. In the United States the proportion is 1 to 400. In England and in Europe it is even less frequent than this. Both sexes are equally liable, but it is rare before ten or after thirty. It is, however, not very uncommon to see the disease in persons over forty, especially in men. The disease is sometimes hereditary, but is very much more common in the dark races and in those who are frequently exposed to the sun. By many exposure to the sun is considered as an exciting cause. It is also very common in persons of a neurotic temperament, and is considered by many as entirely a neurosis. As an associated condition it is frequently met with in alopecia areata and with morphea. Depressing influences, especially following severe illness, seem to have an exciting cause in producing the disease. Thus it is very commonly found following typhoid fever, intermittent fever, and scarlatina.

Pathology.—There are strong grounds for regarding the disease as due to a trophoneurosis, but why it should follow it is not clear. Ehrmann explains the mechanism of leukoderma as follows: "While pigment is duly formed in the corium, owing to the absence of the transferring cells it cannot

reach the rete, but in albinism there is a total absence of pigment-forming cells. In vitiligo the untransferred pigment in the corium is partially reabsorbed and partly transferred to the adjoining normal skin; hence the excess of pigment that is generally absorbed on the borders of the white patch. What leads to the atrophy of these pigment-transferring cells, and why in progressive leukoderma an increase of pigment precedes its disappearance, cannot be explained."

Diagnosis.—Leukoderma may be mistaken for nerve leprosy, tinea versicolor, chloasma, morphea, and pigmentary syphilide, but the diagnosis is usually easy. Nerve leprosy may be distinguished from leukoderma by the pronounced anæsthesia in the affected area, by the smallness of the white area, by the absence of increased pigmentation about the borders, and by the presence of general constitutional symptoms. Chloasma differs from leukoderma by the absence of the concave border of the pigmented area, the length of time in which the disease has lasted, and the general history of the case. The whiteness often seen in morphea may be distinguished from leukoderma by the accompanying changes in the texture of the skin, by the peculiar character of the border, and by the absence of the pigmentation around the white patches. The concave border of the pigmentation in leukoderma will distinguish it from tinea versicolor, together with the absence of scales and parasites, which are always present in the latter disease.

Prognosis.—The prognosis is not good. A very small percentage of cases entirely recover, although spontaneous arrest of the disease may occur. Improvement may take place from the good result of treatment through fading of the excess of pigmentation about the border or by a whole area becoming white, so that the contrast between the absence of pigment and the increase of pigment is lost. Spontaneous cures can sometimes be explained by this last condition.

Treatment.—Internal treatment in leukoderma is not very satisfactory. As it is frequently present in persons of poor general health, an improvement of it with the use of tonics may prevent the spread of the disease, but this has little effect on the patches already present. In persons of neurotic temperament the use of arsenic and the bromides has sometimes a beneficial effect. Kaposi has found the bromides especially useful, and has recorded some cases in which the white patches have disappeared under its continual use for some time. Locally, the only success seems to lie in stimulating the patches. This may be done by keeping up a constant irritation by frequent applications of tincture of iodine, or by occasionally painting over the patches with acetic acid or pure carbolic acid, or by the application of blistering plasters—in other words, modes of treatment which usually result in pigmentation of the skin if long continued. Another way of treating these cases locally is to remove the pigmentary deposit from around the edges of the patches. There are few drugs which have a tendency to hasten the disappearance of these pigmentary stains. Bichloride of mercury, resorcin, acetic acid, and sulphur are the four drugs which may be used for this purpose. The following combination is a very good one:

R̄. Resorecini,	ʒj;
Hydrarg. chlor. corros.,	gr. ij;
Acid. acetic. dil.,	ʒij;
Aquæ,	ad ʒij.—M.

This should be applied over the pigmentation two or three times a day with a camel's-hair brush. At night apply an ointment composed of one dram

each of ammoniated mercury and subnitrate of bismuth to the ounce, which is favorably spoken of by Neumann. Practically, whatever plan of treatment you adopt, the result is slow and often very unsatisfactory. Many physicians resort to staining the white patches with walnut-juice, thus artificially obtaining the natural color of the skin, but this, of course, only affords a temporary relief.

ATROPHIA CUTIS SENILIS. (CONDUCT W. CUTLER, M. D.)

Synonym.—Atrophoderma senilis.

Definition.—A true atrophy of the skin in consequence of advanced age, either partial or general, and accompanied by other degenerative changes.

Symptoms.—The affected skin may be paler, but it is usually much darker, than normally, often a tawny brown, and frequently having the appearance of very large and dark freckles. Owing to the loss of fat and elasticity the skin is more or less in forms of folds. From atrophy of the glands it is usually dry and often covered with fine branny scales; to the touch it feels thin and atrophied. The hair on the affected skin is lanugo-like or may be absent. Itching of the part is often severe and persistent. New growths are also liable to arise. Thus the arms, trunk, and neck are often covered with numerous flat warts of a dirty-brown or black color. The horny covering of these warts can be easily picked off, leaving hypertrophied papillæ exposed, which bleed easily. Besides these warts, pendulous sacs of skin containing fibromata which have atrophied are frequently present about the neck and trunk. Soft mole-like growths are frequently present, which have a tendency to take on malignant growths. From these new growths epithelioma and rodent ulcer not infrequently have their origin. Red spots dotted here and there over the skin are frequently seen, and are the result of dilated capillary blood-vessels.

Etiology.—This condition of the skin is always the result of old age, and is more apt to occur in men than in women. Although it may occur in those who are especially depleted, it is also seen in old age in those who are well nourished.

Pathology.—The epidermis is thin and forms a wavy line over a shrunken papillary layer. The corium is thinned, and its connective-tissue cells fewer and smaller, containing pigment-granules. Of the blood-vessels, some are atrophied and others enlarged, containing pigment-masses. The fat-cells are absent, leaving the connective-tissue meshes empty. All the appendages of the skin are either atrophied or hypertrophied, usually containing the pigmentary deposit.

Diagnosis.—The age of the patient, with the atrophied condition of the skin, together with the presence of the large, flat warts, usually makes the diagnosis easy. It is seldom mistaken for any other skin-disease.

Prognosis.—The disease is one of old age, and the best that can be done is to prevent the further atrophy from taking place. In many cases by appropriate treatment and care of the skin this can be done, but a cure of the atrophy which has once taken place is impossible.

Treatment.—When atrophy of the skin has once taken place we cannot by any method of treatment restore it to its normal condition, but by proper constitutional treatment we may prevent further atrophic changes occurring. By attention to the general health and by the means of tonics, especially those containing arsenic, strychnine, and phosphorus, atrophic changes in the skin may be delayed. The new growths which we are so apt to see in this

form of skin-atrophy, especially the flat warts, may be delayed by the use of thuja. Locally we can do considerable to improve the condition of the skin and to prevent further changes from taking place. Massage, electricity, bran baths, and inunctions of oil often keep the skin nourished and prevent further changes. The large, flat warts may be made to disappear in many cases by the application of a 10 per cent. solution of thuja applied two or three times a day. When other new growths make their appearance on the skin they should be carefully watched, care being especially taken to prevent their irritation, as their tendency to be the starting-point of malignant growths is well known. If raw surfaces make their appearance the result of injury to these growths, the use of nitrate of silver, aristol, balsam of Peru, and diachylon ointment may be beneficial in healing. If epitheliomata or other malignant growths make their appearance, they should be removed at once.

STRIE ET MACULÆ ATROPHICÆ. (CONDUCT W. CUTLER, M. D.)

Definition.—A condition of the skin, either idiopathic or symptomatic, characterized by circumscribed atrophied streaks or spots.

IDIOPATHIC STRIE ET MACULÆ ATROPHICÆ.

Symptoms.—Idiopathic atrophy is a rare disease. It may occur either in the form of streaks or spots. In either case these lesions make their appearance unnoticed by the patient and give rise to no inconvenience. The "*streaks*" or lines are pearly or bluish-white in color, glistening, and scar-like. They are one or two lines wide, slightly curved, and from one to several inches long. They are nearly parallel, but inclined at various angles to the longitudinal axis of the body, and are situated chiefly about the thighs, buttocks, and lower anterior part of the abdomen. They are slightly depressed below the surface of the skin, and feel to the touch as though the skin was thin. Sometimes they seem to follow the natural lines of the skin, and again to follow in the course of some nerve-supply. In one case in my own practice the lesion began in the center of the forehead and extended down over the center of the nose to the upper lip. This began as a thin, white line with slightly reddened borders, the white part widening and deepening. Subsequently the sides of the sulcus were greatly drawn together, leaving a deep groove like a sword cut. The "*spots*" or maculæ are isolated, and from a pinhead to a finger-nail in size. These occur most frequently about the lower part of the trunk, but may occur on or about the neck. They are very much less common than the streaks or lines. These spots frequently first make their appearance by the presence of slight redness and by well-marked hypertrophy of the skin. This condition, however, is soon followed by the second characteristic white stage and a shrinking process, which draws the whole surrounding tissue together, leaving a depression in the center, which may, owing to the contraction of the surrounding tissues, become barely perceptible.

Etiology.—The cause of the disease is obscure, but is regarded by many as a trophoneurosis. Both the striæ and maculæ are seen in adults of both sexes, but also, less frequently, in children. The disease occurs more frequently in men than in women, and especially tall men. The streaks are supposed to be due often to the stretching of the skin during the rapid growth and expansion of the pelvis and thighs. Not infrequently, however, the striæ occur in persons convalescing from typhoid and other fevers in young adults, probably due to the rapid growth which frequently follows such affections. The damage to the nutrition of the skin by the fever is doubtless the

predisposing cause. In many cases the lines are probably clearly neurotic. No explanation, except a neurosis, can be given for the production of the maculæ.

Pathology.—Kaposi has found atrophy of the epidermis, dilatation of the papillæ, separation of the connective-tissue fibers, and diminution of the glands, vessels, hair-follicles, and fat-globules. This condition is partly due to atrophy and partly to separation.

Diagnosis.—It is sometimes difficult to diagnose the formation of the macules in the early stages in their erythematous and hypertrophic condition from morphea, which they very closely resemble, but the subsequent history of the case and the absence of the lilac-like ring about these patches will aid in the diagnosis.

Prognosis.—The lesions give rise to no inconvenience. They never go away entirely when once formed, although they may get less obvious from the natural elasticity of the skin drawing the sides together.

SYMPTOMATIC STRIÆ ET MACULÆ ATROPHICÆ.

This condition may be either simple or degenerative.

SIMPLE SYMPTOMATIC ATROPHY.

Symptoms.—Simple atrophy may occur either in the form of striæ or maculæ. The disease is very common, and is seen frequently upon the abdomens of pregnant women, where it is called *lineæ albicantes*, and also on the breasts of nursing women. The lesion in appearance and in anatomy is the same as that described in the idiopathic form of the disease. The lesions when they first make their appearance are bluish red, often very itchy, and gradually assume a white, scar-like appearance.

Etiology.—Anything causing a distention of the skin, such as pregnancy, ascites, ovarian or other tumors, will give rise to the formation of these atrophic lines. They may also be produced by violent stretching of the skin, by heavy lifting, or by very severe coughing. The maculæ or spots, although usually classified as ordinary scars, are really atrophy of the skin due to pressure from small tumors, or atrophic spots remaining after absorption of inflammatory or other infiltrations of the skin which occur in syphilis, lupus, leprosy, and lichen planus.

Anatomy.—The lesions are produced by, or result from, the stretching or rupture of the more superficial bundles of white and elastic tissues of the skin. Taylor says that if the fibers are ruptured the striæ will be most pronounced, and there will be little left of the skin but the epidermis and a thin fibrous membrane.

Diagnosis.—The striæ cannot be mistaken for any other disease of the skin. The maculæ, however, are frequently mistaken for scars, but the history of the case and the absence of cicatricial tissue will make the diagnosis plain.

Prognosis.—The striæ when once present never disappear, but the scar-like macule, if of small size, may gradually disappear or grow less distinct from the contraction due to the natural elasticity of the skin.

DEGENERATIVE SYMPTOMATIC ATROPHY.

Symptoms.—In degenerative symptomatic atrophy of the skin the same changes are present which are found in the senile atrophy, but in addition there are fatty, hyaline, and lardaceous changes, which are the consequences

of chronic dermatitis, pemphigus foliaceus, eczema, etc., together with an endarteritis which is always present to a greater or less extent in these cases, diminishing the nutrition of the skin.

Prognosis.—The prognosis in this form of atrophy is bad, owing especially to the endarteritis, which is progressive.

Treatment.—The treatment of *striae et maculae atrophicæ* is not satisfactory. You can lessen somewhat the rapidity of the atrophic changes by massage, electricity, oil-inunctions, baths, and general care of the skin. By improving the general health by means of tonics, especially those containing arsenic, strychnine, and phosphorus, you may apparently lessen the extent of the lesions, but it is doubtful if, atrophy having once taken place, the skin will ever return to its normal condition. By means of plastic surgery, carefully dissecting out the atrophied skin, you may lessen somewhat the deforming effects. This can be done, and is to be advised, where the lesions are upon the face, thus producing a deformity. When malignant growths make their appearance they should at once be removed.

PERFORATING ULCER OF THE FOOT. (CONDUCT W. CUTLER, M.D.)

Definition.—A degenerative disease of the skin resulting in ulceration and the formation of a sinus leading into the deeper tissues as a result of a trophoneurosis.

Symptoms.—The disease, although spoken of as an ulcer, is really, more correctly speaking, a sinus. It usually begins by the formation of a corn or callosity, under which suppuration takes place. This suppurating process burrows into the soft tissues, so that when the horny covering is thrown off a sinus is exposed leading down to the bare bone. Sometimes when the process is very acute a slough is formed, but the result is the same. The position of this ulcer is on the sole of the foot and over the metatarsophalangeal joint of the great or little toe. Sometimes it begins on the pulp of the big toe, but always on the plantar surface. Occasionally the same process affects the palmar surface of the hand at the junction of the ring finger. After the ulcer is once formed pressure from walking results in the epidermis about the opening becoming much thickened and forming a horny callus around the sinus. Frequently there are granulations about the surface. The process is very slow and generally painless, although hyperesthesia about the lesions is quite common. Burning of the foot at night is very common. There is a tendency also to a fetid perspiration of the affected foot.

Etiology.—The exciting cause is pressure or injury of some kind to a foot in which the protecting nerve influence is absent from disease or damage to the nerve-center. It is very frequently seen as a complication of locomotor ataxy, also as a result of syphilis or leprosy. This disease of the nerves may also result from either central or terminal neuritis.

Pathology.—The process begins as a proliferation of the epidermis like a corn, under which suppuration takes place. This suppuration continues until a sinus is formed, which is usually quite extensive, often leading down to the bone. The edges of the ulcer are hard, owing to the heaping up of the epidermis, while the sides of the sinus are frequently cartilaginous.

Diagnosis.—The only affection from which it requires to be distinguished is ordinary suppurating corn. It is distinguished from it, however, by the absence of pain and sensibility about the lesion and the presence of the deep sinus leading down to the bone.

Treatment.—As it is frequently the result of some constitutional disease, we can sometimes hasten the cure of the ulcer by proper treatment. Thus when the disease is the result of a syphilitic affection the internal use of mercury and iodide of potash will frequently aid in establishing a cure. In most cases the internal use of the iodide of potash is to be recommended. Attention to the general health is also to be advised. Usually, however, these perforating ulcers will not heal without appropriate local treatment. This local treatment may either be palliative or protective. The palliative treatment is sometimes curative if you can keep your patient quietly in bed. Continual walking with a perforating ulcer will always prevent its healing. Absolute rest is imperative. The following treatment, suggested by Treves, is sometimes followed by a good result: The pigmentary epidermis around the sinus is pared down completely after softening by repeated poultices, and the sinus filled with a 5 per cent. solution of salicylic acid in glycerine, with the addition of a 1 per cent. solution of carbolic acid. In other cases a good result may be obtained by scraping the sinus with a sharp dermal curette and filling it with balsam of Peru containing 10 per cent. of iodoform, this dressing to be repeated night and morning. Cases which do not heal properly may be operated upon, the sinus thoroughly opened, the cartilaginous tissue dissected carefully away, and the edges of the wound brought together with sutures. In case of the presence of any dead bone it should be excised. As the disease is usually due to some constitutional taint, when the lesion is once healed it may form again if care is not taken by attention to the construction of the stockings and boots to prevent fresh injury.

GLOSSY SKIN. (CONDICT W. CUTLER, M. D.)

Synonym.—Atropho-derma neuriticum.

Definition.—An atrophy of the skin resulting in a peculiarly glossy or varnished appearance, occurring in a limited area, usually upon the extremities, and due to disease or injury to a nerve.

Symptoms.—The fingers are usually the seat of the disease. Occasionally, however, it may appear upon the feet or upon the neck or face. A severe and persistent burning pain called causalgia precedes and accompanies the atrophy of the skin. The affected part becomes very dry, smooth, and glossy, and afterward very thin like a scar. The fingers, which are most usually affected, are tapering and hairless, are almost void of wrinkles, and commonly pink or deep red. Not infrequently they have a mottled appearance resembling chilblain. The affected skin is easily inflamed, excoriated, and fissured. The appendages of the skin are also affected; hence the dryness, loss of hair, and changes in the nails, which become curved in both directions. Frequently there is thickening of the cutis beneath the free end of the nail, and sometimes retraction of the skin, exposing the sensitive matrix. Ulceration sometimes occurs between the fingers, and almost always between the toes when they are affected. When the feet are affected there is apt to be increased sweat instead of dryness, and this often is very offensive.

Etiology.—This atrophy of the skin always follows injury of the nerve, especially where the nerve is not completely divided, thus setting up a neuritis. It may also, however, be a complication of leprosy, gout, or rheumatism, and occasionally from chronic disease of the cord, such as myelitis or locomotor ataxy.

Pathology.—The disease is a neuritis pure and simple, and is the result of inflammation of the nerve supplying the affected area.

Prognosis.—The condition always tends to get well spontaneously. This result is only one of time.

Treatment.—The condition requires protection from cold and other external influences. The use of electricity to the affected area and to the nerves supplying it is followed by good results. Nerve-tonics are also to be recommended. The causalgia is generally best relieved by the application of very hot water, although ice-cold water in other cases seems to be equally efficacious. Sometimes the pain is so severe as to require the use of sedatives, such as morphine or phenacetine. Watson recommends the occasional use of blistering fluid applied to the affected area.

AINHUM. (CONDICT W. CUTLER, M. D.)

Definition.—An endemic disease, occurring especially in the negro race, in which there is a gradual atrophy of all the structures of the little toe, leading to spontaneous amputation.

Symptoms.—This disease always begins as a seamy, circular furrow in the digito-plantar fold of the fifth toe, starting from the inner and under surface. The first symptom which the patient notices is a little itching, but otherwise than this there is absolutely no inflammatory or subjective symptoms. In a few exceptional cases there has been some pain, but this is not the rule. At first there is no breach of surface or interference with the movements or sensibility of the toe. The furrow gradually extends very slowly, getting deeper and extending in both directions around the toe, eventually completely encircling it, forming a groove about one-eighth to a quarter of an inch deep. This groove looks as though it was produced by a ligature tied tightly around the junction of the little toe with the foot. The result is the same as though a ligature was tied around the toe, for beyond the constriction the little toe swells to two or three times its normal size, becomes red, and loses its sensibility. After a time the toe becomes separated from its neighbor and is rotated outward. While the constriction deepens the tissues atrophy beneath, so that the toe looks like a roundish tumor with a narrow pedicle attaching it to the foot. This pedicle becomes smaller and frequently ulcerates, the discharge being fetid. When ulceration takes place there is a considerable amount of pain. After a time the toe drops off, either due to the ulceration or to an accidental wrench. Frequently the patient will remove the toe by pulling it off or by means of a pair of scissors. Occasionally other toes on the same foot become affected, but this is very rare, the disease usually being limited to the little toe. Two or three cases are reported in which the little finger became affected instead of the toe, and in one case both the little toe and little finger on the left side were simultaneously attacked.

Etiology.—The disease never occurs under fifteen years of age. It usually attacks adults, rarely old age. It affects the male sex very much more frequently than the female, and at times is apparently hereditary. The disease occurs almost exclusively in negroes, and especially on the gold coasts of Africa. Occasionally the disease is seen in this country, especially in Virginia and North Carolina. The true cause of the disease is entirely unknown. It is supposed by some to be due to a parasite, but this is disputed by others. Some have ascribed it to injuries resulting from walking barefooted, but as it occurs in negroes who wear shoes, it is not believed to be due to that cause. It is probably a parasitic disease.

Pathology.—There is hyperplasia of the epidermis and a downgrowth

of the interpapillary processes. There is a great increase of fibrous tissue and fat. The blood-vessels are affected. There is a great increase in the adventitia, while the intima is much thickened, so as to encroach upon and fill up the lumen, producing endarteritis obliterans. The bones are in a condition of "rarefying osteitis." The bone-tissue is gradually absorbed and replaced by fibrous tissue.

Treatment.—In the commencement of the disease, if the restricting band is cut across at right angles, the process is usually checked. If the restricting band, however, becomes complete and entirely encircles the toe, there is nothing to be done but to amputate it. This should be done as soon as ulceration begins or the toe becomes troublesome.

CLASS V.—NEW GROWTHS.

CICATRIX. (JAMES C. JOHNSTON, M. D.)

Definition.—A cicatrix is a connective-tissue new growth in the skin, formed at the site of and replacing a previous loss of substance which extended into the corium.

Symptoms.—Scars of recent development are a lively red in color, following which they may become pigmented as in syphilis; in time they become white. They are set into the surrounding skin and are level with its surface, when they are called *normal* or *flat* cicatrices; or they are depressed below, *atrophic* cicatrices; or elevated above it, *hypertrophic* cicatrices. Atrophic scars are usually glistening, smooth, thin, and pliable, and result from a superficial ulceration or a resorptive process, as in erythematous lupus, or pressure, as in favus. Hypertrophied scarring follows a deep ulceration, and is hard, uneven, traversed by ridges, approaching what is known as keloid. Scars may or may not be attached to underlying tissues. Between the atrophic and hypertrophic forms all grades and appearances may be encountered. They exhibit no follicles, none of the gland-openings or furrows of the normal integument, these having been lost in the previous destructive process. Subjective symptoms are often absent, but when present range from a mild itching or burning to violent pain—a true neuralgia from involvement in the scar-tissue of nerve-filaments.

Etiology.—Scar-formation is always the result of a destruction of skin-tissues extending at least into the papillary body. This process is not necessarily ulcerative. It may be an exudation followed later by absorption, as mentioned in lupus erythematosus and certain syphilides, or a stretching—*e. g.* the lineæ albicantes—or a pressure, as in favus. Loss of the epithelial layers alone will not cause scarring; eczema, impetigo, pemphigus, leave the invaded skin intact, while the diseases whose course entails an extensive necrobiosis (gangrene) or suppuration (syphilis, furunculosis) leave permanent traces of their presence. Mechanical and chemico-dynamic factors, such as burns and caustics, are often causal in relation to cicatrix-formation. In accordance with this a distinction has been made between *traumatic* and *pathological* scars.

Anatomy and Pathology.—Since cicatrices in a majority of cases follow a necrosis *en masse*, and are the product of the process of healing in the open, granulating wound remaining in the skin, a knowledge of the

phenomena of granulation is necessary to a clear conception of scar-production. The appearance of granulation-tissue is familiar: the individual growths are rounded, soft, at first coarse, becoming finer at a later stage. They consist, microscopically, of two layers—an outer pyogenic, which is composed of pus-cells chiefly, and an inner plasmatic layer rich in vessels. The principal part of the granulations is made up of young connective-tissue cells derived from similar cells in the neighborhood of the wound. These corpuscles are converted in the deeper parts into fibers of the white variety, which gradually, by proliferation of the cells, increase in number, interlace, and form bundles. The interfibrillar spaces close, while the fibers themselves contract, thus drawing together the sides of the wound and narrowing its area. At the same time their contraction partially or wholly obliterates the nutrient vessels and hyperemia diminishes. This constitutes the first stage of repair. The second begins when the granulations reach the skin level, and includes the re-forming of the epidermic covering. A thin white border appears at the edge of the wound and slowly covers it in. This is always derived from old epidermis, even in case of islands of epidermis which may appear here and there, remnants of the previously existing glands perhaps. Cicatrization proper is then complete, but contraction of the connective fibers continues for some time, causing the puckering of the scar and surrounding skin occasionally seen, and, by obliteration of blood-vessels, the white glistening appearance already mentioned.

In a cicatrix of some years' standing the pathological changes present only a slightly modified picture. The skin-appendages, hair and glands, with the furrows, have been entirely lost. The corium is occupied by dense bands of white fibrous tissue interlacing and exhibiting few corpuscles and greatly contracted interfibrillar spaces. The blood-vessels are small and scattered or completely occluded. The papillæ have disappeared, together with the rete-pegs or are represented by stunted projections, a fraction of their former length. Kaposi's statement that they are invariably absent is not borne out by other observers (Heitzmann), and in consequence his microscopical distinction between keloid, cicatrix, and cicatricial keloid fails of universal application. In younger scars some vessels remain patent and give the formation its bright-red color. The polyhedral rete-cells may also contain much pigment (syphilis), which is carried into the blood-current later, and finally disappears altogether.

Cicatrization may become abnormal, and in this case the granulations are flabby, pale, dropsical, or hemorrhagic, a condition due to local causes—*e. g.* varicose veins—or to general derangements, as in tuberculosis or anemia, or to great size of the wound, when obliteration of peripheral vessels prevents proper nourishment of the central granulations.

Diagnosis.—Differentiation of scars from other skin lesions presents little difficulty. The chief point lies between hypertrophic cicatrix and keloid, and will be considered under the latter heading.

More difficulty attaches to the diagnosis of scars as the result of various diseases, and opinions are much at variance as to their nosological significance. A probable diagnosis, however, as to their origin can often be made. Those of syphilis¹ are oval or reniform, smooth, sharply defined, pigmented at first, but becoming an opalescent white later. Variola pockmarks are familiar; zoster occasionally leaves shallow, grouped cicatrices following the course of a nerve; lupus erythematosus and lupus vulgaris may be diagnosed by

¹ For further consideration see article by J. N. Hyde, "Cutaneous Cicatrices of Syphilis," *Journ. of Cut. and Gen.-urin. Diseases*, March, 1893.

their characteristic scars in many cases. On the other hand, it is often impossible to distinguish a burn-scar from that of a suppurating bubo, those due to glandular tuberculosis from syphilis, syphilis from a non-specific, ecthyma. Hence great care must be exercised on this point, which is often of the greatest value retrospectively.

Prognosis.—Scars of course have no effect on the duration of life. They may, however, particularly when extensive, cause frightful deformity, fixation of joints, stenosis of visceral openings, etc. Prognosis as to sequelæ and to the subsequent cosmetic effect should be guarded, but the latter is of little moment when the cicatrix can be covered by the clothes or hair. Much can be done by skin-grafting during the healing process.

Treatment.—Treatment should begin with the process of granulation, and should be directed to the production of a thin, flat, movable cicatrix. Feeble granulations will require stimulation by balsam of Peru, cauterization with nitrate of silver or sulphate of copper. Exuberant granulations must be repressed. A very good dressing for a healing ulcer, syphilitic or otherwise, is mercury plaster, which stimulates and at the same time tends to the production of a thin, flat cicatrix.

Treatment of a fully-formed scar is unsatisfactory—unnecessary if it is not hypertrophic. In that case, particularly if the scar is painful, some remedial measure is necessary. Excision may be done, thus substituting a linear cicatrix for the first. Vidal recommended deep parallel incisions, mincing the tissue and destroying the vessels.

Plastic operations and skin-transplantation may be necessary when deformities are produced. Pain in cicatrices is treated by emollient or narcotic applications (belladonna, cocaine).

KELOID. (JAMES C. JOHNSTON, M. D.)

Definition.—Keloid is a fibrous-tissue new growth, developing without demonstrable inflammatory symptoms in the corium and recurring upon removal.

Symptoms.—The division into spontaneous and scar keloid, true and false or primitive and secondary (Besnier), made to indicate the origin of the tumor, is not based on solid grounds, for the reason that spontaneity is difficult of proof, and in the predisposed the slightest injury, an insect-bite or a contusion, may form the starting-point. Cases such as those of Schwimmer¹ and De Amicis² must be accepted as primitive in all probability, but the growth is practically the same in any case, so that the distinction is unimportant.

A keloid appears as an elevated, scar-like body, usually flat on top, rising sharply from the healthy skin and projecting above it two to three millimeters. Its contour is variable—oval or flat and plate-shaped, crab-like, cylindrical, or rounded and nodular. From it claw-like processes are sent out into the surrounding skin. It may be single or multiple (the number in De Amicis' case was three hundred), and occurs symmetrically or otherwise, the sternal region, breasts, ears, neck, face, and genitalia being its sites of predilection. It is covered with epidermis, and is white, or more commonly a glistening red from the vessels running over it. It is firm and elastic, movable only with the skin, bald or dotted with a few hairs. Keloid may be painful on handling or spontaneously; again, the subjective symptoms may be confined to a prickling and burning.

¹ *Viertelj. f. Dermat.*, 1880.

² Congrès de Derm. de Paris, 1889, *Transactions*, p. 93.

After reaching a certain size the growth of the tumor usually ceases. It may continue to increase for a considerable time, or recommence its activity after a period of quiescence. Keloid never ulcerates, never displays more than a superficial excoriation. It is said to undergo involution very exceptionally, usually in young people, according to Hutchinson.

Etiology.—Age and sex have little or no influence on the development of keloid, although it is usually first seen between the ages of twenty-five and fifty. An inherited predisposition undoubtedly exists in certain individuals and races. Negroes are peculiarly liable to the disease. The slightest injury in certain subjects, a pin-prick, application of a mustard-leaf, an acne-pustule, may suffice to determine its development. It is a rare affection, multiple keloid more so than the single tumor.

Anatomy and Pathology.—Warren, Jr., was the first to describe the structure of keloid accurately, showing that the disease has its origin about the vessels of the corium. A fully-developed tumor consists of fine, dense bundles of white fibrous connective tissue, the fibers running with the length of the keloid and parallel to the surface. The cutis is occupied by this formation, which is separated from the epidermis by a layer of loose connective tissue, the latter forming an incomplete capsule around the new growth. Here and there a few oblique bundles may be seen. There are few nuclei and connective-tissue corpuscles, and those present are found about the scanty vessels in the center. In younger tumors and in the growing portions of old ones these cells are more abundant. The vessels are affected far beyond the actual limits of the growth—a fact which affords a reasonable explanation of its invariable recurrence. The connective tissue covering the tumor is loose and highly vascularized. The vessels in this situation give the keloid its bright-red color.

Kaposi states that the rete-cones are absent over a cicatrix and present in a keloid (see Cicatrix), making this the basis of his distinction between the two. Babes found in Schwimmer's case of keloid an entire absence of papillæ and pegs, and Crocker states they were wanting over the greater part of the tumor. Their appearance in a section of keloid seems to depend on the depth of the new growth in the corium: if it lies near the surface, pressure upon the cones and papillæ will cause their obliteration. In a keloid following a solution of continuity they will be absent over the site of injury. The rete itself is usually somewhat thickened.

Diagnosis.—The clinical appearance of a keloid is such that there is little danger of mistaking it for anything else. It may be distinguished from an hypertrophied cicatrix by the fact that the latter does not extend beyond the limits of the original injury. Localization and presence of hairs or furrows will aid in the diagnosis. In view of what has been said, a diagnosis by the microscope is not possible. No object is to be gained by a differentiation of keloid of spontaneous and cicatricial origin.

Prognosis.—This is so commonly unfavorable that the few cases of spontaneous involution or remedial improvement may be said to have no effect on the total. No measures devised, so far, are reliable. The keloid which follows syphilides sometimes disappears, as we have seen it in at least one case, but even here retrogression occurred in a few of the tumors only.

Treatment.—Treatment offers no satisfaction. Excision or removal by cautery is followed by a recurrence of the growth in a few months. The absorbents, external and internal, are inefficacious even when the tumor is of recent development. Iodine, iodized glycerine, emplastrum hydrargyri, and pressure may be tried, but in using the latter in the shape of bandages and

elastic coverings care must be taken to avoid friction, by which the growth may be increased. Vidal's deep parallel incisions, dividing the vessels and producing obliteration, may have a good effect if done repeatedly. Hardaway has seen fair results from electrolysis, but care must be taken not to use too strong a current, thereby stimulating the growth. It has been suggested—and the proposition seems worthy of trial—to remove keloids with as wide an incision as possible, and begin the use of Vidal's linear scarifications on the first evidence of a reappearance (*Le Dentu*). Pain may be relieved by anodyne applications or may require morphia or cocaine hypodermically. Pain usually ceases after the first deep scarification.

FIBROMA. (JAMES C. JOHNSTON, M. D.)

Synonyms.—*Molluscum simplex s. pendulum* (Willan); *Molluscum fibrosum*; *Molluscum non-contagiosum* (Bateman); *Fibroma molluscum* (Virchow).

Definition.—Fibromata are cutaneous neoplasms of connective-tissue origin, appearing in the form of flattened or pedunculated tumors of a uniform soft consistence.

Symptoms.—The tumors which constitute the disease occur in various shapes, colors, and sizes. They vary in number from one to several hundred; in size they run from a pin's head or a split pea to a man's head. Their color is usually that of the normal skin, but they may become pinkish from increased vascularity or brown from pigmentation. In the larger growths particularly numbers of dilated vessels are seen traversing them. The tumors are round, rather flattened, and sessile; when the size is great they are almost invariably pedunculated; in any case they project above the surface of the skin. They may be firm to the touch, but are usually doughy and their contents lax, so that they can be rolled between the fingers. The skin over them is usually free from follicles, though an occasional hair may be present. They often show a huge comedo in the center, which may approach a condition like that of atheromatous degeneration. There is no opening into the center of the growths, but in the pedunculated forms a pedicle may sometimes be felt, running down into the deeper tissues. Growth is usually slow; many remain stationary, and others undergo involution, leaving lax folds of skin, like empty bags, depending from various portions of the body. This condition is known as *fibroma pendulum*. It is merely a later development of the disease, the intermediate steps often being wanting, and should be differentiated from dermatolysis, a congenital condition which permits of extensive stretching of the skin.

Subjective symptoms, except such as arise from accident, are wanting. The tumors cause no other inconvenience than that due to interference with the movement of joints or of the lids or by excessive size. Maceration between folds of fibroma pendulum may result in an offensive discharge, with inflammation of the skin; when the cutaneous covering is stretched in the development of larger tumors, it may ulcerate or become gangrenous; the same effect may be seen from traumatism.

The site of predilection for fibroma is the trunk, but no part of the body is exempt. The entire surface may be studded at one time. The tumors occasionally also appear on the mucous membranes, particularly those of the palate, tongue, and fauces. Several varieties of the disease have been described, but, as they are parts of one process at various stages, it is not necessary to describe them. Certain writers (Crocker) regard the soft wart and fibrous mole as identical with this affection.

Etiology.—It is impossible in the present state of our knowledge to lay a finger upon a definite cause for the disease beyond a congenital idiosyncrasy and heredity. Groups of cases (Hebra,¹ Ochterlony,² Atkinson³) have been reported as occurring in the same family. Fibroma is about equally common in both sexes, and often begins in early childhood. Not interfering with the general health, it may be seen at any age. The pendulous form appears usually later in life. Certain races—*e. g.* the Chinese—exhibit a peculiar proneness to develop the affection. Hebra's statement that the patients are degenerate in body and mind applies to the majority only. Taylor and Schwimmer cite traumatism as a cause of fibroma.

Pathology and Anatomy.—Fibroma of the skin is due to a hyperplasia of the connective tissue of the deeper parts of the corium (Rokitansky) or of the subcutaneous tissue (Virchow, Kaposi), or, as is most probable, of both. The tumors arising from nerve-sheaths will be discussed under Neuroma. This hyperplasia of the connective-tissue elements in turn arises from a blocking of the lymphatic channels of the skin, but no reason has ever been assigned for this obstruction.

The histological appearance, as well as the theory just mentioned, seems to indicate a connection between fibroma and elephantiasis Arabum (page 970). The young tumors consist anatomically of gelatinoid connective tissue—in other words, of proliferated cells which later become transformed into fibrous tissue, as was explained under the heading of Cicatrix (page 986). The fibrous change first appears at the periphery of the growth. The fibers there are fine and delicate, densest at its base, while the center maintains its gelatinoid appearance. The transition is everywhere very gradual. The new growth pushes the skin before it and forms nodular or pedunculated tumors. At the apex the new tissue merges directly into that of the corium. Elsewhere the attachment is loose and the tumor easily enucleated. Between the fibers are seen numbers of connective-tissue cells with large nuclei, most numerous in the gelatinoid portion. Large vessels enter and emerge at the base, breaking up into fine capillaries at the periphery. The epidermis remains unchanged, while the glands and follicles are partly intact, partly atrophied, varying in degree with the amount of tension. Comedones and atheroma occurring in the tumors have already been mentioned.

Diagnosis.—The chief difficulty in the diagnosis of fibroma lies between it and lipoma. The latter is lobulated, not pedunculated, and its numbers are rarely anything like so great. The microscope will settle the question beyond the possibility of a doubt. Sebaceous cysts have been mistaken for fibromata, but a puncture will allow their contents to escape, while fibromata are solid. Molluscum contagiosum differs from molluscum fibrosum in the presence of a central depression, its auto-inoculability, and the possibility of squeezing out its whitish, semi-fluid contents. Mollusciform and pigmented nevi are congenital in origin, and usually confined to one spot.

Prognosis.—The prognosis is bad, since we are unable in any way to prevent the development of the tumors or to cause their absorption. The result of treatment may be good when the number is small, but it should be remembered that recurrence may take place unless removal is complete. The disease in itself is not a fatal one, but marasmus and tuberculosis frequently attack the patients.

Treatment.—Treatment may be summed up in one word—removal. No matter what means are employed, the removal must be complete. The

¹ Hebra: vol. iii. p. 341.

² Ochterlony: *Amer. Arch. of Derm.*, July, 1875.

³ Atkinson: *N. Y. Med. Journ.*, vol. xxii. p. 601.

pedunculated tumors may be separated by ligature, the éraseur, or galvano-cautery. Care should be taken to secure the vessels, as in the larger growths hemorrhage is apt to be great. When small they may be excised or snipped off with the scissors. Electrolysis is useful in the sessile forms. When the numbers run into hundreds, little can be done beyond removing those which by their size or position are most annoying.

LIPOMA. (JAMES C. JOHNSTON, M. D.)

Definition.—Lipoma is a term applied to a connective-tissue tumor consisting of fat-globules lying either in the corium or subcutaneous tissue.

Symptoms.—Two varieties of this new growth have been described: the *diffuse*, in which the fat is distributed over comparatively large areas and merges gradually into the surrounding skin—a condition known as leontiasis; and the *circumscribed* form, most often seen. The latter consists of one or many rounded lobulated elevations covered by normal or slightly pigmented skin, which is movable over them. Their sites of predilection are the neck, back, and buttocks. The tumors themselves are usually movable, and impart a peculiar sensation of softness to the touch. They are painless, except when injured or when nerves are involved in their growth. They are rarely pedunculated, the base being usually broad. Their growth is slow, but in course of time the size attained may be very great.

Étiology.—Circumscribed lipomata are more common in women than in men, and usually appear after puberty. A congenital growth is rarely seen. The diffuse form is confined practically to men well advanced toward middle life. Beyond these generalities knowledge of their origin does not extend.

Anatomy.—Lipoma consists of a white fibrous-tissue framework in whose meshes lie the fat-globules. The latter are identical in appearance with physiological fat. When the framework is small the tumors are soft and the fat-globules large; when it is well developed (steatoma), they are hard and the fat more solid. The connective tissue may undergo calcification or ossification. Lipomatous growths may be combined with myxoma, fibroma (nævus lipomatodes), or with angioma or sarcoma.

Diagnosis.—Diagnosis is comparatively easy. Lipoma might be mistaken for sarcoma, but the microscope will definitely settle the question.

The **prognosis** is good, for lipomata offer no menace to life or health.

Treatment is surgical, and consists in removal. The growths do not require treatment unless they are disfiguring or interfere with movement by their size. Complete excision should be practised where possible.

MYOMA. (JAMES C. JOHNSTON, M. D.)

Definition.—Myoma cutis is a rare new growth composed of fibers of unstriped smooth muscular tissue.

Symptoms.—Besnier,¹ who has studied the affection carefully with the aid of one of the rarer eases, divides the tumors into two classes: a large variety, usually single, occurring where this muscle is well developed, as in the scrotum, and chiefly of surgical interest; and a smaller, or *liomyoma*, which is multiple. Of the latter about 11 cases have been reported—by Jadasohn (2 cases), Lukaszewicz, Hardaway, and others. (A bibliography will be found in the reference to Besnier.) The tumors appear first as macules, and

¹ *Annales de Derm. et de Syph.*, 1880, p. 25, and 1885, p. 322, Besnier-Doyon, Kaposi, vol. ii. p. 345—notes.

develop through a papular stage into tubercles or nodules the size of a pea. These nodules occur in groups asymmetrically scattered over any part of the body, head, trunk, or limbs. Their growth is slow and is attended by much pain, spontaneous or caused by the slightest pressure. They are white, pink, rose-red in color. A few may undergo involution, but the usual course is progressive, new crops forming and the size of each lesion increasing. The pain may also grow worse, but may be paroxysmal, coming on at intervals of varying length, more violent at night.

The **etiology** is obscure. Six of 8 cases were females, their ages ranging from twenty-three to sixty. In one case (Brigidi's) the tumor-formation began as an ecchymosis.

The **anatomy** sheds a little light on the subject. The neoplasm is composed of involuntary or unstriped muscle-fibers, surrounded often by what appears to be a capsule of elastic tissue, seated entirely in the cutis and developed from pre-existent fibers of the arrectores pilorum or of the middle coats of the blood-vessels.

Diagnosis of such growths is never easy. They may be mistaken for xanthoma, lymphangioma, fibroma, if only the clinical characters are relied upon, but under the microscope the difficulty is readily removed.

The element to be considered in **prognosis** is the pain, which may be violent enough to occasion a deleterious effect on the health. The tumors themselves are of course benign.

Large single myomata occur usually on the mammæ or genitals in the shape of large projections, perhaps the size of an orange. They are painless, and contractile on stimulation. They often occur combined with fibrous tissue (fibro-myomata), with vascular new growths (angio-myomata) or with lymphatic hyperplasias (lymphangio-myomata).

Treatment is only successful when it consists in removal. Excision is the best method if the neoplasms are not too numerous.

NEUROMA. (JAMES C. JOHNSTON, M. D.)

Definition.—A neoplasm in the skin consisting of medullated and non-medullated nerve-fibers, with a large admixture of fibrous tissue.

Symptoms.—The two cases of Duhring¹ and Kosinski² furnish the description given here. In these two there is no doubt the growth was cutaneous, not subcutaneous. Both patients were men in whom the disease had been developing for ten and fourteen years respectively. In one the area supplied by the circumflex was attacked; in the other, that of the sciatic and external cutaneous. The tumors appeared as small pale nodules seated in the skin and movable only with it, discrete or confluent. They varied in size from a pinhead to a hazelnut. The skin between showed no change except when pain was present, changing then to pink or violet. The pain, at first absent, became later exquisite, particularly on pressure, occurring in paroxysms and radiating from the original seat.

Etiology.—Trauma and mechanical irritation are probably determining influences in the growth of neuromata. Virchow claims that tubercular patients are prone to their development. They sometimes occur in members of the same family, and may be congenital. All forms of neuromata commonly appear between twenty and fifty years.

Anatomy.—Fibro-neuroma is the name which should be applied to

¹ Duhring: *Amer. Journ. Med. Sciences*, Oct., 1873.

² Kosinski: *Centralbl. f. Chirurgie*, No. 16, 1874.

these tumors, for the reason that they are composed chiefly of fibrous tissue in which the nerve-fibers are scattered. True new formation of nerves of both medullated and non-medullated does take place (Kaposi). Fibro-neuromata are connected with nerve-trunks in various ways, adherent to the sheaths or separating the fibers. The form of connection in Duhring's case was not demonstrated. They are localized in the derma or subcutaneous tissue, usually the latter.

Diagnosis by microscopical examination may be necessary. Myomata resemble these growths very closely.

The **prognosis** is good.

Treatment.—Both the cases mentioned were cured by removing a part of the nerve-trunk distributed to the tumors. Both the tumors and the pain forthwith subsided.

OSTEOMA. (JAMES C. JOHNSTON, M. D.)

Only two cases of new bone-formation in the skin proper have been thus far reported. In Coleman's¹ case the osteoma appeared in the derma of the foot, one of the toes, and the heel of a young girl. Salzer, Jr., reported a case from Billroth's clinic in which the bone formed in the scalp, the plate being pierced by the follicles and glands. In both the bone occurred in the form of plates, elevating the skin above them. Their nature was not suspected until placed under the microscope.

The only efficacious **treatment** consists in ablation.

MOLLUSCUM CONTAGIOSUM. (S. POLLITZER, M. D.)

Synonyms.—Molluscum epitheliale; Molluscum sebaceum; Molluscum verrucosum; Molluscum sessile; Epithelioma contagiosum; Acné varioliforme of Bazin.

Definition.—A contagious disease of the skin characterized by discrete, pearly-white, or pinkish papules, from a pinhead to a pea or larger in size.

Symptoms.—The disease occurs most commonly on the face, the neck, the chest, and the genitals, and but rarely elsewhere, and is more common in children than in adults. The lesions vary from a few in number to several score. At its very inception the disease is not recognizable: even the smallest papules, of a mustard-seed in size, are complete in their clinical features, though they may later attain a much larger size. They appear as hard, round, hemispherical papules, of a pearly-white color or having the normal color of the skin. As a rule, they have the appearance of a semi-translucency like that of paraffine. The base of each little nodule is sometimes surrounded by a pinkish areola. The upper surface of the papule is seldom smooth; in the larger papules a distinct central umbilication is the rule, and in all close inspection will reveal a darker spot at the summit of the papule, from which, on lateral pressure, a whitish curd-like matter may be expressed. The growths, firm and round at first, become as they increase in size somewhat softer and flatter, like half of an oblate spheroid. The course of the lesions varies. Sometimes the papules remain hardly more than a pinhead in size, persist for several weeks or even months without change, and then disappear, leaving no trace behind. As a rule, however, they increase in size, sometimes rapidly, sometimes slowly, the majority perhaps attaining a diameter of about 3 mm. Having reached this size, they remain stationary until through some perhaps accidental cause they begin

¹ Coleman: *Journ. of Cut. and Gen.-urin. Dis.*, May, 1894.

to soften and undergo suppuration, the little tumor being thus thrown off. In such cases the central depression is converted into a deeper pocket filled with pus, and the signs of inflammatory reaction may extend for some distance around each nodule. Very rarely they continue to grow beyond the size of a pea, and a few instances have been recorded in which a single tumor has attained the size of a small orange (*molluscum giganteum*).

While, as a rule, the lesions are few and scattered, they are occasionally present in enormous numbers, and they may be grouped closely together or may be scattered promiscuously over the whole integument, as no part is exempt except the palms and soles. They have been observed even on mucous membrane. The disease occasions no subjective symptoms, except rarely a slight itching.

Anatomy and Pathology.—Notwithstanding its clinical unimportance, the disease has given rise to a comparatively extensive literature and been

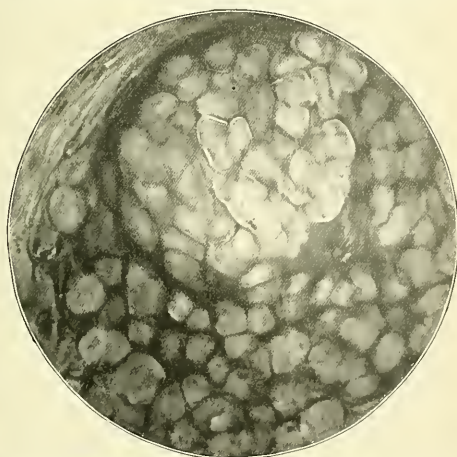


FIG. 246.—Molluscum contagiosum, showing group of typical molluscum-cells (author's case, section, and photomicrograph).

the occasion of very warm discussions. Dermatologists to-day are by no means agreed as to the nature and seat of the pathological changes. The peculiar acinous structure of the new growth on vertical section, as well as the gland-like and sebaceous appearance of the mass when expressed, furnished fair foundation for the belief of the earlier writers that the affection was a disease of the sebaceous glands. The most elementary of modern histological methods, however, readily demonstrate the incorrectness of this view, which, in fact, is maintained to-day only by Kaposi and a few others. According to the vast majority of competent authorities, the disease is a proliferation of the epithelial cells of the rete, accompanied, according to some, by degeneration of the protoplasm of the cells—due, according to others, to an invasion of coccidia. It is not improbable that the first changes occur sometimes in the rete of the hair-follicle, but this seat is exceptional.

On vertical section through the middle of a molluscum-nodule, a glance

through the microscope with a low power reveals an epithelial structure bearing considerable resemblance in its lobular arrangement to a sebaceous gland. Between the lobules, at their deep portions, are fine septa of connective tissue. Toward the upper part of the growth the epithelium merges into a thick layer of cells containing kerato-hyaline, above which a broad, irregular mass of large cornified cells may be seen. These cells contain the peculiar homogeneous, transparent, highly reflective, spherical bodies known since Patterson¹ as "molluscum bodies," and regarded by Bollinger, Darier, Neisser, and others as animal parasites (coccidia) which have penetrated and developed within the epithelial cells. A closer study with higher powers of the microscope and suitable staining² reveals changes in the lower epithelial layers of the new growth, which become more and more marked as the higher layers and the horny plug are reached. The protoplasm of the cells here and there contains small clumps of a denser hyaline appearance, which, becoming more and more numerous toward the upper part of the growth, more or less fill the body of the cell, whose nucleus is compressed and pushed to one side by them. These little masses within the body of the cell often acquire, by mutual pressure, a faceted appearance, but above the kerato-hyaline layer they are agglomerated into a uniform mass, completely filling the cell, which, instead of having the flattened, shrunken aspect of a normal horn-cell, is distended by the included mass (the molluscum body) into a large oval or spherical cell.

The process of cornification appears to be not much affected by the serious changes in the protoplasm of the cell. The walls of the cells above the kerato-hyaline layer are completely cornified, and form a close mantle surrounding the molluscum body, which is distinctly differentiated by its optical and chemical properties. The most careful and elaborate study of these bodies made by Török and Tomasoli³ has satisfactorily demonstrated the absence of any signs of independent vitality on their part, and from their chemical reaction has shown them to be masses of colloid matter. As to the theory of their parasitic nature, the writer is of the opinion that not one particle of evidence has been advanced which could fulfil the postulates established by the Koch school of bacteriologists: the alleged organisms have not been cultivated, and of course no cultures successfully inoculated. The theory rests solely on some gross morphological resemblances.

The cutis bordering the little growth shows but slight signs of irritation, unless suppuration has occurred, when the inflammatory reaction may be somewhat marked.

Etiology.—The cause of the disease, while there is no doubt of its parasitic nature, remains unknown. The evidence that the disease is contagious is so strong that there is now practical unanimity on this point. This evidence⁴ may be grouped under three heads: 1. Clinical evidence of occurrence in epidemics. Numerous observations are recorded of a great many cases occurring in groups in asylums and institutions for children. 2. Evidences of accidental inoculation, as from the face of the nursing child to the breast of the mother or to the arm on which the child's head rests, and from the patient to the hand of the physician (Brocq, Allen). 3. Direct experimental inoculation. A small but convincing number of successful inocula-

¹ *Edinb. Med. and Surg. Journ.*, 1841.

² Cf. Unna: *Histopath. der Hautkr.*, Berlin, 1894, p. 798 *et seq.*

³ *Monatsh. f. prakt. Derm.*, x. p. 149.

⁴ A résumé of the most important facts is given by Stelwagon, *Journ. Cut. and Gen.-urin. Dis.*, April, 1895.

tions with particles of molluscum tumor transferred to the skin of healthy persons has been made (Retzius, Vidal, Pick, and others).

The disease is seen more commonly in dispensary than in private practice; that is, it occurs chiefly among the poorer classes living under unhygienic conditions. It is far more common in children than in adults, and in the latter occurs almost exclusively on the genitals. Hutchinson and Crocker believe that they have in several cases been able to trace the infection to the Turkish bath.

Diagnosis.—The diagnosis of the disease presents no difficulties. The small, hard, round, glistening, translucent tumors occurring discretely on the healthy skin are so characteristic that, once seen, they cannot be mistaken for anything else. At first glance the vesicles of varicella bear a resemblance to molluscum-nodules, but a closer inspection and, above all, the effect of pricking open and squeezing the lesion, will clear the diagnosis.

Treatment.—The treatment of molluscum contagiosum is very simple. It suffices in most cases to make a superficial incision at the top of the tumor, and by lateral pressure with the thumb-nails to squeeze out the contents of the growth. Several drops of blood generally follow, but a pad of cotton readily stops the bleeding. Some authors recommend the application of the caustic pencil to the floor of the lesion after the extrusion of its contents, or touching it with a pointed stick dipped into acid nitrate of mercury, but I have not found it necessary. I generally advise the innunction of white precipitate ointment as a mild antiseptic and astringent to the skin all around the affected region for a week or two after the nodules have been emptied.

THE XANTHOMATA. (S. POLLITZER, M. D.)

Three varieties of xanthoma of the skin are usually described: xanthoma planum or palpebrarum, xanthoma tuberosum or multiplex, and xanthoma diabeticorum. The writer is of the opinion that the term xanthoma covers several pathologically distinct diseases, and that xanthoma planum or palpebrarum has nothing in common with the generalized xanthomata.

The disease, as affecting the eyelids, was first described in 1835 by Rayer under the name of *plaques jaunes folliculeuses*. Addison and Gull (1851) gave it the name *vitiligoidea*; Erasmus Wilson proposed *xantheasma*. Bazin (1869) described it under the name *molluscum cholestérique*. In the same year W. F. Smith called the disease *xanthoma*.

XANTHOMA PLANUM SEU PALPEBRARUM.

The disease in this location is not at all rare. It occurs in small flat papules or plates very slightly raised above the surface of the skin in which they lie imbedded, of irregular but sharply-marked outline, the longer axis horizontal, of a lemon-yellow to a chamois-leather-yellow color. The patches are soft and smooth to the touch, and on pinching up the skin it does not feel thickened. At their origin they are no doubt microscopic, but we rarely see them less than an eighth of an inch in their long diameter. The patches appear first, as a rule, on the upper lid near the inner canthus of the left eye, and new ones, forming gradually, to a greater or less number may coalesce with the older ones, so that in extensive cases the entire lid, or even both lids, may be involved, the yellow plates forming a complete circle around the eye. In most cases the right eyelid is sooner or later affected, so that ultimately the disease is symmetrical. Once established, the disease undergoes no apparent change. It occasions no subjective symptoms, and no inconveni-

ence except that due to the disfigurement or sometimes to interference with the movements of the lids.

Etiology.—The disease occurs more frequently in women than in men, and begins, as a rule, at about the fortieth year, the extremes of age, however, being twenty and eighty-four years (Hutchinson) for adults, though a few cases have been recorded in children and infants. There is no doubt that the disease runs in families, and many cases of heredity¹ through several generations have been recorded.

Diagnosis.—The only condition likely to be confounded with xanthoma of the eyelids is milium, especially when the lesions are large and occur on a deeply pigmented skin. On pressure, however, the little tumors of milium appear distinctly whitish, while the yellow color of the xanthoma plates becomes even more marked, and milium feels firm and hard like a shot superficially imbedded. Furthermore, the milium tumor can be readily shelled out.

Treatment.—The treatment is surgical, but where the disease is extensive nothing should be done. Where the patches are few in number they may be removed by the knife, the incision going down to the muscle. But great care must be exercised lest the resulting contraction produce ectropion. I have seen fair results from electrolysis; many sittings are necessary, and the operator must not attempt too much at once, lest too close punctures produce sloughing.

XANTHOMA MULTIPLEX.

The terms xanthoma tuberosum, xanthoma tuberculatum, and xanthoma *en tumeurs*, referring to the different sizes of the lesions, are all included under the term xanthoma multiplex. Since the first case published by Addison and Gull (1851) about 70 cases have been recorded. The lesions are from a pinhead to a pea in size (except in the rare cases in which single lesions have attained the size of a large walnut), of a pale yellowish color, and consist of firm, roundish tumors imbedded in the skin, which is raised into more or less prominent nodules by them. In the "giant" form the tumors are apt to flatten out at the top and assume a mushroom shape. The lesions vary from a few in number to many hundred. They may occur on any region of the skin, but their most frequent situation is the extremities, on the extensor side of the large joints, and on the buttocks. They are always discrete, but may in places be so closely aggregated as to give the appearance of an almost unbroken sheet over a considerable area. The tumors occur also on mucous membranes and endothelial surfaces, and have been observed on the cornea and conjunctiva, in the mouth, the respiratory tract to the bronchi, the esophagus, on the capsule of the spleen and the liver, the lining of the bile-ducts, the pericardium, and on the sheaths of tendons, though the identity of the growth in these regions with that in the skin has not been definitely established in every case.

While, as a rule, there is a certain degree of symmetry in the distribution of the lesions, this is not always the case, and the disease may be limited to a single group of nodules. In a case of Hardaway's they were distributed like zoster over the ninth and tenth intercostal spaces. In Köbner's case the disease was limited to the neighborhood of the axilla, and the nodules were reddish in color, owing to their association with capillary nevi. In other cases the lesions have been associated with multiple fibromata, with fibroid thickening around the joints, or with fusiform thickening of numerous ten-

¹ Cf. Török: *Annal. de Derm.*, 1893.

dons. The disease rarely undergoes any change for many years after its establishment, though in several cases spontaneous involution has been recorded, and it is probable that they all get well in time.

Etiology.—The great majority of cases occur in male adults, but the disease has been observed also in children. In most of the cases developing after puberty (about four-fifths) there has been a distinct history of chronic obstructive jaundice, often associated with enlargement of the liver (Crocker). In the infantile cases there seems to be sometimes an hereditary tendency, associated perhaps with gouty and rheumatic conditions.

Diagnosis.—Crocker refers to two cases in which urticaria pigmentosa was mistaken for xanthoma. In the former, however, the lesions are of a more brownish tint, are very hard, and are always associated with wheals or factitious urticaria. I have recorded a case in which multiple dermoid cysts to the number of about one hundred and fifty so closely simulated xanthoma that the diagnosis was made only after microscopic examination.

Treatment.—Excision is an efficient mode of treatment, but it is applicable, of course, only to those cases in which the lesions are very few in number. The same remarks apply to treatment by electrolysis. Morrow records a case of the successful removal of the lesions situated on the sole of the foot by the application of a strong salicylic-acid plaster.

XANTHOMA DIABETICORUM SEU GLYCOSURICUM.

The first case of this form of xanthoma was described, though not recognized as a separate disease, by Addison in 1851. Malcolm Morris¹ in 1883 first called attention to the disease as a clinical entity. Altogether, about 30 cases of the affection have been recorded, one-quarter of them in America.

The eruption bears a strong resemblance to that in xanthoma tuberosum. The lesions consist of rounded or obtusely conical papules, whose summit is of a pale or lemon-yellow color, while their base is of a dull-red hue. The papules are firm to the touch, from a tenth to a sixth of an inch in diameter, though sometimes larger, and sharply defined. In my case² some of the lesions formed prominent excrescences, such as occasionally occur in xanthoma tuberosum. The eruption is most frequently located on the buttocks, the knees, and the elbows, but may occur almost anywhere on the integument. The papules may be very numerous or comparatively few. Itching, prickling, and tenderness commonly occur. The eruption comes out quite rapidly at first, and after persisting a variable length of time—months or years—disappears, often very quickly, without leaving a trace; or new papules may come while the old ones are going; or there may be a fresh outbreak after the eruption had completely disappeared.

Etiology.—With a single exception all the cases have been males. In age they have ranged from seventeen to forty-six, though most of the cases occur between thirty and forty. The majority of the patients have been rather florid, well-nourished-looking people. In most of the cases there has been glycosuria, either preceding or following the outbreak, but repeated examinations failed to disclose sugar in some of them. In one case pentose was found in the urine.

Anatomy and Pathology.—The histology of the xanthomata has been the subject of much controversy. In the current view of the relationship of

¹ *Path. Trans.*, xxxiv., 1883, pp. 278 and 284.

² *Brit. Journ. Dermat.*, 1893. A list of all the published cases is given by Johnston, *Journ. Cut. and Gen.-urin. Dis.*, Oct., 1895.

the various forms of the disease to each other xanthoma planum palpebrarum and xanthoma tuberosum multiplex are regarded as identical processes, while most authors agree in regarding xanthoma diabeticorum as a distinct disease. The characteristic cells of all the xanthomata are large, often multinuclear structures, more or less filled with fine granular fat. Aggregations of these cells occur in the corium, the epidermis showing virtually no changes; and considerable quantities of pigment, free in the lymph-spaces or enclosed in cells, are scattered through the affected region. The yellow color of the patches is probably due, however, to the fat rather than to the pigment. As to the nature of the xanthoma cells there is great difference of opinion.

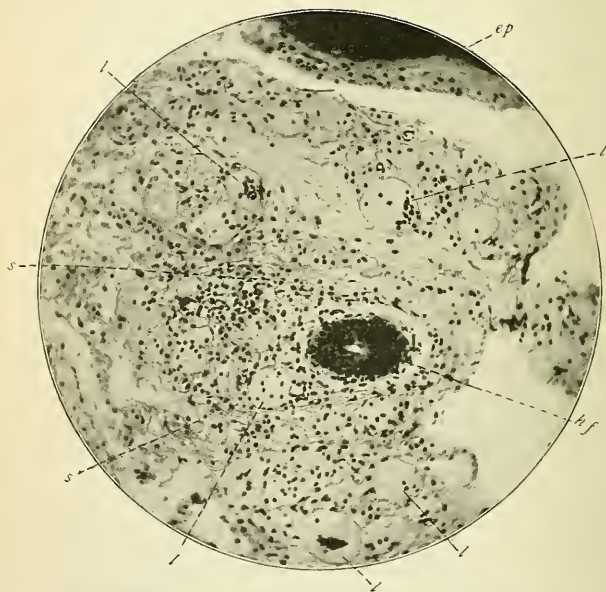


FIG. 247.—Xanthoma planum palpebrarum vulgare: *ep*, epidermis; *hf*, hair-follicle; *l*, large xanthoma cells; *s*, small xanthoma cells (author's case).

Some authors look upon them as connective-tissue cells that have undergone fatty degeneration; some, as endothelial cells; some, as embryonically misplaced fat-cells. For most authors the sole difference between xanthoma diabeticorum and the other xanthomata consists in the signs of more active inflammation which the former shows. In my opinion,¹ the two forms of generalized xanthoma are pathologically similar processes, and have no connection whatever with the localized form, the xanthoma planum palpebrarum. I regard the generalized xanthomata as hyperplastic connective-tissue processes whose cells have a tendency to undergo fatty infiltration with ultimate degeneration. In the common multiple xanthoma the process

¹ "The Nature of the Xanthomata," *Journ. Cut. and Gen.-urin. Dis.*, 1898.

of degeneration is extremely slow, and it may be years before the cells are finally destroyed; in the diabetic form the process is more rapid. Xanthoma planum palpebrarum is the result of the degeneration of fibers of the orbicularis muscle of the eye; the large multinuclear granulo-fatty structures do not represent cells, but are fragments of muscle-fibers that have undergone a slow degeneration analogous to the more rapid change that occurs in many of the systemic muscles after acute infectious diseases, such as typhoid. The generalized xanthomata are probably the manifestations of a metabolic



FIG. 248.—Xanthoma tuberosum multiplex (author's case), showing circumscribed nodule in the cutis: part of another nodule to left of field.

disturbance of hepatic diabetic, or rheumatic origin; the palpebral form is a purely local process.

ANGIOMA SERPIGINOSUM. (S. POLLITZER, M. D.)

Only half a dozen cases of this rare disease have been described, the first by Hutchinson.¹ The disease consists of minute bright-red macules, arranged, for the most part, in irregularly round patches. As the process continues the patches clear up in the middle while spreading peripherally, thus forming rings with free and sometimes atrophic centers. As outlying patches are continually though slowly developing, the various bright-red rings often meet, coalesce, and thus form irregularly gyrate patches, sometimes of con-

¹ The first four cases will be found in *Hutchinson's Archives*, vol. iii. (1891). A. G. Francis has a beautiful illustration of a case in the *Int. Atlas of Rare Skin Diseases*, xxxiv. White's valuable contribution was published in the *Journ. Cut. and Gen.-urin. Dis.*, Dec., 1894.

siderable extent. The little macules which make up the patches vary in size from that of a pinhead to a point visible only with the lens. The larger of them have a bluish-red hue. We do not know as yet what the termination of the disease is. In most of the cases observed the disease developed in early infancy, and its progress, though extremely slow, was continuous. In the majority of recorded cases the patches were located on the arm, but the disease has been observed also on the leg, the chest, and the face.

Anatomy and Pathology.—Of the recorded cases, only one, that of White, has been subjected to careful histological study. The specimen was examined independently by Darier of Paris and Councilman and Bowen of Boston. The growth is made up of masses of endothelial cells arranged in groups which indicate their connection with the blood-vessels of the corium. In these cell-masses there is evidence of the new formation of capillaries. Many of the cells afterward undergo atrophy and necrosis—a fact which explains the retrogression of the growth. The authors agree in regarding the process as a variety of angio-sarcoma.

DARIER'S DISEASE AND PROTOZOAN INFECTION. (S. POLLITZER, M. D.)

Synonyms.—Psorspermosis follicularis vegetans (Darier); Keratosis follicularis (White); Ichthyosis sebacea cornea (E. Wilson); Ichthyosis follicularis; Aene sebacée cornée (Fr.).

Definition.—An extremely chronic affection of the general integument, characterized by the formation of horny plugs at the sebaceous orifices and a tendency to papillomatous hypertrophy.

Although the disease, which is so rare that only about twenty cases of it have been recorded, was described nearly forty years¹ ago, the remarkable publication of Darier² on its pathology, based on two cases in 1889, first called general attention to the disease. The association of his name therefore with this affection seems, at least provisionally, justifiable. Notwithstanding the general objection to naming diseases after individuals, we do so in this case, following Buzzi, Crocker, and Unna, rather than accept any of the other names suggested, which convey erroneous ideas of its pathology or commit us to a theory.

Symptoms.—The disease occurs anywhere on the integument, its seats of predilection being those regions that are most bathed in perspiration—that is, the middle of the chest and back, the neck, the axillæ, the umbilical and inguinal regions, and, to a less extent, the scalp, the face, and the extremities. The elementary lesion consists of a flat, rounded, or conical, slightly elevated papule of reddish color, located at the pilo-sebaceous orifice, and covered with a dirty grayish-brown, yellowish, or black, firmly adherent, greasy crust, sometimes pierced by a hair. Removing this crust discloses a conical depression, the widened orifice of the hair-follicle, from which a yellowish-white cheesy matter may be expressed. The lesions are discrete at first, but as the disease progresses they become confluent, and large areas of skin become covered with the dirty grayish-brown masses, which impart a rough, grating sensation to the finger passed over its surface. The crusts or plugs of horny sebaceous matter increase gradually in size, as well as in number, and many of them project above the surface as little horns, one-third, one-half, or even three-quarters of an inch in height. Large masses, constituting elevated flat

¹ The case occurred in the service of Bazin at the hospital at St. Louis in 1859, and was published by Lutz, *Thèse inaugurale*, under the title "General Hypertrophy of the Sebaceous System," Paris, 1860.

² *Annal. de Derm.*, July, 1889.

tumors, may be formed by confluence of the lesions, especially on the chest, abdomen, and the anal and inguinal regions. These tumor-like masses become excoriated, and their papillomatous hypertrophic vegetating surface is bathed in a fetid and sanious secretion. On the scalp the disease may resemble a seborrheic eczema, the moist red surface being covered with greasy scales and crusts. On the back of the hands the lesions appear as firm, translucent, flat, verrucous elevations, which may become confluent and cover the surface in an uneven and horny plate. The back of the feet may be covered with large blackish-scales, as in ichthyosis. The palms and soles may be dotted by small yellow papules consisting of the horny layer thickened over the papillæ. The nails are generally rough, longitudinally furrowed, and ragged at their free edges. In the axillæ, owing to maceration, the plates of horny matter have a softer consistence and may more easily be rubbed off. The course of the disease is constant, progressive, and slow, though at times its evolution over a given area may be rapid. Itching, more or less marked, is always present, and the affected surfaces are, in consequence, excoriated by scratching. The larger vegetating tumors occasion considerable pain, and by robbing the patient of sleep seriously interfere with the health. Otherwise, the general health of the patient is not at all affected.

Anatomy and Pathology.—A number of competent observers have made careful studies of the anatomical conditions underlying the disease. Of these, the observations of Darier, Boeck,¹ Bowen,² and Buzzi³ are perhaps

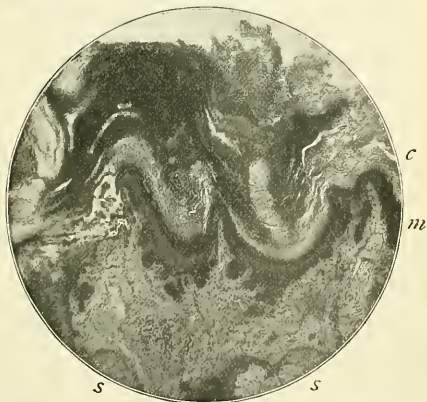


FIG. 249.—Darier's disease: *c*, greatly thickened horny layer; *M*, rete Malpighii, irregularly thickened and proliferating; *s*, sebaceous gland (author's specimen and photomicrograph).

the most important. All writers on the subject agree in the main features of their description, with which my own observations upon specimens kindly presented to me by Darier, and on material which I obtained from Lustgarten's case,⁴ are in harmony (see Figs. 249, 250). The chief seat of the disease is the upper portion of the pilo-sebaceous follicle and its immediate neigh-

¹ *Archiv für Dermat. u. Syph.*, 1891.

² *Boston Med. and Surg. Journ.*, 1891.

³ Buzzi and Miethke: *Monatsh. f. p. Dermat.*, 1891, Bd. xii.

⁴ *Journ. Cutan. and Gen.-urin. Dis.*, 1891.

borhood. The mouth of the follicle is widened into a funnel-shaped opening, which is filled with a mass of horn-cells continuous with the thick crust or projecting horn that covers the follicular orifice. The wall of the follicle is composed of an abnormally thick horny layer which limits a rete whose cells are irregularly arranged and whose basal layers shows signs of very active proliferation. The rete is of irregular thickness, in some places being limited to one or two layers, in others sending numerous long digitations into the cutis—a constant and characteristic feature which Darier expressed in the term “vegetante.” Here and there in the rete there are irregular spaces, lacunæ, around which the cells have lost their prickles and their nuclei and stain feebly. In the lower portion of the mass filling the follicle Darier discovered peculiar refractive double-contoured cells, somewhat larger than an epithelial cell, containing clear or granular protoplasm and large, well-marked nuclei, which he, supported by the authority of the biologists Malassez and



FIG. 250.—Darier's disease: detail from Fig. 249 in the stratum granulosum in the middle of the field—a so-called psorosperm.

Balbiani, regarded as animal parasites—coccidia. Similar cells, or “round bodies,” are found in the rete, with the rete-cells arranged concentrically around them as in epithelial pearls. The greater mass of the horny plug in the follicle is made up of cells refractive and homogeneous or containing traces of a nucleus about half the size of the “round bodies.” The larger tumor-like masses are papillomatous growths of the same general characters as the lesions elsewhere. The cutis proper is not at all affected or shows but slight inflammatory reaction.

According to Darier, the disease, pathologically, is to be regarded as an infection with psorosperms through the follicles, with irritative disturbance due to the presence of these organisms. But the majority of observers outside of France do not share this view. Boeck, Buzzzi, Bowen, Unna, and others regard the so-called psorosperms as metamorphosed rete-cells which have undergone either hyaline or corneous degeneration. All attempts at cultivation of the suspected organism and at inoculation have proven failures, while there is not much difficulty in obtaining evidences of vitality in

undoubted coccidia, such as those found in the liver of the rabbit; and the resistance of these cells to stronger reagents, acetic, nitric, hydrochloric acids, etc., serves also to differentiate them from coccidia.

Etiology.—Aside from the theory of the coccidial origin of the disease, we know nothing of its etiology. From its clinical aspects, however, it seems safe to regard it as of infectious origin. Nearly all the cases have occurred in males, and in the great majority of them the disease began in childhood or early manhood. Three of Boeck's four cases occurred in one family, a father and two sons; and White observed the disease in father and daughter.

Diagnosis.—A well-marked case of the disease should offer no difficulty in diagnosis. In an early stage the papules may suggest lichen planus, and Lustgarten's case had previously been described by another writer as one of lichen ruber acuminatus; but the peculiar greasy, horny plugs and the sebaceous matter that may be expressed from the widened follicles, and, later, the vegetating masses in the inguinal and other regions, together with the distribution of the lesions, form a sufficiently characteristic picture. While the peculiar coccidia-like cells occur in other diseases, in no condition are they nearly so abundant as in Darier's disease, and a microscopic examination should clear up any doubt.

Prognosis.—No cases of the disease have yet been reported cured, and in none has there been any appreciable amelioration under treatment. While the patient's general health may remain but little influenced, the disease progresses steadily or persists unchanged.

Treatment.—The treatment, it is clear, has so far been very unsatisfactory, no permanent benefit having been achieved in any case. On general principles the therapeutic indications would seem to be to remove the crusts and apply antiseptics and resolvents. A 5 or 10 per cent. salicylic-acid ointment or plaster, in connection with frequent baths with *sapo viridis*, would fulfil these indications. Boeck found an ointment of pyrogallol useful. Crocker suggests prolonged baths with potassium sulphide, $\frac{5}{16}$ to 30 gallons. The fungating, oozing conditions may be combated with antiseptic dusting-powders or a lotion of boric acid and acetate of lead, and later, perhaps, the actual cautery.

PROTOZOAN INFECTION OF THE SKIN AND OTHER ORGANS.

In connection with the diseases in which a protozoan parasite has been suspected, but not proven, it is of interest to refer to those rare cases which have been shown beyond a doubt to be due to infection with protozoa. The subject is so recent and the cases are so few in number that we shall present merely a brief summary of the important facts as observed in two cases by Rixford and Gilchrist:¹ In the first case, a man aged forty, the disease began on the neck, eyebrows, nose, and back of right hand, and presented the general appearances of a tuberculosis cutis. For many years the disease remained localized in the skin, though slowly extending, and, by the production of numerous abscesses, proving very destructive. Both eyes, the nose, the upper lip, and part of the ear were lost by extension of the process. The general health of the patient during all this time remained good. Nine years after the onset of the disease the nearest lymphatic glands became involved, and then, as shown by the autopsy, the infection became general—lungs and pleura, adrenals, the entire genital apparatus, the surface of the liver, spleen, peritoneum, and bones presenting characteristic nodules and

¹ "Two Cases of Protozoan (coccidioid) Infection of the Skin and Other Organs," by E. Rixford and T. C. Gilchrist, *Johns Hopkins Hospital Reports*, vol. i., Baltimore, 1896.

abscesses. An intermittent fever was present from the time the glands became enlarged until the patient's death. Enormous numbers of protozoa were present in all the lesions, especially in the caseous nodules and in the pus from the cutaneous lesions. The organisms were spherical, unicellular bodies, 7 to 27μ in diameter, and consisted in the encapsuled state of a thick, doubly-contoured capsule enclosing a finely granular protoplasm. The parasite was found both intra- and extracellular, and many characteristic sporulation forms were observed. Cultures were negative, but inoculation experiments in dogs and rabbits were successful.

In the second case, a man aged thirty-three, the disease was more acute, the lymphatic glands being involved within two months of the appearance of the cutaneous affection; temperatures ranging from 102° to 104° F. developed, and the patient died twelve weeks after the onset of the disease. No autopsy was obtained. Sections from the skin showed the same general features as in the first case, but the number of protozoa was far greater and sporulation forms were much more numerous. The organisms were larger than those of the first case and contained a vacuole.

Both patients were Portuguese, natives of the Azores, and both had lived in California a number of years.

The authors were able to find in the literature but one case of protozoan infection—that of Wernicke¹ in 1892, occurring in Buenos Ayres.

TUMORS AND MALFORMATIONS OF THE BLOOD-VESSELS.

(S. POLLITZER, M. D.)

The affections of the skin in which there are permanent changes in the blood-vessels, as contradistinguished from the transitory or inflammatory changes, may be grouped under the head of—I. Angioma, which is anatomically characterized by the new growth of capillaries; and II. Angiectasis, in which there is dilatation of existing vessels without capillary budding. The angiomata are commonly congenital, but their main growth is post-natal. Of the angiectases some forms are congenital and some acquired.

The angiomata include the simple hyperplastic angioma of Virchow and the cavernous angioma of Winiwarter. They are true tumors of new formation, with a tendency to more or less-extensive proliferation. The angiectases are in general stationary in character, and are either primary or idiopathic, or secondary and symptomatic. They vary greatly in appearance, from a simple superficial reddening of the surface to the striking bluish-red massive tumor of the hypertrophic nevus. They include (a) telangiectases, consisting of dilated capillaries; (b) the papillary varices, seen chiefly on the trunk in old people; (c) varicose and cavernous changes of the cutaneous veins in general varix occurring on the lower extremities; and (d) the vascular nevi proper.

I. (a) *Angioma simplex hyperplasticum* (Virchow), *angioma plexiforme* (Winiwarter), *angioma glomeruliforme* (Unna), constitutes the common type of angioma of the skin. It may occur in any part of the skin or mucous membranes, but is most frequent on the head and neck and in the neighborhood of the large joints. The tumors vary in size from a milletseed to an area many inches in diameter. They do not, as a rule, project much above the level of the skin, but, when they are extensive, give the surface an irregular nodular appearance of a mottled light-red or bluish-red color. To the touch they are moderately firm but compressible, and when they are

¹ *Centralbl. f. Bakteriol.*, 1892.

large, and especially if they are situated over bone or cartilage, a distinct pulsation is apparent. They swell under the influence of gravity or any other cause that impedes the return circulation. They are present at birth, generally as a small speck which within a few weeks begins to take on noticeable dimensions, and sometimes to increase very rapidly. Sometimes they disappear spontaneously, or they may undergo cystic or cavernous changes without increasing much in size. Ulceration of traumatic origin may occur on their surface and occasion dangerous hemorrhage. Phleboliths are frequently observed on palpation. In a rare form the new growth extends enormously, involving perhaps an entire limb, which then appears enlarged irregularly in all dimensions. The irregular nodular appearance is due to differences in the extent of the growth in different parts. In places the growth is cavernous, giving to the touch the sensation of a sponge which may be squeezed out, leaving the firmer parts below covered apparently only by skin. This condition is called *angio-elephantiasis* (Virchow).

The idea that a proliferating angioma may develop out of a vascular nevus lacks anatomical foundation, and probably owes its origin to the great confusion that exists in this field of dermatopathology.

Pathological Anatomy.—The tumors consist of a new growth of arterial capillaries. The proliferation is most marked in those regions where the capillary supply is normally most abundant; that is, around the sweat-glands and hair-follicles and in the fat-lobules. There results therefrom a peculiar appearance of lobulation in the tumor which is absolutely characteristic. In the older and larger angiomata, by dilatation of capillaries or by the formation of endothelial giant-cells, varicose and cavernous changes occur, though the glomeruliform character of the growth as a whole is preserved.

I. (*b*) The *angioma cavernosum* of Winiwarter is a diffuse or a circumscribed tumor of lobulated or semispherical appearance, bluish rather than red in color. The tumors are soft to the touch and diminish more or less under pressure. They swell readily on pressure in their neighborhood. When they are encapsulated they are freely movable under the skin. They are more often subcutaneous than in the skin itself, and occur more frequently on the extremities than do the glomeruliform angiomata. They arise most commonly in the first year of life, often after a trauma; their growth is slow, but constant, and, unless they become encapsulated, they extend, involving also the mucous membranes, soft tissues, cartilage, and even bone, being destroyed. They are often very painful.

These angiomata, according to Winiwarter, bear the closest analogy in their pathological origin and development to the normal cavernous tissue of the penis.

Treatment.—The treatment of angioma is surgical. In view of the sometimes unbridled growth of the tumor it is advisable to employ radical and prompt measures for its removal. As a rule, the tumors are small when first brought under observation, and their removal by the knife presents but little difficulty; the resulting scar is a comparatively trifling deformity. When excision is impracticable, as when the growth is located on the pinna of the ear, ligation of the afferent artery is indicated. With very small angiomata I have had good results from the employment of electrolysis, the object of the operation being to produce cicatricial tissue all around the angioma, thus slowly strangulating it.

II. (*a*) **Telangiectasis.**—The capillary dilatations are primary or secondary. The latter are common in many forms of skin diseases, such as rosacea,

lupus erythematosus, xeroderma pigmentosum, circumscribed scleroderma, some forms of lupus and syphilis, etc. They are the result either of the persistent inflammatory conditions or of collateral hyperemia.

Primary telangiectasis, independent of these conditions, is common in the middle of the cheeks, the region described by Hutchinson as the flush-patch, where twisted venous radicles, seldom anastomosing, may be seen, especially in old people and in those leading an out-door life. Similar telangiectases may frequently be seen on the abdomen, in a chain at the border of the ribs, in some forms of obstruction in the central circulation. In another form, sometimes congenital, seen in children as well as in adults, occurring on the face, it begins as a slightly raised bright-red point, a papillary varix from which venous branches develop radially, constituting the so-called spider-cancer, *nævus araneus*.

(b) The papillary ectases of old people occur as soft, dark-red, slightly elevated patches, from one to five millimeters in diameter, on the trunk and occasionally on the upper part of the thighs, in middle-aged and old people. They consist of varicose dilatations of the capillaries of a small group of adjacent papillæ, with dilatation of the subpapillary veins immediately below. When the process is advanced larger cavities lined with endothelium—cavernous ectases—may result. The epithelial layer over the varix is always greatly thinned and the rete-pegs are obliterated.

(c) Hypostatic ectasis, *angioma venosum racemosum* (Virchow), occurs chiefly on the feet and legs of people with a feeble circulation and those whose occupation requires much standing. It begins as a diffuse reddening of the surface over a greater or less area. The skin appears somewhat edematous, reddened, smooth, and sometimes shiny. Dilated veins may be seen as bluish islands or cords under the surface. More or less pruritus is common. The disorder often occasions the beginning of an *ulcus cruris*, and eczematous conditions frequently supervene.

The anatomical changes consist (*Unna*) in the dilatation of the subcutaneous veins, with a giving way of part of their walls, the elastic coat being pushed farther and farther away from the ectatic vessels, so that ultimately a cavernous network filled with blood is formed, which is limited exteriorly by a dense but incomplete layer of elastic tissue. The connective tissue in general is converted into coarse homogeneous bundles in which few elastic fibers are found. The sweat-glands are greatly hypertrophied, as in elephantiasis. The subcutaneous fat is almost entirely absent. Deposits of pigment from old hemorrhages are frequently met.

(d) *Nævus vasculosus* (*nævus vascularis*, *nævus angiectodes*, *nævus flammeus*, port-wine mark, *Gefässmal*, *Feuermal*, *tâche de fen*) is the most common of the fixed or permanent disorders of the blood-vessels of the skin. It is nearly always present at birth, but may not develop till some time later. It varies in size from a few millimeters to an area covering an entire limb or a large part of the trunk or head. The color is usually a bright blood-red, but it may be any shade of red down to a deep bluish red. The color may be made to pale or, in the case of small nevi, to disappear momentarily under firm pressure: as with all vascular tumors, the color is deepened and the tumor increased in size under the influence of gravity. The discolored area usually terminates in a well-marked line, but sometimes numerous small bright-red spots are scattered over the skin for quite a distance beyond the border of the main patch, looking as if red pepper had been dusted on the surface. The surface of the skin over the growth is usually smooth or it has a "chagreen-leather" appearance. The growth is quite uneven on its surface,

and in older nevi the horny layer in places may be thickened into wart-like processes, and nodular or polypoid growths may project above the surface, affording ready opportunity for traumatic hemorrhages. These polypoid growths sometimes become pedunculated and fall off spontaneously.

The most frequent site of these nevi is the face and head, but they may occur anywhere in the integument. By far their most common location is the back of the head just below the occipital prominence. Out of 114 newborn infants which I examined for this purpose at the Sloane Maternity in New York, 40, or 35 per cent., had nevi in this region. These figures corroborate the statement of Depaul,¹ who says that about one-third of the children born at the Paris Clinique have nevi. Nevi are often single, but they may occur in any number. I have recorded a unique case² in which the entire body was covered with nevi of an average size of a dime, so closely packed as almost to form a network. A large number, perhaps the majority, of the more superficial nevi disappear spontaneously in the course of a few months after birth, and sometimes leave more or less marked white atrophic or pigmented patches behind. They increase in area only in proportion to the growth of the body.

Étiology and Pathology.—None of the various theories that have been advanced in explanation of the occurrence of vascular nevi are entirely satisfactory. Simon's theory of their dependence on disturbances in the nervous system is wholly without foundation. Virchow's fissural theory—that is, that they occur at points where, in the development of the embryo, several planes of growth approximate each other—affords an explanation for the location of a large number of nevi, especially those of the face and neck. The same may be said of Unna's view, that they occur at points at which the fetal integument is subject to pressure from the maternal hard parts, such as the frontal and occipital regions of the head, the anterior aspect of the knee, etc. In the same way, I should add, compression of the cutaneous vessels from an unusual degree of flexion or extension of the head and limbs might serve to account for the location of many nevi.

Histologically, the vascular nevi are composed entirely of dilated veins and capillaries.

Treatment.—The angiectases require no treatment, except for cosmetic purposes; that is, in most cases only when they are located in the face, especially in girls. The small capillary angiectases are best treated by electrolysis. The mode of application of electricity for this purpose has been so often described that it need not be repeated here. It should be borne in mind that only a very short duration of action is required to effect coagulation in the little vessel that is to be punctured by the needle, and care must be exercised lest too noticeable scarring be produced. The blanching of the skin which follows the action of the current usually puts a stop to much further work, and several sittings are necessary where there are many vessels to operate upon. Where there is a close network of dilated capillaries, as in rosacea, scarification gives good results. Fine parallel incisions are made as close together as possible, of a depth that is estimated to extend to the upper layers of the cutis, and at once another set of similar parallel incisions is superposed on the first, crossing them at a very oblique angle. *Nævus araneus* can generally be cured at a single operation. It is necessary only to destroy the central varix, best by electrolysis, and the radial angiectases soon shrink and disappear.

The hypostatic venous angiectasis should be treated on purely surgical

¹ Quoted in Crocker.

² *Internat. Atlas of Rare Skin Diseases.*

principles. Under antiseptic precautions the entire region affected is sliced by a series of deep parallel incisions, each cut going down to the underlying muscle or fascia. The rather profuse venous bleeding is readily checked by a firm bandage. Within a week the wounds are healed, and soon firm cicatricial tissue takes the place of the former diffuse spongy tumor. This method is radical, but when patients are unwilling to submit to it, as is frequently the case, palliative measures must be substituted. A good elastic bandage is our best resource in these cases.

Small vascular nevi may be treated, like the isolated telangiectases, by electrolysis or by scarification. Larger nevi can but rarely be considered a proper subject for treatment. All the various older methods, such as cauterization with the actual canterly or with nitric acid, vaccination, setons, etc., are open to the objection that their action is uncertain in its effect and not easily controlled in its extent. Linear scarification has not yielded the good results that were once expected from it. Excision, with subsequent transplantation, by the method of Thiersch or of Mikulicz, is practically the only reliable remedy. It should be executed only by a competent surgeon.

LYMPHANGIOMA. (S. POLLITZER, M. D.)

The lymphangiomata are tumors consisting of new-formed and dilated lymph-vessels. They are divided into two groups—those affecting the superficial layers of the skin, and those of the hypoderm. Both forms present themselves as circumscribed tumors, commonly congenital, and are located most frequently on the neck and upper part of the trunk. Both are very rare diseases.

A. *Lymphangioma Circumscriptum*, *Lymphangioma Superficium Simplex* (Unna), *Lymphangioma Capillare Varicosum* (Török), *Lupus Lymphaticus* (Hutchinson), *Lymphangiectodes*.¹—The first case of this disease was described by Tilbury Fox, and most of the published cases have occurred in England. The disease consists of irregular groups of minute vesicular papules, between which, and occasionally over whose apices, telangiectatic capillaries are found. The appearance has been aptly compared to frog-spawn. The patch, which may be three to four inches in diameter, is usually made up of several smaller patches of one-fourth to three-fourths inches in diameter, between which the skin is smooth or may contain an isolated vesicle or two. The vesicles are from a pinpoint to a large hempseed in size, and are transparent or pearl-colored or may have a pink tinge. The roof of each vesicle is firm and does not rupture readily. If it be punctured, a clear colorless alkaline fluid exudes, and the flow of fluid is sometimes very considerable. The vascular tufts over the summit of the vesicles sometimes may obscure their usual color, as in one of Hutchinson's cases. These telangiectases may develop with each fresh eruption of lymph-vesicles, and disappear subsequently, as in a case of Crocker's. In addition to the regions already mentioned, the disease has been seen on the vulva, buttocks, arms, and legs, but, as a rule, the patch is limited to a single region.

The disease is extremely chronic, and the patches, once established, may remain stationary through life, though there is commonly a very slow extension at the periphery. There are no subjective symptoms whatever, but of course the affected region is liable to injury and subsequent infection.

¹ This adjective, through some strange misconception, is used by many English writers as a substantive.

The majority of the cases observed have occurred in childhood, and probably in most of them the disease was present at birth.

Pathology and Pathological Anatomy.—While there are still so many unsolved problems in the physiology of the lymphatic system, it is but natural that the pathogenesis of these tumors of the lymphatics should be involved in much obscurity. It is quite certain that obstruction of a lymph-vessel cannot alone produce dilatation of the lymph-radicals peripheral to the point of obstruction. In the condition in question there is always more or less involvement of the blood-vessels, and the relation of the changes in the two systems to each other has been the subject of much controversy. Under the microscope the principal change is seen to consist of greatly widened lymph-channels and vessels. On section these appear irregularly circular, oval, or flask-shaped, and are most abundant in the middle and upper portions of the cutis and the papillary layer. That they are not simply passively dilated lymph-vessels is clear from the fact that their walls are lined with

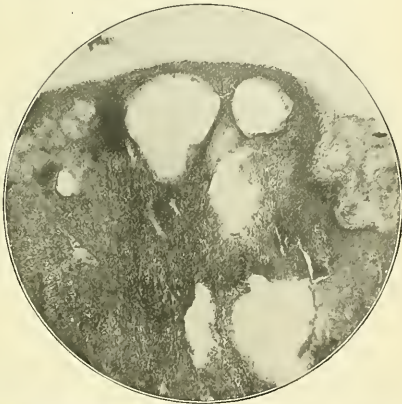


FIG. 251.—Lymphangioma circumscriptum (author's photomicrograph; specimen from Török's case).

proliferated endothelium. In many of the cases associated with the changes in the lymph-vessels there is a hyperplasia of the blood-vessels, with new formation of capillaries by budding. It happens occasionally that a blood-capillary may rupture into one of the lymph-cysts, and thus a direct channel of communication be established between the blood- and the lymph-systems.¹

Treatment.—The treatment of these conditions is, as a rule, very unsatisfactory, and unless there be some positive indication for interference they had better be let alone. We are limited virtually to two methods of treatment—destruction by electrolysis and complete ablation with the knife. In view of the tendency of the growth to recur the line of incision should include a large area of normal tissue.

B. Lymphangioma Tuberosum Multiplex.—The majority of the subcutaneous lymphangiomata occur as deep-seated—as a rule isolated—tumors,

¹ For the pathology of lymphangioma cf. Török, *Mouatsch. f. prakt. Dermat.*, xiv. p. 169; and Unna, *Histopathol.*, p. 930.

whose treatment falls into the domain of the surgeon. The disease, first described by Kaposi under the name of lymphangioma tuberosum multiplex, has since been shown to be of epithelial origin—probably syringo-cystadenoma. Pospelow, however, has described a case of tuberoso lymphangioma in which multiple tumors, from a milletseed to a pigeon's egg in size, were scattered over the trunk, face, and neck in a girl of twenty-three. The largest of these tumors was said to be congenital; of the smaller no history could be obtained. They were slightly elevated above the surface, and on firm pressure could be made to disappear. On incision they discharged a little blood and lymph. Microscopically they were found to be made up of loose tissue with large cavities filled with lymph and lined with endothelium.

LEUKOKERATOSIS BUCCALIS. (S. POLLITZER, M. D.)

Synonyms.—Leukoplakia buccalis; Psoriasis, Ichthyosis, or Tylosis linguæ; Leukoma; Chronic superficial glossitis; Smoker's patches.

Definition.—A disease in which white patches of greater or less extent occur in the mouth. A similar condition occurs on other mucous membranes, as the vulva, but we shall consider here only the disease as affecting the mouth.

To Bazin and one of his pupils, Debove, we owe our first definite knowledge of this disease, though it had occasionally been mentioned by previous writers. Schwimmer directed special attention to the affection in an extensive publication in 1877,¹ and proposed the name of leukoplakia. The exhaustive studies of Vidal and Leloir² have completed our knowledge, so far as it is complete, of this condition. Besnier proposed the name of leukokeratosis, which we have adopted.

The disease occurs most frequently on the cheeks and tongue, and less commonly on the gums. The bluish-red patches with which the affection begins, according to Schwimmer, are rarely seen or noticed by the patient. His attention is first called to the condition by the discovery of pearly-white or bluish-white patches or bands on the cheek or tongue. These vary in size from a pinpoint to an area covering the greater part of the buccal mucous membranes. At an early stage the patches are irregular in outline, sharply defined, flat, insignificantly raised above the surface, and slightly rough and dry to the touch. The condition may remain limited to a few discrete plaques, or the patches may increase in size with more or less rapidity and the epithelium become thicker and more opaque. At the same time, changes in the submucosa may cause the affected region to become more prominent and nodular, and the papillæ of the tongue may become greatly hypertrophied. In the earlier stage and with the disease of limited extent no further disturbances may occur. But, as a rule, through the loss of pliability of the surfaces affected cracks and fissures occur and lead to ulceration, and secondarily to more serious changes. It is these secondary changes which give the disease its chief interest. In a not inconsiderable number of cases epithelioma develops, and the condition becomes extremely grave. It is doubtful whether the epithelioma is a natural termination to leukokeratosis. The researches of Leloir have shown that the malignant growth originates at points at which fissures have occurred, so that it seems likely that the epithelioma is a mere accident, the result of chronic irritation under suitable conditions. The epithelioma appears at its inception either as a nodular swelling or as an ulcer with raised, hardened margins, whose further course is that of epi-

¹ *Viertelj. f. Dermat.*

² *Arch. de Phys.*, 1887.

thelioma under any other condition. The disease, owing to the stiffness and dryness of the affected part, occasions considerable annoyance, though there is no real suffering, unless cracks and fissures render the parts sensitive to spicy food, alcoholics, etc.

Anatomy and Pathology.—In an early stage changes are confined to the epithelium, in the upper layers of which we find a peculiar alteration. The mucous membrane has practically been converted into skin. A stratum granulosum, consisting of several layers of cells containing kerato-hyaline, has been developed. Superposed upon this is a layer containing eleidine, over which a layer analogous to the stratum corneum of the skin—in which, however, the nuclei are preserved—is found. It is to this *cutinization* of the

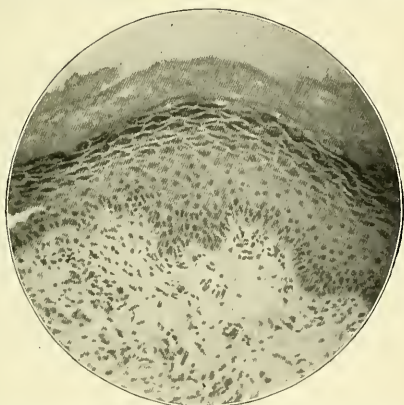


FIG. 252.—Leukokeratosis, early stage, showing thickened horny layer, dense kerato-hyaline layer, and slight leukocytic infiltration of the submucosa (author's case, section, and photomicrograph).

mucous membrane that the white color of the patches is due. The other structures of the mucous membrane, mucosa, and submucosa at this stage may appear perfectly normal. Later the whole epithelial layer may become thickened, the papillæ more or less obliterated, or the interpapillary processes greatly hypertrophied, while an infiltration of round-cells takes place in the subepithelial tissues. Where fissures or ulcers develop the irritative changes are of course more marked. Finally, a sclerosis of the submucous tissues, with compression and obliteration of vessels and glands, may occur.

Etiology.—An enormous preponderance of the cases occurs in males and, as a rule, at or after middle life. The two causes most frequently assigned for its occurrence are syphilis and tobacco-smoking, but inasmuch as the disease occurs in non-syphilitics who do not smoke, the direct etiological value of these causes seems to me doubtful. Probably if we examined the mouths of non-syphilitics as regularly as we do those of syphilitics, we should find the proportion of cases in the former not less than in the latter. Possibly our antisiphilitic treatment may be a factor in the production of the disease. Certain it is that the condition is rarely benefited, but, on the contrary, often aggravated, by mercury. Strong alcoholics, highly-seasoned food, irritation from rough teeth, etc. have also been assigned as causes, but, while they un-

doubtedly aggravate an existing leukokeratosis, it is doubtful whether they can produce the condition. The disease is frequently observed in glass-blowers.

Prognosis.—The prognosis of the disease is doubtful, and is largely dependent on the treatment. There are certain abortive forms which disappear spontaneously, and in the majority of cases the disease remains stationary or progresses very slowly. The possibility of development of epithelioma should not be forgotten, and the prognosis in case of its occurrence is, of course, grave. This incident is far more likely to happen when the disease is located on the tongue than elsewhere, but on the whole it is not a frequent occurrence.

Treatment.—The aim of the treatment should be to soothe the irritated mucous membrane, to heal existing fissures or ulcers, and to avoid every possible source of irritation. The use of tobacco should be absolutely interdicted; alcoholics, very hot or very cold food, spices, acids, and sweets must be avoided. The hygiene of the mouth must be carefully attended to. In mild cases these methods alone, together with the frequent use of a chlorate-of-potash mouth-wash, will suffice to cure the condition or check its progress. Where more active measures are desired the daily application of a paste consisting of two parts of zinc ointment, one of kaolin, and three of resorcin is useful, the applications to be made till the cuticle desquamates and to be recommenced after a week. Where fissures or slight ulcers occur a mouth-wash consisting of aqua calcis diluted with an equal volume of water is valuable. Ulcers and abraded surfaces may require pencilling with nitrate of silver. But, in general, all strong applications, such as salicylic acid or chromic acid, which have been recommended, do harm by acting as irritants. In view of the occasional occurrence of epithelioma, all warty or nodular prominences ought to be promptly and radically removed with the scissors, knife, or actual cautery; but, unfortunately, the resultant scars are themselves irritants.

XERODERMA PIGMENTOSUM. (R. W. TAYLOR, M. D.)

Definition.—Xeroderma pigmentosum is a disease peculiar to early life, presenting polymorphous lesions of the most varied orders, attended by a great variety of symptoms, chronic and often unending in its course, and tending to produce the most disfiguring deformities, and in many cases, by means of its malignant growths, to cause death. Various names have been given to this disease since the original one of Hebra—xeroderma. Thus, Neisser calls it *lioderma essentialis cum melanosi*; Pick, *melanosis lenticularis progressiva*; Vidal, *la dermatose de Kaposi*; Radcliffe Crocker, *atropho-derma pigmentosum*; while I myself years ago ventured to propose the provisional term *angioma pigmentosum et atrophicum*. After more than twenty years' consideration of the subject the term *xeroderma pigmentosum* has been quite generally settled upon, and will probably live.

It should be clearly understood that the dry skin of ichthyosis—or, as it is called by some, xeroderma—is an entirely different affection from the one under consideration.

This disease is rather rare, since there are less than 60 authentic cases of it on record, of which I have had the good fortune of having had 7 under my own observation for very many (twenty-one) years.

Symptoms.—In a general way, the clinical picture of xeroderma pigmentosum consists in an indiscriminate intermingling of small red vascular

spots or telangiectases and pigmentations, combined with more or less extensive atrophic patches; all of which, we shall find, have intimate pathological relations. Superadded to these polymorphous lesions there are sequelæ or new growths which are at first of a benign nature, and may thus remain, or they may degenerate into malignant growths.

Xeroderma pigmentosum may be said to be a disease whose evolution begins, as a rule, in very early life. Of my 7 cases, it began in 6 at about the sixth or seventh month, and in 1 about the fourteenth month of life. Of the remaining cases by other observers, it began between the third month and the end of the first year in 10, and between the first and second years in 14 cases; and there is inherent evidence in the histories of several other cases of very early evolution. In the face of this strong array of facts we find cases reported by Kaposi, Heitzmann, Vidal, and Falçao in which the appearance of the disease is stated to be at respectively nine, sixteen, seventy-two, eighty-eight, and eighty-nine years. While I do not take the ground that these cases are not true instances of this disease, I must confess that I am very skeptical about them, seeing that they are so exceptional in their course. It should be distinctly borne in mind that the coincidence of the various pigmentations of the skin with epitheliomatous and other malignant growths does not of necessity constitute xeroderma pigmentosum, and that because a child had severe freckles in early life and some malignant tumor in after years the two may simply be coincidences. The weight of evidence, therefore, places the disease as one of very early childhood.

The mode of invasion of xeroderma pigmentosum is very constant, beginning about the face or under the eyes as a well-marked, smooth, superficial erythema, which is often regarded by the parents or guardians as the result of sunburn. With the exception of this blemish there is no impairment of health; indeed, the fact of the good health of most children is well attested. The erythematous patches extend, coalesce, and gradually creep over the face and neck, usually stopping at about the region of the third rib by an abrupt margin. This condition of the face, neck, and trunk is of variable duration—from one to several months, during which the erythema may become less red. As this prodromal hyperemia disappears pigmented spots and red ones, or telangiectases, make their appearance, scattered irregularly over the affected regions. The pigmentations are at first of a light-brown, and may become of a blackish-brown and even black color. They vary in size from a pinhead to a lentil, and usually are not much if at all elevated, and of very irregular shapes. Scattered among them with great irregularity, but less numerous, are the red or telangiectasic spots, which are smaller, rather more salient, and of irregular outline. By a strong glass a congeries of capillaries can be made out. In most cases thorough pigmentation of the face and neck takes place in about six months. Upon the hands there is not such a marked prodromal erythema as upon the face, and in some cases there was no evidence of its presence. With the evolution of these lesions there are no marked local subjective symptoms. If a case be carefully studied and frequently observed in its early years, it will be very often plain to the eye that the pigmented spots follow exactly upon the site of a pre-existing red spot, and the conclusion will be obvious that the red lesion was the forerunner and that its pigmented fellow was the sequel.

This I have seen to take place time and again. Very often pigmented spots appeared where the red one was only visible by means of a glass. The pathological relationship, therefore, between the red and the pigmented spots is, to my mind, very clear. The further course of these two orders of lesions

can be accurately studied. They are erratic, they come and they go, they have periods of exacerbation and of remission, but their hold is never lost. If one disappears, it is soon replaced by another or by several. Thus, as the child grows older its disfigurement becomes more or less rapidly worse, the disease relentlessly persisting. There is no record of a case in which anything like amelioration in its course was observed. A very few children escape with the disfiguring pigmentations and perhaps slight atrophy, but even these are either attacked later on by severer lesions or the milder ones remain indelible for life. The period of activity of the pigmented spots and telangiectases is greatest in the very early years and during childhood. After the fifteenth or sixteenth year they may reappear, but rarely in such profusion as in the early years.

These two orders of lesions—the telangiectases and pigmentations—are peculiar to what we may call the stage of hypertrophy of *xeroderma pigmentosum*. Disfiguring as they are, we find that in every case—in some in a mild, in others in a severe form—atrophic changes are soon superadded. In the majority of cases atrophy begins about the end of the first year of the existence of the morbid changes, but it may occur at any subsequent period. Its course is subject to marked exacerbations and remissions, and, though it occurs on both sides of the body, it is not usually symmetrical. In some cases it progresses and produces hideous deformities by reason of the size and situation of the patches; in others, again, it is limited in extent and not strikingly observable. Upon the face this form of atrophy reduces the skin to the thinness of parchment and destroys nearly all of the follicles.

Such atrophic patches are usually traversed by minute lines, and frequently so transparent are they that the vessels can be seen beneath. Upon the hands and arms and feet and legs atrophy is not usually as well marked as upon the face, and it occurs mostly on parts subjected to tension, such as over the knuckles. If an atrophic patch of the skin of the face be attentively watched for a long period, it will be seen that there is a constant evolution and involution of the telangiectasic spots, which are here sometimes followed by pigmentations. The atrophy of the skin takes place in proportion to the growth and atrophy of these minute vessels, and always where the atrophy of the skin is active close observation will show this rapid development of the red spots. This process seems to go on until all of the vessels of the part have undergone increase and decay; in fact, until no more are left or until the skin is reduced to such a dense fibrous condition that they can luxuriate in it no longer. Due undoubtedly to the excessive vascularity and exposed position of the parts, atrophic changes are prone to occur upon the forehead, also on the scalp, about the eyes, nose, mouth, and ears. As a result, besides the disfigurement, ectropion occurs with its train of bad symptoms, and incomplete stenosis of the nasal and oral apertures and deformities of the ears are produced. It is an interesting fact that when the atrophic process is at an end no further pigmentation takes place, and a smooth, white, mother-of-pearl surface is left.

In almost all cases, particularly in those in which the pigmentations are deep and extensive, hypertrophic changes take place, very often coincidently with the atrophic processes. We find in the course of *xeroderma pigmentosum* epithelial new growths. In their simplest and most rudimentary form these consist of plaques or spots of thickened pigmented epidermal cells, resembling *keratosis senilis*. This may be the full development of the hyperplastic process in a given case or it may be the starting-point of larger growths. While the atrophic process is to be dreaded for its terrible disfig-

PLATE 18.



Xeroderma pigmentosum, mild form.

PLATE 19.



Xeroderma pigmentosum with keratotic plaques.

nements, these at first seemingly simple and harmless growths are often more terrible in their effects, since their development produces the leaven upon which malignancy may later on be engrafted. These are border-line lesions between benign and malignant new formations. These keratotic patches may long remain as such, or they may be cast off and re-formed, and they may disappear. But about the face, particularly at the junctions of the skin with the mucous membranes on the cheeks, chin, and ears, their tendency is to become larger. They soon form sessile or pedunculated, more or less elevated tumors, whose surface, after the shedding of their pigmented epidermal covering, may in general be termed fungating. At first they are of a deep-red or purple-blue color, soft and compressible, and remind one of erectile tumors. They frequently become pale, less vascular, and so brittle and friable that they fall off, leaving sometimes a surface which heals spontaneously or an ulcer which may be very intractable, which may extend in depth and breadth, and frequently are surrounded by thickened and everted edges which may become the seat of malignant degeneration.

Thus far in the hyperplastic processes of xeroderma pigmentosum we have found two principal forms of new growth: First, the keratotic plaque or tumor; second, the large and at first vascular tumor. While the tendency to malignancy is often found in the first, it is very constant in the second form; yet, on the other hand, the latter tumors frequently wither and fall. A study of the reported cases of this disease shows that malignant new growths were present in about two-fifths, and non-malignant growths in about one-eighth, of all cases. Further, that of 9 cases in which no new growths were noted, in 5 the children were respectively two and a half, three and a half, five and a half, six, and twelve years old—ages far too young to warrant the prognosis of future exemption from new growths. Of the remaining 4 cases, 2 were seventeen, 1 eighteen, and 1 twenty-two years of age. Their chances of immunity were better, yet the ugly fact obtrudes itself that in one case new growths, which underwent malignant degeneration, appeared at about the thirty-fifth year. This, however, was in the rather exceptional case of Heitzmann.

Of the cases in which malignant new growths appeared, epithelioma was noted; melano-sarcoma, sarco-carcinoma, and cancer were the varieties. Out of my own 7 cases, epithelioma occurred in 3 children. These tumors were of the sessile and pedunculated shapes already spoken of.

The instances of benign new growths are as follows: Papillary warts, papilloma, granuloma, and pannus. The dates, as far as can be ascertained, at which the malignant new growths began in 17 cases are as follows:

From four to ten years	8 cases.
From ten to twenty years	7 “
From twenty to thirty-five years	2 “
Total	17 cases.

These statistics would seem to indicate that the period of greatest malignancy is under ten years, nearly as great until twenty years, and not great beyond the twentieth year.

Of 40 well-observed cases of xeroderma pigmentosum, 21 patients were males and 19 were females. Several members of a family were usually attacked—in some cases males alone, in others the females, and in still others both males and females.

The occurrence of malignant growths, particularly epithelioma, in such young subjects is remarkable and exceptional, and is to be explained on pathological grounds to be considered shortly. What has struck me as being

equally singular is that there is no evidence presented by any case, either during life or after death, of metastasis to the viscera. This seems to be another peculiarity of this wonderful disease.

It is impossible to give an exact description of all these tumors. In general they are red or purple, sessile or pedunculated, fungating or raw; smooth, sometimes encrusted, again oozing, and often the seat of hemorrhage.

Pathology and Anatomy.—The pathology of this disease has been well studied by Kaposi, Geber, Neisser, and Pick, and it is to their writings that I am indebted for the facts I present.

Neisser gives the histological appearances of the skin of xeroderma pigmentosum as follows: The pigment is distributed in isolated spots, similar to melanotic tumors, and is seated in the deep layers of the epidermis and rarely in the corium. The pigment is precisely similar to that of melanotic new growths, and differs from that of ecchymosis. In spots where there is an accumulation of pigment the interpapillary prolongations of the rete Malpighii are more abundant and compressed than in the normal state. This augmentation in number and size of these prolongations seems to be the first stage of the ulterior epithelioma. It was from this fact that Kaposi was able to predict the development of epithelioma in one of his cases.

The little, dirty-yellow, warty elevations undergo corneous transformation, and there is in them a rapid increase of the papillary vessels. The atrophic condition is similar to that of senile atrophy of the skin, and involves the connective tissue of the papillæ and upper portion of the derma. The subcutaneous tissues are usually not altered, at least not until late. It thus happens that the morbid skin often freely glides over it.

In the white spots there is an entire absence of pigment, and the lines of demarkation between the thinned epidermal and papillary layers is perfectly regular. With atrophy of the epidermis there is absence of pigment, while in spots where it is thickened the pigmentation is great. The production of the pigment seems to depend on the alteration in the vessels.

Leloir's results are similar to the foregoing. He found in the atrophic spots very few vessels and an absence of the papillary loops of capillaries. In the superficial layers of the derma embryonic cells were abundant, and also there was a large quantity of elastic fibers in the deep layers of the papillæ, which seem to have replaced the atrophied connective tissue. This condition probably gives rise to the hide-bound tension observed in some cases.

Pick says that at first the epidermis is entirely unchanged, but thickened, and from it conical processes pass into the rete which tend to reduce and thin it. In the corium there is an abundance of vessels; the endothelium of the same and of the capillaries is swollen and folded, so that it obstructs the lumen. Around the adventitia of the vessels are masses of small-cell infiltration, particularly in those of the papillæ. Pigment deposit keeps pace with the invasion of the vessels and with the small-cell infiltration of the corium. The cell-infiltration is undoubtedly the carrier of the pigment. From this it would seem that in the majority of the pigmentations the cell-increase is not great, but, beginning with the keratotic patches, it becomes more and more abundant. In the fawn-colored pigmentations, in which it almost conclusively appears that the rete is the seat of pigment, the vessels are dilated and distended with blood, and it is evident that they have their origin in the red spots. While the keratotic or warty patches are also related to the pigmentations, there is found much variation in the amount of cell-infiltration and vascular change. This fact explains why some tumors are very vascular and others firm and dry.

With these facts before us, Kaposi's explanation of the occurrence of epithelioma at such early ages as being due to the rapid changes going on in the epithelial layer in the production and rapid disappearance of new papillæ and epithelium, and of the pigment-carrying elements, is very satisfactory.

For an elaborate exposition of the histology of the morbid growths incident to the course of xeroderma pigmentosum the reader is referred to an essay by Pollitzer.¹

Treatment.—Though every suitable external remedy has been tried, no case of xeroderma pigmentosum has ever been cured. Our measures, therefore, should be directed toward placing the skin at rest and removing any possible source of irritation to the morbid parts. Especial care should be taken of the eyes, nose, mouth, and ears, since in these situations the disease expends its activity and malignancy. The details of this preventive treatment will suggest themselves as the cases present. Knowing so well as we do that these pigmented warts carry in their train such terrible consequences, they should be removed as soon as possible with the sharp spoon. In fact, all, both small and large tumors, should be removed as soon as possible. There need be no fear of excessive hemorrhage, and if the operation is performed tolerably early, we are warranted in expecting prompt cicatrization. Especially should this procedure be adopted in small and commencing lesions about the eyes, nose, mouth, and ears. The sooner they are destroyed the greater is the immunity of the patient to further growth and perhaps malignant degeneration. All large tumors should be removed and the subjacent tissues scraped thoroughly, if necessary, to the periosteum and bone.

RHINOSCLEROMA. (JAMES M. WINFIELD, M. D.)

Synonym.—Gleoscleroma (Besnier).

Definition.—Rhinoscleroma is an infectious neoplasm, affecting the mucous membrane of the nose, naso-pharynx, and lips, and characterized by isolated or confluent plaques, nodules, and tubercles of ivory-like hardness, produced by the action of a distinct and specific bacillus.

The disease was first discovered by Hebra and Kaposi in 1870. They gave the history of 7 cases, and further supplemented this in 1872 by observations upon 9 more. Since then a number of others have been reported from various parts of the world.

The name rhinosclerome given by Hebra to this disease seems to have been well chosen, for the growth begins about the nose in at least 75 per cent. of all recorded cases.

Besnier, however, contends that this name should not be applied when the disease begins in the pharynx, and consequently advised the term gleoscleroma to cover the whole condition, irrespective of location, choosing the name from the pathological findings rather than from the anatomical situation.

Since this first classical description there have been cases reported from various parts of the world, principally, however, from Austria and South-western Russia. A few more have been observed in Central and South America, Egypt, and India.

In Morrow's *System of Dermatology*, Pollitzer of New York gives the history of a case occurring in his practice which was subsequently reported by Dr. George T. Jackson in the *Journal of Cutaneous and Genito-urinary Diseases*, October, 1893. Since Dr. Jackson's report Dr. Freudenthal has added another to the list occurring in New York City. (See Plate 20).

¹ *Journ. of Cut. and Gen.-urin. Dis.*, vol. x., 1892, pp. 133 et seq.

It is a notable fact that most of the cases in France, England, and the United States have been in foreigners, generally Austrians or Russians. This peculiarity might lead one to suspect that the disease was endemic to that part of the world. The only native American case is that of Dr. Wende of Buffalo. By careful research I have succeeded in finding in all only 5 authentic cases occurring in or reported from the United States.

Symptoms.—The disease usually begins on the nose and in the neighboring parts. Its origin, as a rule, is on the mucous membrane of the alæ or upper lip. While the nose has been the seat of election in a great majority of cases, still a number of observers have reported cases of primary lesion in the larynx and pharynx.

The lesions are thick plaques or elevated nodules or tubercles deeply imbedded in the skin or mucous membrane. Each plaque is sharply bounded from the adjacent surface and is movable upon the underlying tissue. The



FIG. 253.—Rhinoscleroma: boy twelve years old, native of the United States. Disease has existed over three years. The dark spot on the side of the nose is a necrosis from injections of arsenic. (Courtesy of Dr. G. W. Wende of Buffalo.)

tumors are either distinct or they may coalesce; to the touch they are hard, giving the impression of ivory.

The covering of the growth is either of normal color or else of a light reddish brown. Frequently a few dilated blood-vessels are seen running over the surface; the affected skin is destitute of glandular structures. Pain is absent, except on deep and firm pressure. The progress of the disease is slow, but continuous. When the process starts in the alæ the nose is gradually increased in size, until eventually it is broadened and great disfigurement results. The nares become occluded from extension of the growth backward; late in the course of the disease the posterior nares and palate may become involved.

Cornil and Alvarez reported two cases where the larynx alone was affected, the nasal passages remaining free through the course of the disease.

PLATE 20.



Rhinoscleroma (by permission of Dr. Freudenthal of New York).

Subsequently, Ganghofner made a similar observation. Kaposi is inclined to believe that some of the laryngeal stenoses described under various names are really due to rhinoscleroma.

The growth never suppurates, except as a result of improper or meddling treatment, although sometimes fissures form about the angles of the nose, from which oozes a sticky serous fluid, which eventually dries into a yellow crust. Kaposi has observed small ulcerations on the soft palate which bear some resemblance to syphilitic lesions in that location. The fissures and ulcerations never show any sign of active inflammation and do not extend deeply into the tissue.

On cutting such a tumor one is struck by the facility with which the knife enters, the tissue proving less resistant than might be expected from the external hardness. The wound made by excising a piece of the growth rapidly heals without any suppuration or tendency to break down, as commonly occurs in other neoplastic growths. If the tumor be removed, the gap is soon filled in by more of the same tissue.

Etiology.—The disease occurs in both sexes. Infants and old people seem to be exempt. From a study of fifty cases Kaposi places the age limit between fifteen and forty years. Jackson's patient was fifty-four years old when reported, but the disease had probably existed sixteen years before coming under his observation. It does not seem to affect one class of society more than another. The presence of local disease seems to have no effect on the general health. Since the discovery of the bacillus by Frisch in 1884 the etiology of the disease has been clearly established.

Pathology.—It was the belief of the earlier writers that this disease was one of the manifestations of syphilis, but this has been clearly disproven by subsequent anatomical and bacteriological study.

The histological features are similar to the chronic inflammatory granular tissues found in tubercular leprosy and syphilis. The connective tissue is arranged into firm supporting bands; within these wide meshes is found the characteristic soft tissue of rhinoscleroma. This tissue consists of an accumulation of round-cells, two varieties of which have been described, one by Mikulicz and another (hyaline) by Pellizzari. "These two kinds of degenerated cells were confounded by many, until finally they were distinctly separated and described by Mibelli" (Unna).

The first (Mikulicz) are numerous large, dropsical cells, in which Frisch found the characteristic bacillus, which closely resembles the pneumococcus of Friedländer. The large, watery cells lie close together, having a definite contour. Mibelli considers the contents of the cells to be a mucus produced by the bacilli. The second variety, or hyaline cells, are more isolated, and are never so plentiful as the dropsical. They are filled with a homogeneous matter, and are easily stained; it is difficult to demonstrate the presence of bacilli in the cells, although their presence here is claimed by many observers. The arrangement of firm fibrous bands, together with the infiltration of large, dropsical cells filled with bacilli, and the other small ones containing highly refractive colloid substance, makes the microscopic appearance characteristic of rhinoscleroma.

Diagnosis.—The presence of a stony, hard growth about the nose, lasting for a long time without signs of disintegration, would serve as a guide to the diagnosis of rhinoscleroma; still, there may be some difficulty in differentiating this neoplasm from syphilitic infiltration—epithelioma, sarcoma, lupus, keloid, and possibly rhinophyma. The diagnosis from syphilis will readily be made by the absence of disintegration or suppuration of the tumors.

The ulceration that does occasionally occur in rhinoscleroma is superficial and has no sharp lines of demarkation. Any doubt regarding diagnosis would be removed by obtaining a syphilitic history and in a cure resulting from the administration of antisymphilitics.

Epithelioma and sarcoma rarely occur on the upper lip, and should they be found at the vermilion edge of the lips or about the nose, they would break down comparatively early. The pearly nodules about the border of an epithelioma would materially aid in arriving at a correct diagnosis. Lupus does not appear as a hard chronic tumor which rarely if ever goes on to supuration or spontaneous involution. Keloid, especially if accompanied with dilated blood-vessels over its surface, would appear similar to rhinoscleroma, but hypertrophied scar-tissue seldom occurs about the nose, and a history of previous traumatism would aid in diagnosis. Hypertrophic rosacea (rhinophyma) might be mistaken for the affection under consideration, but here we have the history of a previous acne; the irregular, nodular, lobulated, soft tissue containing dilated sebaceous glands and ducts spreading only in and on the skin of the nose, and never involving the nasal mucous membrane.

Prognosis.—The prognosis is unfavorable regarding cure. While the growth may extend slowly, the tendency is to spread, and often endanger life by interference with the respiratory functions.

Treatment.—Permanent cure has never been accomplished by removal, for the growth has a tendency to recur after excision. If the nostrils become occluded, the tumor may be bored through with caustic or electric cautery and an aluminum tube introduced to prevent reclosing of the passages.

The most satisfactory treatment thus far reported has been attained by Lang, who used salicylic acid and salicylate of soda internally and externally; the tumors were injected with a 1 per cent. solution of the acid or a 2 per cent. solution of the salicylate of soda. Ten grains of the acid were given by the mouth. Lactic acid and various preparations of arsenic have been used similarly, but none of these drugs have succeeded in absolutely curing the disease. Still, from the favorable reports thus far, these measures should have further trial.

From an observation made by Ducrey,¹ that the streptococcus of erysipelas is attenuated by the bacillus of rhinoscleroma, it might be interesting to inject into these tumors the toxins of erysipelas, after the Coley method. This treatment might succeed in cases not far advanced or if they were not situated in the air-passages exclusively.

TUBERCULOSIS CUTIS. (JAMES C. JOHNSTON, M. D.)

Within the last twenty years, following the investigations of Koch, Doutrepoint, and Baumgarten, the subject of cutaneous tuberculosis has been practically rewritten; many affections whose true nature was unsuspected, and which were classified often as chronic ulcer or under other headings, have now been placed in their proper position and a common etiology recognized for all of them. The lesions in all the varieties are due to the presence and activity of the tubercle bacillus, however widely they may vary in their clinical features. The terms "lupus" and "scrofuloderma" have been recently objected to on apparently good grounds, but, since they indicate two well-defined types, we shall retain them. There is a second sub-class which properly finds a place here, the members of which were called² by the writer

¹ *Annal. de Derm. et de Syph.*, 1892, Paris, p. 309.

² *Amer. Journ. of Med. Sci.*, Nov., 1897.

in a recent paper "Paratubercloses." These affections occur in persons suffering from other manifestations of tuberculosis, but in them the finding of the bacillus is so rare as to be for practical purposes negligible.

I. TUBERCULOSES.

Symptomatology.¹—Five varieties of tuberculosis cutis are now commonly recognized: (1) Lupus vulgaris; (2) Tuberculosis verrucosa; (3) Tuberculosis cutis vera; (4) Scrofuloderma; (5) Tuberculosis miliaris. Lupus, taken as the type of the whole class, will receive first consideration.

LUPUS VULGARIS.

Synonyms.—Lupus vorax; Dartre rougeante; Esthesiomène.

Definition.—Lupus vulgaris is an infectious neoplasm of the skin and mucous membranes, characterized by brownish-red, deeply-seated nodules, which tend to absorption or ulceration and result in cicatricial atrophy.

Symptoms.—The primary efflorescence in this disease is a bright- or brownish-red nodule—*lupoma* it has been called—situated in the deeper tissues of the corium. Its color, which has been likened by Hutchinson to that of apple-jelly, does not disappear entirely under pressure, but fades slightly. The development of the papules in various ways gives rise to different clinical pictures of lupus which have been designated by numerous qualifying adjectives. The individual lesions grow very slowly, but they finally project somewhat above the cutaneous surface and become perceptible to the touch. They are rather soft in consistency and of a painless character. The disease may run its course in this shape (*lupus élevé*).

The nodules may be aggregated into a dense mass or plaque elevated above the surface, of a more or less vivid red (*lupus tumidus*). It increases slowly, rarely ulcerates, and involution begins after a longer or shorter interval. The papules may undergo fatty degeneration and be absorbed, leaving a desquamating surface (*lupus exfoliativus*). The epidermis becomes wrinkled and the tuberculous deposit is replaced by scar-tissue. In place of absorption, the plaques or nodules may exhibit a superficial necrosis, resulting in ulceration (*lupus exulcerans*). This phenomenon is somewhat rare in this country. The ulcers become covered with crusts which are composed of the tissue-detritus, added to the products of a suppurative process usually super-added. The ulcer, when exposed, is seen to be roundish, with soft red borders and a grayish-red floor covered by flabby granulations. Its chief characteristic is its softness.

The ulcer at times takes on an exuberant growth, the granulations projecting above the surface (*lupus papillaris seu verrucosus*). On the nose this process may convert the organ into a misshapen, fungoid mass. When ulceration progresses rapidly deep into the tissues or over extensive surfaces, the disease is called *lupus vorax*; when it spreads over large areas in a few weeks, *lupus phagédénique*. In certain cases recurrent inflammation may occasion an increase of connective tissue in the patch (*lupus sclerosus*), which may result in elephantiasiform hypertrophy. When the nodules are scattered about irregularly, *lupus disseminatus s. discretus* are the names employed; when they appear at the periphery of an old patch in lines which form arcs of a circle, the lupus is said to be serpiginous.

The clinical aspect of lupus varies to a considerable degree with the site upon which it makes its appearance. It is, in consequence, necessary to describe these variations somewhat in detail.

¹ The arrangement of this section is that used by Bowen in *Morrow's System*, vol. iii. p. 519.

Localization of Lupus.—The face is most frequently the seat of lupous infiltration, and exhibits nearly all the forms just described. Of the various regions, the nose is most often attacked. The lupus nodules appear first on the lining mucous membrane or the alæ; from either focus it may involve the whole organ, covering it with crusts and exuberant granulations, so that it appears greatly increased in size. When these are finally removed, the nose will be seen to be reduced often to a mere stump covered by a thin white cicatrix, the cartilaginous portion totally destroyed. (Kaposi states that he has never seen the bones attacked.) Next in order of frequency are the cheeks, lips, and ears; from these localities the disease may extend down on the neck, taking on there a serpiginous form. The ear may be enormously hypertrophied by *lupus tumidus* or *papillaris*, or, like the nose, may shrivel up. The external auditory canal and membrana tympani may be attacked, resulting, by extension, in otitis media. Lupus of the forehead and scalp is rarely primary, being usually the result of extension from other parts. The whole face may be attacked at one time, producing frightful deformities.

Lupus of the extremities is a comparatively common localization, next in frequency to the face. The forearms and legs are the chief sufferers. The disease begins usually at or near the joints or on the backs of the hands and feet, and may extend to the underlying fascia, tendons, and bones, causing abscesses, fistulæ and necrosis, with final deformity of the parts. The joints, for example, may be ankylosed by cicatricial contraction or the fingers destroyed by a secondary tuberculous dactylitis. An important sequela must be added to these—an elephantiasiform thickening of limbs, most often displayed in the legs, in which there is an actual increase in size of all structures, until in certain cases the limb loses all semblance to its former symmetry. This condition is the result of a chronic edema due to obstruction of the vascular and lymphatic circulations by scar-contraction and obliteration of the channels by recurrent attacks of dermatitis and lymphangitis.

Lupus of the genitalia is rarely met with. Kaposi has seen lupus seated exclusively on the penis and scrotum; Hebra, one case on the penis. The reported cases of lupus of the vulva have had much doubt cast upon them by Taylor and other competent diagnosticians.

Lupus of the mucous membranes occurs in about one-third of the cases—according to Leloir's figures, 109 times in a total of 312 instances. The disease is frequently due to extension from cutaneous foci, but it occurs in this situation primarily. The primary efflorescence is here a soft, brownish-red, papillary outgrowth covered with gray epithelium. Numbers of these prominences may be aggregated into elevated, fissured plaques, which ulcerate or terminate finally in cicatricial retraction. The plaques present a raw surface or remain covered with macerated epithelium. The mucous membrane of the bucco-pharyngeal cavity is the seat most frequently attacked, except in the case of the tongue. When the gums suffer, they become spongy and the teeth fall out; the soft palate may be destroyed by ulceration; Leloir, in opposition to Kaposi, has reported a case of perforation of the palatal vault. Riehl and Chiari found lupus of the larynx in 6 of 70 cases involving these membranes. It results in ulceration or stenosis from cicatricial formation. The epiglottis and vocal cords are the sites of predilection. Lupus of the nasal mucous membrane has been mentioned. It is of peculiar importance, in that it is apt to be mistaken for eczema. The disease on the conjunctiva, whether primary or secondary, is of vast importance in view of its menace to the sight. A trachomatous or pannus-like formation or corneal opacity may be left as a milder sequela, while perfora-

tion of the cornea, staphyloma, and panophthalmitis are among the possibilities.

Complications.—Involvement of the lymphatic glands in the tuberculous process, particularly those of the neck, is not an infrequent accompaniment of this disease. Lymphangitis, perilymphangitis, and the formation of gumma-like nodes (*gommès scrophuleuses* of the French), with the ulcers resulting from the tissue-necrosis, are developments of the same process, and can scarcely be spoken of as complications. Recurrent and evanescent attacks of inflammation (erysipelatous, so called) may occur in the course of a lupus, particularly of the extremities, and sometimes exercise a beneficial influence upon it. Secondary tuberculous infection in lupus patients has been observed by several writers, and its existence denied *in toto* by others who regard it as due to depraved systemic conditions and prolonged hospitalism, rather than to the integumentary affection. A very grave complication of lupus is epithelioma, which in this combination pursues a peculiarly rapid and malignant course.

TUBERCULOSIS VERRUcosa CUTIS.

Synonyms.—*Verruca necrogenica*; Post-mortem wart; Anatomical tubercle; Lupus verrucosus; Scrofuloderma verrucosum.

Definition.—A tuberculous affection of the skin, characterized by warty, papillary outgrowths, usually occurring on the backs of the hands and resulting from direct inoculation.

Symptoms.—The disease described by Riehl and Paltauf¹ under the name of tuberculosis verrucosa cutis has since been recognized as uniting in one group a number of diseases previously classified as distinct affections. It is found usually on the hands of those who in their occupations come into direct contact with animal bodies—*e. g.* butchers, tanners, doctors, attendants in morgues and dissecting-rooms. The post-mortem wart, *verruca necrogenica*, is a type of the early appearance of the disease. It begins as a small papule upon which a pustule develops. This becomes capped with a dried crust which in time falls off, leaving an irregular surface. Upon this ulcer papillary outgrowths appear, but a considerable length of time elapses before the true horny covering is formed.

Verrucous tuberculosis appears in the shape of one or more round or oval patches on the backs of the hands or fingers—only exceptionally elsewhere on the body. They vary in size from that of a dime to an area including the whole dorsum, part of the palm, and the wrist. Two or more patches may unite, forming an irregular, scalloped, or serpiginous border. There is an elevation of one or two millimeters above the skin-surface, sloping by an erythematous border into the healthy integument. Inside this erythematous zone is a ring of miliary pustules, and in the center of the patch a warty growth covered by crusts and horny material. A little pus may be squeezed from tiny pockets between these papillary excrescences. The surface may become eroded or fissured in places, but it does not ulcerate. The center of a patch may undergo spontaneous involution, leaving a cicatrix surrounded by a ring of disease.

The **course** is very chronic, running for years. The lesions may give rise to a general infection, and in this way serious sequelæ may be seen. Years ago McCall Anderson described this condition on the hands, legs, and arms of children, giving it the name *lupus verrucosus* or *scrofuloderma verrucosum*.

¹ *Viertelj. f. Derm. u. Syph.*, 1886, Heft i. p. 19.

TUBERCULOSIS CUTIS VERA.

Synonyms.—Tuberculosis cutis ; Miliary tuberculosis.

Definition.—A rare form of orificial tuberculosis, characterized by the presence of ulceration and miliary tubercles.

Symptoms.—Tuberculosis cutis is a rare affection occurring, according to Chiari, who first described it in 1877, 5 times in 6000 post-mortems. Kaposi has since then seen some 30 cases. It occurs in the form of an ulcer or fissure at one of the body-orifices—the nose, mouth, anus, vulva, ear—just at the junction of skin and mucous membrane. The corner of the mouth is the site of predilection. The ulcerations are shallow, flat, irregular, with serrated borders, and are very painful. The edges and base are grayish, a pale red showing underneath—an appearance due to the presence of a thin purulent secretion. At the border new, rather firm papules develop, which finally break down and leave a punched-out ulcer. These papules have been demonstrated to be miliary tubercles. The ulcers enlarge by their peripheral growth. Complete spontaneous recovery rarely or never takes place, although the center may cicatrize, leaving only an ulcerating ring which may be broken in places by the scar-formation. Tuberculosis cutis is almost always secondary to some internal focus of disease in the lungs, intestine, uterus, and results from the passage of discharges containing the tubercle bacillus over abraded surfaces. Kaposi states that he has seen the lesions elsewhere on the body, as on the ankle and buttocks and in the bucco-pharyngeal cavity, without coincident tuberculosis of the skin.

SCROFULODERMA.

Definition.—A disease of the skin resulting from the extension to the integument and subcutaneous tissue of a tuberculous process in the underlying lymphatic glands and channels.

Symptoms.—Scrofuloderma is a term which has been, and is still, used to cover more sins of diagnosis than any other in the field of dermatology. Many of the affections formerly placed under this heading have, however, been properly classified, and all ambiguity is removed when the application of the term is limited to the condition described in the definition.

Scrofuloderma has its seat in the subcutaneous tissues, and involves the skin only by extension and secondarily. It begins as a perilymphangitic node or follows a suppurating, caseating process in the glands. The former condition is also known as a scrofulous gumma (*gomme scrofuluse*), and occurs especially on the limbs. The latter is seen generally on the neck, but may be found anywhere over a chain of glands. At first the skin is uninvolved, and the nodule can be felt as a soft mass underneath ; later, the skin becomes firmly attached to the growth and takes on a bluish-red tint. It is soon tense and shining, and is finally destroyed. The necrosed and caseous material is permitted to escape, and an ulcer of a depth varying with that of the original focus is left.

The ulcer may be shallow when the infiltration is subcutaneous, or very deep, opening into a fistulous tract which leads to the tuberculous glands. Its edges are soft and often undermined for some distance around, and the floor is uneven, covered by pale, flabby, easily-bleeding granulations. Several openings may be made into one nodule. If the process is arrested, either by absorption or by being encapsulated, ulceration will not appear. In case it does, however, its course is most chronic, and it heals with the formation of puckered, irregular cicatrices formed of thick bands, with, here and there, an island of healthy skin in their meshes.

TUBERCULOSIS MILIARIS.

Miliary tuberculosis, so far as the writer's knowledge extends, has been reported in one instance only, but that is of sufficient interest to warrant a short review of its points. Leichtenstein's patient, a boy aged four years,¹ developed first a pulmonary tuberculosis which became generalized, and of which he died. In the course of the fourth week a discrete papular eruption appeared on the trunk, face, and limbs. The lesions were small, hard, red, rounded or acuminate, and clearly marked off from the surrounding skin. Successive outbreaks occurred, lasting eight to fifteen days, when the papules would disappear. The number of lesions in each relapse was never more than twelve or fourteen, but the recurrences followed each other closely. The papules occasionally became vesicular or pustular, and after resolution left a desquamating surface.

Etiology.—After passing through various changes of theory all of these five dermatoses are now, almost universally, recognized as being due to the activity of the tubercle bacillus of Koch, and are included under the term cutaneous tuberculosis.² Syphilis was formerly thought to play a part in the origin of certain forms of lupus (Ricord), but the concurrence of recent syphilis and lupus, observed by Hebra and Kaposi, has shown beyond a peradventure the falsity of the supposition.

Denne was the first to report the finding of Koch's bacillus in six lupus cases. Pfeiffer, Krause, Dontrelepon, and Koch himself have since confirmed the observation. The bacilli are usually very few in number, one to ten in each giant-cell. Direct inoculation of lupus tissue in the anterior chamber of the eye of rabbits was first performed successfully by Schüller and Hueter, followed by Leloir, Cornil, and Martin. A systemic tuberculosis was also produced by inoculation into the peritoneum. Only one link in the chain of proof remained to be forged—viz. the production of lupus by inoculation of tubercle bacilli. No reliable experimental proof has been offered as yet, but Besnier, Sachs, Jadassohn, and Wolters have reported cases occurring respectively in a vaccination scar, a piercing of the ear, a tattoo-mark, and in a scalp wound, which seem to demonstrate this occurrence.

Tubercle bacilli are found in larger numbers in the other four cutaneous tuberculosis. In tuberculosis cutis vera the disease often arises from auto-inoculation—on the mouth from tuberculous sputa, at the anus from the discharges of intestinal tuberculosis. In other cases of direct inoculation, however, the lesions produced are usually verrucous, as in Pfeiffer's case, a veterinarian who acquired the disease from a cow and died afterward of phthisis pulmonalis; and in Dubreuil's, a young woman whose disease finally attacked the glands of the axilla and produced typical scrofulous ulcers on the arm. The latter observer also reported 17 cases of tuberculosis of the penis after ritual circumcision by one operator, who applied his lips to the wound. Hard and fast lines are, however, difficult to draw, and the exceptions, as in the reported cases of lupus from inoculation cited above, should be borne in mind.

Tuberculosis of the integument may develop by indirect inoculation, in which there is a transference of tuberculous material from deep-seated foci to the skin, with or without implication of the intervening tissues. In this condition Bowen claims³ that the lesions are the nodules of lupus in a majority of instances; and his statement is probably true if we except scrofuloderma. Bands of lupus nodules have been seen following the course

¹ *Münch. med. Wochenschr.*, 1897, No. 1, p. 1.

² Leloir: *La Scrofulo-tuberculose de la Peau*, 1892.

³ *Loc. cit.*

of infected lymphatics in the cicatrices of scrofuloderma and around tuberculous fistulae. Leloir's statistics¹ demonstrate the comparative frequency of indirect ocalation. It was found in 104 of his 312 cases, in which, moreover, lupus occurred secondarily to tuberculosis of the glands in 32 cases, to disease of the bones and joints in 29, and to scrofuloderma in 41.

Age plays some part in the development of cutaneous tuberculosis. Lupus appears in most cases in childhood, but old age is not exempt, as it has been reported at seventy. Scrofuloderma is also largely a disease of young people; tuberculosis verrucosa and vera may be seen at any time of life. The question of heredity is not one which may be discussed with propriety here. It is sufficient to say that no authentic case of skin-tuberculosis has ever been reported as congenital. Phthisis pulmonalis may occur concurrently in these cases: a connection between them can rarely be proved. Leloir found it 98 times in 312 cases.

It should be remarked that Kaposi and others regard the theory of the tuberculous origin of these dermatoses as not clearly proved. His stand, like that of Besnier's in his brilliant advocacy of the theory of a similar infection in lupus erythematosus, finds few supporters now.

Pathology and Morbid Anatomy.—All of these affections rest upon the same histological basis, the product of the activity of Koch's bacillus—the tubercle. This common groundwork, by various modifications in its development, produces the clinical pictures with which we are familiar. The tubercle is a granuloma. It is composed of granulation-tissue. In its earliest stage it is seen to consist of leukocytes, lymphoid cells, and proliferated connective-tissue corpuscles. These cells are imbedded in a delicate reticulum composed of very fine branched fibers. The tubercle is usually marked off from the surrounding tissue in the skin by a condensation of the white fibers in its vicinity. Later, in the mass of round cells a number of epithelioid cells appear—large, oval cells with clear, refractive nuclei; when the tubercle is fully developed one or more large bodies, staining with difficulty and containing twelve or fifteen nuclei ranged in a row about their periphery, develop in the center, surrounded by the two zones of epithelioid and round-cells. They are the giant-cells of Langhans, and were thought by Friedländer to be pathognomonic of tuberculosis. Their significance has, however, been lost since their discovery in numerous other morbid conditions, and since they have even been produced experimentally. The tubercle bacilli are usually found in the giant-cells in varying numbers, from one, two, or three in lupus to a dozen or more in tuberculosis vera. They may be found elsewhere as well. After a time, by an increase in the density of the cell-infiltration, the numerous vessels supplying the growth may become blocked, and the central portion undergoes a tissue-necrosis, the coagulation-necrosis of Weigert, by which it is converted into a cheesy material, the cells becoming cloudy and disintegrating. After this necrobiosis of its elements the tubercle undergoes absorption or elimination if conveniently situated, with the exception of a part of its elements, which may be converted into connective tissue. This, together with the inflamed surrounding fibrous material, undergoes cicatricial contraction.

Lupus Vulgaris.—The tubercle in lupus is situated deep in the corium, and progresses upward and toward the subcutaneous tissue by extension of the diseased foci and their coalescence. At the same time, the connective tissue around becomes infiltrated with inflammatory products, round- and connective-tissue cells, together with the plasma-cells of Waldeyer, accord-

¹ *Loc. cit.*

ing to Unna, and an irregular, diffuse infiltration of all the layers finally results, taking the place of the original arrangement. The giant-cells are numerous and the epithelioid few—a characteristic of the slowly-growing tubercloses of which lupus is a type. After a long time the cell-infiltration may disappear, leaving a cicatricial retraction of the skin and its glands (*lupus scléreux*). The connective tissue, however, under the stimulus of inflammation, may undergo hypertrophy and produce the condition of elephantiasis of the limbs already spoken of.

Changes take place in the epidermis when the infiltration reaches the papillary layer of the corium, very often early in the process. Proliferation, cloudy swelling, and vacuolization are seen in the rete-cells. The demarkation between epidermis and derma is lost by the spread of the inflammation into the former. The rete may be exfoliated or lost by a suppuration resulting from an infection by pus-cocci, exposing the nodules of lupus (*lupus exulcerans*). If, instead of ulcerating, the layers of epidermis take on an hyperplasia, there may be seen in the section enormously hypertrophied rete-pegs, with corresponding increase in the size of the papillæ. The horny layer may be markedly increased also, resulting in a verrucous condition. This hyperplasia is the basis for the development of epithelioma in these cases. The skin-glands and follicles share in these processes. The latter may atrophy and disappear completely in one case; in another they may put out hyperplastic offshoots from their sheaths. The ducts of the sebaceous glands may atrophy, leaving only the shrivelled acini, filled with flattened epithelial cells, like those in the nests of cancer.

Tuberculosis Verrucosa.—This is described by Riehl and Paltauf¹ as occupying an intermediate position, histologically, between lupus and tubercular ulceration. The condition is practically that of lupus verrucosus (*vide supra*). There are many tubercles, some undergoing caseation. Bacilli are present in the giant-cells and granulation-tissue; still very few, but more numerous than those in the lupus-nodules. There are, besides, in the upper layers a number of foci of inflammation, many of which have advanced to the formation of miliary abscesses. The chief distinguishing characteristic is the enormous growth of the papillæ, with their thick epidermal, particularly the horny, covering, resembling the condition seen in ichthyosis hystrix. The structure of verruca necrogenica is the same.

Tuberculosis Cutis.—The tubercles seen in this condition are those of a rapidly progressing tuberculosis in any situation. They contain all of the histological elements in numbers, giant-, epithelioid, and round-cells. The bacilli are very numerous in the tubercles, granulation-tissue, and the secretion of the ulcer after its formation by the same process of necrobiosis seen in lupus. In addition to the miliary tubercles in its base and edges, the ulcer shows under the microscope a dense infiltration of lymphoid cells in the same situations. The tubercles may be formed at some distance from the original seat of disease, and are seen in all stages of caseation.

Scrofuloderma.—Tuberculosis of the subcutaneous tissues exhibits no marked anatomical divergence from the same morbid process elsewhere in the body. The areas of caseation and necrosis are much larger than in lupus, and occasion a far greater destruction of the tissues. The epidermis is lost and an ulcer formed, as in lupus and true tuberculosis. The bacilli are present in numbers varying with the case, but are more frequently seen than in lupus, if not so many as in miliary tuberculosis.

In the single case of miliary tuberculosis the papules were found to con-

¹ *Viertelj. f. Derm. u. Syph.*, 1886, Heft i. p. 19.

sist of tubercles situated in the papillary layer, and containing numerous bacilli. A secondary infection by pus-organisms accounted for the pustulation.

Diagnosis.—The chief feature of lupus, from a diagnostic point of view, is the apple-jelly nodule deeply seated in the corium and not disappearing under pressure. If the clinical picture is obscured by complicating accidents, search should be made at the borders of the growth for these primary efflorescences. Lupus vulgaris must be differentiated from syphilis in some of its many forms, from lupus erythematosus, scrofuloderma, epithelioma, and leprosy.

The forms of cutaneous *syphilis* most likely to be taken for lupus are the ulcerative and serpiginous. Lupus runs a slower course than syphilis; its nodules do not spread so regularly from center to periphery, so that its ulcers do not take the familiar kidney shape. These ulcers differ also in their indolence, the flabbiness of their base, their slight painfulness, and their abundant granulations. In lupus the nose is diminished by retraction; in syphilis the diseased portions are sharply defined and the bones are attacked, producing a sinking in of the bridge not seen in lupus. An elephantiasis of the leg, combined with the presence of papules, can only be due to a lupus. The therapeutic test is sometimes useful, but its occasional unreliability should be borne in mind. Anatomical investigation is the final test to be applied, but entire confidence can be placed in it only when bacilli are found.

The differentiation from *erythematous lupus* will be found discussed under the latter heading (p. 1038). *Scrofuloderma* being a closely-allied condition, the diagnosis is not of great importance. The involvement of the subcutaneous tissues and the presence of caseating glands should be noted. As has been said, the two diseases may occur together. In middle-aged persons *epithelioma* may be mistaken for lupus in case of ulceration. The ulcer of epithelioma has hard edges, raised and everted; its surface is uneven; its progress more rapid; its character more painful. Involvement of the neighboring glands is common in malignant disease, rare in lupus. As in scrofuloderma, the two may attack the same region. A confusion with *leprosy* is only possible in the early stages of the diseases when only nodules are present. The enlargement of nerve-trunks, presence of anesthetic areas, or the demonstration of the lepra bacillus will make the diagnosis.

Tuberculosis verrucosa may be confounded with true *verruca* or papilloma, as it was often called before the nature of the disease became known, and, when the warty condition is not marked with eczema. The first two do not pursue the course of the tuberculosis, are not inflammatory, and do not heal with the formation of cicatrices. A patch of chronic *eczema* is often not unlike this condition, but there is no scar-formation; it does not advance by peripheral growth, and at some time there has been an exudation from its surface—an exudation which may be experimentally produced by irritants. *Ichthyosis hystrix*, being a congenital malformation, could hardly be mistaken for an inoculation-tuberculosis.

Tubercular ulceration—*tuberculosis vera*—offers little difficulty in diagnosis. It might be mistaken for a simple ulcer, a mucous patch, an ulcerative syphilide, or an epithelioma. It is distinguished from the first two by its slow course, softness, scalloped edges, and miliary tubercles; from epithelioma by the proneness of the latter to occur in middle age or later, by its painful character and hardness, and by the appearance microscopically of epithelial pearls.

Serofuloderma may be mistaken for the condition following a simple suppurative process in the glands. The discovery of tubercle bacilli will set all doubts at rest. The scars of serofuloderma are in no wise characteristic; they could not be distinguished, for example, from those resulting from a gangrenous bubo.

Inoculation of the diseased tissue into the lower animals is a valuable aid to diagnosis, only, however, in the hands of those expert in such measures. Positive results are even then not always obtained, and a failure to produce a tuberculosis is not to be regarded as excluding the disease, any more than the failure to find Koch's bacilli in the sections examined. As has been said, the histological characteristics alone are not sufficient to make the diagnosis.

Prognosis.—The prognosis varies not only with the particular tuberculosis in question, but also with the form which it takes. Verrucous tuberculosis and serofuloderma respond more readily to treatment, as a rule, than lupus. In the latter disease a superficial ulceration or confluent mass of nodules will heal more readily than the same efflorescences enclosed in dense scar-tissue. The prognosis in tuberculosis vera and miliaris is worse than in other forms, since they accompany disease of the internal organs, and are liable to recur from reinoculation. Spontaneous involution in all varieties is possible, though rare in lupus, but the tendency to relapse, so marked in all, must never be lost to sight. Moreover, no matter how skilful the treatment, a scar is the inevitable result of healing. It results as well in cases of spontaneous involution.

Under proper treatment the disease may remain dormant for a long time or for the rest of the individual's life, with always the fear of recurrence hanging over it. If left untreated, lupus, in particular, will drag its course out over years, new areas being attacked and new nodules appearing in old scars.

The danger to life is a minimum. A general infection from tuberculosis of the skin is a rarity. The prognosis as to cosmetic effect is uniformly bad.

Treatment.—Many of the methods to be discussed here are applicable to all forms of cutaneous tuberculosis. They will be considered at length in the Treatment of Lupus.

Internal Treatment.—In 1890 the discovery of Koch's tuberculin raised great hopes that at last a specific in tuberculous affections had been found. The first reports of its use in lupus were as glowing as is usual in such cases, but, one by one, its advocates have dropped off, until, so far as we know, Crocker's is the only voice raised in its behalf among the well-known writers. Even he claims for it only a limited application, in conjunction with other measures, to reduce hypertrophic scar-tissue and to destroy nodules deep down in the cicatrix. The injection produces a violent reaction in and about the disease, with a temporary improvement, but relapse soon occurs, metastases appear in other locations, and the dangers to health and to life itself from the use of tuberculin have brought about a very general condemnation of its use. Thiosinamin, recommended by Hans von Hebra (0.2 c. c. of a 15 per cent. alcoholic solution injected two or three times a week) in the same class of cases as those in which Crocker uses tuberculin, while not making complete cures, still occasions resolution enough to merit investigation further. The drug's specific effect appears to be on the scar-tissue.

The general measures adapted to the improvement of a lowered vitality are often useful in these cases. Lupus and tuberculosis verrucosa may occur

in apparently healthy persons, but the so-called scrofulous habit is often as plainly manifest in them as in the other forms of tuberculosis. Cod-liver oil, iodine, iron, quinine, ferruginous mineral waters, and a strict diet, all have their place as adjuvants to the line of treatment adopted.

Local Treatment.—Since specific medication has failed, recourse must be taken to older methods whose results are more certain and dangers less great. These measures look toward the removal of the disease, and may, for convenience, be divided into two great classes—caustics and surgical procedures. As in lupus erythematosus and other obstinate affections, a great number of ingenious and varied methods have been invented, the most important of which will be considered.

There are certain adjuvants to local treatment, such as oils, ointments, lotions, and plasters, used to macerate crusts and the lupus-nodules, to reduce inflammation and swelling, to cover suppurating wounds, and to promote the formation of smooth cicatrices. The maceration may be affected by olive or cod-liver oil, soft soap, unguentum simplex, salicylic and mercury plasters. The plasters are used to remove the horny covering in lupus verrucosus and to aid in the absorption of hypertrophic scar-tissue. Lotions of sulphur (*lotio alba*) and of calamine and zinc are serviceable in acute attacks of inflammation.

Caustics.—One of the most efficacious of this class of local measures is the solid stick of silver nitrate. It is sufficiently resistant to penetrate the nodules of lupus, but not the healthy tissue. It also destroys the vessels and causes thrombosis in them, but it is only applicable in superficial infiltrations. It is very painful, and, like most other cauterizations, should be used only under local anesthesia by cocaine or an ether or chloride-of-ethyl spray. Kaposi particularly recommends it in lupus conjunctivæ.

Arsenical paste (*arsenici albi* 1.0, *cinnabar. fact.* 3.0, *ungt. emoll.* 24.0) has the great advantage that it attacks only the diseased tissue. It is applied on linen strips for twenty-four hours, then a fresh quantity is put on. Pain is usually severe on the second day. The treatment is not carried beyond the third application, and more than three or four square inches should not be covered at one time, for fear of absorption and poisoning. The nodules become necrotic and are easily removed. It is most useful in lupus of the face.

Pyrogallic acid (10–20 per cent.) in ointment possesses the same selective action, and cannot be recommended too highly, particularly after surgical measures, to destroy any foci left. Carbolic acid (pure), applied on a swab to ulcerations and on instruments used to bore out the nodules, is limited to these applications. It cauterizes healthy tissue. White and Doutrelepoint recommend bichloride of mercury in solution (*gr. i–ij to ʒj*) or in ointment of the same strength in the case of ulceration. Vienna paste, a mixture of caustic potash and unslaked lime, zinc chloride, pure in sticks or in Canquoin's or Landolph's paste, lactic acid, and salicylic acid, all destroy healthy tissue and produce hideous scars. Hence their use is to be deprecated even on the limbs.

Surgical Treatment.—Excision with skin-grafting, after Thiersch's method, has been recommended by Lang and Jarisch. Lang has recently reported two cases with good results. Theoretically, this is the ideal method; in practice, relapse commonly takes place in the new skin. Erosion or scraping with a Volkmann spoon is really the first of surgical measures. The soft diseased parts are scraped out, a very little experience enabling the operator to distinguish the resistance of healthy tissue. The

method is not a complete one, inasmuch as small nodules may be left which must be destroyed by other means. It is best adapted for large foci and flabby ulcerations. The scraped surface should always be treated antiseptically. After a few days a necrotic layer is detached and healthy granulations appear.

Multiple puncture may be done with Veiel's instrument or with Pick's multiple scarificator, which consists of several blades fastened together. The knife before use may be dipped in an antiseptic—iodine, carbolic acid, etc. Its results are not to be compared with those of erosion or scarification, which is done with a bistoury or multiple scarificator in parallel lines crossing each other. The tissue in this way is minced and the nutrient vessels occluded. Morris, Vidal, and Brocq claim better results and thinner scars from scarification than erosion. The former must, however, be repeated at intervals, the lupus being covered meantime by *emplastrum de Vigo* or *hydrargyri*. It offers greater possibilities for auto-inoculation than scraping. It is peculiarly useful in hypertrophic conditions, even in the hypertrophied scar which sometimes results from scraping. Fox's dental burr for boring out nodules fails of even this limited application.

The galvanic or thermo-cautery has the disadvantage, applied to a new focus, of burning healthy and diseased tissue. Either—especially the galvanocautery, made of rather fine wire—is, however, most serviceable in destroying recurrent nodules and those located on the mucous membranes. Electrolysis, as used by Lustgarten and Gärtner, is accomplished by means of a metal disk for the negative pole placed on the patch, the current derived from twenty-four Leclanché cells. Jackson used a large needle introduced into the patch instead of the plate. It is applied to recurrent lupus of the face.

It is seldom that any one of these methods will be efficacious in a given case. They must be tried one after the other or combined as circumstances indicate. A patch of tuberculosis verrucosa may disappear under plasters alone, while a lupus of equal extent resists all efforts. The mixed method is undoubtedly best, and as an example of it the following procedure is given: After removal of crusts by maceration with oil or ointment, cornification by strong salicylic plaster or an acute inflammation by calamine-and-zinc lotion, ulcers and the nodules accessible are thoroughly curetted under anesthesia, and an ointment of 15 per cent. pyrogallic acid is applied. In a few days the necrotic material separates, leaving healthy granulating wounds. Under mercury plaster these heal gradually and a scar forms. If hypertrophic, the tissue is minced by scarification and the plaster again applied. If new nodules appear, they are exposed by removing the epidermis and bored out with the stick of silver nitrate or cauterized with the galvanic wire heated to a dull red. So the methods are continued, adopting each as it seems best, until a flat, thin cicatrix results.

Tuberculosis verrucosa has been seen to disappear after removal of the horny material under mercury plaster alone. It may in rebellious cases require curetting or scarification, with a dressing of iodoform or eucrophen. Tuberculosis vera should be well scraped, cauterized, and dressed with a powerful antiseptic. Scrofuloderma is treated on similar lines, but usually falls into the surgeon's province.

Prophylaxis.—Leloir has formulated a code of rules in this connection which are admirable. They may be briefly summarized as follows: Guard against possible infection of the skin by avoiding the contact with it of tuberculous material; by treating all wounds antiseptically in any way ex-

posed to such infection ; by maintaining, as far as possible, in a condition of asepsis every part of the skin likely to be inoculated by discharges from lungs, intestines, urinary tract, etc. Destroy deep-seated tuberculous deposits which may end by involving the cutaneous covering. Watch with the greatest care the health of those who have an inherited family predisposition to the disease, and build it up by hygienic and therapeutic measures. If a tuberculous origin for these dermatoses is recognized, the importance of prophylaxis is at once seen. Many a life-disfigurement by lupus or serofuloderma might be avoided by attention to such simple rules as these. Their importance cannot be overestimated.

II. PARATUBERCULOSES.

In 1894, Fournier published in Paris a book which he called *Les Affections parasyphilitiques*. By the term he means affections not necessarily syphilitic in themselves, but developing and flourishing upon a specific basis. The step is not far from syphilis to tuberculosis in pathology, and by analogy it is not strange that there should be a crowd of diseases with a thoroughly recognized relationship to the latter, in spite of the fact that Koch's bacillus is only very rarely found in their lesions, even then probably resulting from accidental contamination. Many efforts have been made of late to find and fix a place for the paratuberculoses, notably during the Congress of Dermatologists last year in London, by Hyde, Hallopeau, Crocker, and others. (The name I used was not suggested—in fact, none was given—but it seems to fit the case.)

Very few dermatologists are ready to accept as corollaries to tuberculosis all the diseases so designated by Hyde and Hallopeau. Tommasoli appears to have the right of the question when he says that it is a mistake to consider that dermatoses, such as Hebra's pityriasis rubra, general ichthyosis, dermatitis exfoliativa, eczema even, have any causal relationship with tuberculosis other than that, in the impairment of the resisting powers following a long-standing disease of this kind, the bacillus finds its entrance easier and its soil more favorable. Upon one point, although the guess is at present a hazardous one, opinions, in a majority of observers, are apparently agreed—viz., that the origin of the diseases commonly accepted as paratubercular is toxic. They are, in all likelihood, due to the action of poisons derived from distant foci of disease.

For convenience, those diseases concerning whose title to a place here there is little dispute may be ranged in three subdivisions : (1) the serofulides ; (2) the tuberculides ; and (3) hyperchromia. The serofulides, first described by Dühring, are pyodermic affections, which, if toxic in origin, are so probably in the sense that pus-organisms are more easily inoculated upon a skin weakened in resisting power by circulating poisons. In this scheme they include : (a) The small pustular serofulide ; (b) The large pustular serofulide ; (c) Certain suppurative folliculites.

The second subdivision, called tuberculides by Darier, includes, in his classification, a number of affections which may be narrowed to—(a) Lichen serofulosorum ; (b) Aene cachecticorum ; (c) Erythema induratum serofulosorum ; (d) Grouped folliculitis ; (e) Possibly the disease usually described as hydradenitis ; (f) Lupus pernio.

The first three are typical paratuberculoses. Kaposi says one of the diagnostic points in lichen serofulosorum is its occurrence in the tuberculous. The origin of *d* and *e* is more than doubtful. None of these diseases are

commonly pustular, but they may become so by accidental contamination. In this way they are separated from the serofulides, which are pure pyodermias.

The last class includes but one affection, a hyperpigmentation, a "pigmentary dysgenesis" common to various cachexias of syphilis, cancer, paludism, alcoholism, diabetes, as well as of tuberculosis. In this instance it may aptly be called the pigmentary tuberculide, in analogy with the pigmentary syphilide. Fournier (*Les Affections parasymphilitiques*) describes a case¹ in a young girl which could be distinguished from the specific dyschromia only with the greatest difficulty. The pigment is derived from the blood originally, but its chemical composition is changed. Once deposited in epithelial or other cells, it is practically ineradicable.

None of the paratuberculoses are common in practice. Their importance lies in the fact that they are easily mistaken for syphilides. Acne cachecticorum, lichen serofulosorum, and erythema induratum will be found in another place. The two serofulides only will be described here.

The small pustular serofulide shows itself in strumous subjects as a disseminated pustule, pinhead- to pea-sized, with a firm red base. Its seat is on the extremities, especially the hands and forearms. It pursues a chronic course, and is finally capped by a scab which, on falling, leaves a depressed cicatrix. Relapses occur, dragging out the course over years. These pustules are not seated about the follicles.

The large pustular serofulide is a rare disease, occurring, also in the serofulous, chiefly over the sternum. The pustules are few in number, superficial, with a violaceous areola. After desiccation of the pus a crust forms which covers a shallow ulcer. This heals by scar-formation.

Stanley² has published a case of pustular serofulide, a boy of fourteen, in whom the eruption was recurrent and displayed its greatest activity when tuberculosis of the glands was most active. He progressed favorably under ol. morrhue internally and by inunction.

LUPUS ERYTHEMATOSUS. (JAMES C. JOINSTON, M. D.)

Definition.—Lupus erythematosus is a disease of the skin pursuing an essentially chronic course, and characterized by slightly elevated, scaling, red patches which develop from an inflammatory process, and result, after involution, in atrophic scarring.

Symptoms.—All writers agree in describing two forms of the disease—the discoid or circumscribed and the disseminate. To these have been added others, the telangiectatic and the nodular (Crocker), a division found chiefly in the works of English authors.

Lupus erythematosus discoides is much the most common form. It begins usually upon the face, especially on the nose and adjacent portions of the cheeks, upon the scalp and ears, in the shape of discrete or grouped red spots the size of a pea or smaller, raised but little above the surrounding integument, usually sharply demarcated from it, and capped with a thin white adherent scale. This primary efflorescence is the starting-point in both the principal varieties, and, in addition to the locations mentioned, may be found upon the backs of the hands and feet, and very exceptionally upon other parts of the body. The lesions increase in number, extend peripherally, and finally coalesce into patches of varying size, which may be symmetrical. When they occur upon the nose and spread out over adjoining

¹ Some eighteen others have been reported by various observers.

² *Brit. Journ. of Derm.*, Nov., 1893.

regions of the cheeks the disease is said to be, from a fancied resemblance, butterfly-shaped. The center of the patches remains covered with a firmly-adherent scale, which when raised shows projections from its under surface into the dilated openings of underlying sebaceous glands. This central portion begins to undergo involution, the color fades, and an atrophy of the skin, which resembles a cicatrix, results. In this way circinate lesions are produced, a red raised border, dotted with comedones, marking the line between atrophy and healthy tissue. As the border advances it may cover large surfaces, and, joining with others, form gyrate or serpiginous outlines. The resultant scar is thin, white, and smooth, never puckered. Where the process occurs upon hairy surfaces permanent alopecia inevitably remains.

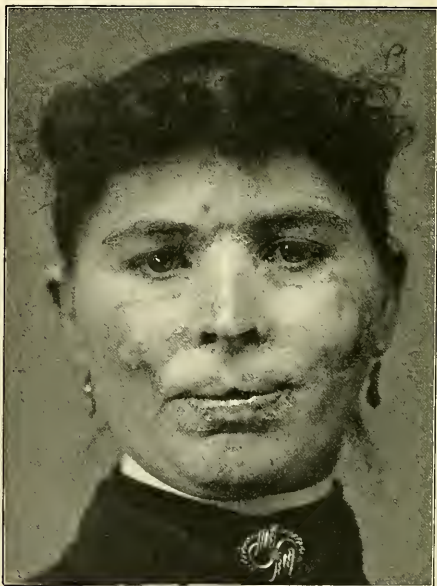


FIG. 254.—Lupus erythematosus discoides (after Bronson).

The subjective symptoms are usually slight, confined to slight itching and burning, and the general health commonly remains unaffected. The disease may become stationary after a time or relapses may prolong its course. Certain of the patches may entirely disappear without leaving a trace of their presence. When the process attacks, as it does in rare instances, the mucous membranes, excoriations with a red or grayish color and the characteristic scarring will be seen.

Lupus erythematosus disseminatus is a disease which is fortunately rare in this country. It pursues often a more acute course than the form already described, in which case the patches appear suddenly; again, however, their evolution is slower. The primary efflorescences are the same as in discoid

lupus, but the disease spreads only by increase in their number, not in their size. The lesions occur in numbers on the face and scalp particularly, and are frequently scattered over the trunk, upper extremities, hands, and feet. In rare cases almost the whole cutaneous surface is attacked. The patches are reddish brown, traversed by dilated capillaries, slightly elevated, hard, and vary in size from a pinhead to a pea. They are formed by aggregation of the primary nodules, and some of them usually exhibit the cicatricial central retraction of the first variety or simply a depression corresponding to the mouths of the follicles. The resemblance to the papules of syphilis, the nodules of lupus vulgaris and leprosy, and to chilblains is often marked.

In certain cases there is an acute febrile movement attended by osteoscopic pains, headache, and swelling of the joints and subcutaneous tissue preceding the development of the spots. Kaposi has seen severe erysipeloid swelling of the face, a temperature of 104° F.—a condition leading through a typhoid state to death in 50 per cent. of cases. A high degree of inflammation may complicate the attack, leading to the development of numerous hemorrhagic or watery vesicles. These latter dry into crusts, which on falling expose characteristic lesions of lupus erythematosus. Such acute eruptions are peculiar to the disseminate form. When they occur in the course of a discoid disease it indicates the combination of the two varieties, whose efflorescences are seen side by side. As in the disseminate form, patches may occur on the buccal mucous membrane. The scars which are left occasion an alopecia in spots over the scalp and give the face an appearance of being pock-marked.

The *telangiectatic* variety occurs in flat red spots over the malar eminences, usually symmetrical. On close inspection they are seen to consist of dilated vessels. The skin is thickened and may show a few comedones. There is no scaling, but a superficial scarring may result. *Nodular* lupus erythematosus (Crocker) is very uncommon. It occurs in the form of raised, convex, slightly scaling brownish-red nodules, closely resembling lupus vulgaris or lichen planus. They appear singly or in groups on the face and hands, and betray little tendency to involution.

While the individual patches of lupus erythematosus may disappear suddenly and completely, their duration is usually for months or even years. The disease, as a whole, pursues a most protracted course, extending over ten to twenty years through recurring outbreaks.

Etiology.—This affection is one of adult life, the majority of patients ranging in age from eighteen to forty-five. Exceptions are found at both extremes, Kaposi reporting a case in a child of three; sixty-five is not a bar to its development. Two-thirds of the cases occur in females. The etiology is, further than this, obscure enough to permit any amount of conjecture. It is regarded by the French as a serofulous affection, a form of skin-tuberculosis. This is not in any sense borne out by microscopical appearances, and the inoculation cases are apocryphal, to put it mildly. Besnier gives as a reason for his belief in this conception that many of the patients give a personal or family history of tuberculosis. The same is true of acne, but no one regards it as tubercular. Chlorosis, anemia, dys-menorrhœa, and other uterine derangements—symptoms of dystrophy in general—are probably predisposing factors in women. A feeble blood-current, the influence of the sun, or great cold are cited by Crocker as probable causes.

Eczema seborrhoicum undoubtedly plays some part in the etiology of certain cases, no matter what its development, whether spontaneous or after

variola or syphilis. The seborrhœa congestiva of Hebra is now recognized as being an early stage of the disease.

Pathology.—Anatomically, lupus erythematosus is an inflammation of the skin in which the infiltration-cells undergo fatty degeneration, together with the tissue in which they appear, leading consequently to atrophy. No tubercle bacilli have ever been found in the diseased foci, and inoculation-experiments have proved nothing. The disease may begin in any portion of the corium, from the papillary body to the subcutaneous tissue, but its usual starting-point is in the neighborhood of the network of vessels surrounding the sebaceous and sweat-glands and the lower portion of their ducts, gradually spreading from them to all the layers of the skin.

In sections of recent nodules will be seen all the evidences of inflammation about the cutaneous glands and follicles—dilatation of the vessels, diapedesis, proliferation of the elements of the vessel-walls, round-cell infiltration of the connective tissue, and proliferation of its corpuscles. This change spreads gradually to the epidermis, producing desquamation, and to the deeper layers of the corium, giving rise to the firmness and nodular swelling of the skin. The increase of blood-supply about the sebaceous glands stimulates them to great activity, with the resultant formation of comedones, already mentioned. In acute outbreaks the exudation of fluid is increased, and vesicles are formed which may or may not be hemorrhagic according to the amount of extravasation of blood-corpuscles into the skin-layers. The process may be arrested here, resolution taking place and the exudate being absorbed; but usually the stage of inflammation passes into one of degeneration. A granulo-fatty change becomes apparent in the rete-cells, those of the infiltrate, and the surrounding connective tissue; the same phenomena are seen in the glands and follicles. Absorption of the granulo-fatty detritus takes place, and later follows a contraction of the connective tissue remaining, with loss of the specialized structures, follicles, sebaceous and sweat-glands, and subcutaneous fat. The vessels are also contracted, some, however, maintaining their dilatation. A delicate fibrillated reticulum between the cells of the infiltration has been described (Leloir and Vidal).

Holder¹ has demonstrated a capillary thrombosis in the patches which goes far toward explaining many of the morbid phenomena.

Diagnosis.—The diagnosis is not infrequently attended with difficulty. The acute outbreaks of the disseminate variety may be mistaken for eczema (eczema seborrhœicum in particular), syphilis papulosa, trichophytosis, and (when on the fingers) for pernio, and the greatest care is necessary to prevent mistakes. The course of the disease, as well as the differential points, must be closely followed.

The discoid disease in its protean forms may simulate an orbicular syphilide, eczema, psoriasis, rosacea, lupus vulgaris, lichen planus (the nodular form), and on the scalp alopecia areata and trichophytosis tonsurans. A typical case, with red, scaling patches, cicatrices localized on the face, may be recognized with comparative ease. In syphilis the infiltration will be greater, and will not fade under pressure of the finger. Its course will be more rapid. Eczema will never occasion scarring; it is more varied and swifter in its changes; its crusts are yellowish, not white, and have no prolongations, and it is prone to exudation. Psoriasis will not result in scars except in the rarest cases; its localizations of preference are different, and its scales are easily detachable and heaped up in masses. Rosacea shows numerous dilated vessels, frequently pustules in abundance, and is subject to ex-

¹ *Journ. of Cutan. and Gen.-urin. Dis.*, March, 1897.

acerbation. It leaves no cicatrices. Lupus vulgaris occurs before puberty, exhibits characteristic apple-jelly nodules, and its scars are very different. Here, as in trichophytosis, recourse to the microscope may be compelled. In alopecia arcata the scalp is smooth, not cicatrized, and the spots are regular in shape, without a trace of inflammation.

Prognosis.—The prognosis in any case, both as regards the duration of the disease and the result of treatment, must be made with the greatest caution. It may be that a patch of considerable extent will disappear in a short time with the mildest applications, and a smaller spot resist every effort for years. The disease is one peculiarly liable to relapse, and the method of preventing recurrence and the formation of scars is yet to be discovered. The patient should be so informed.

Treatment.—General treatment offers little or no chance of success, except, on the usual lines, as an adjuvant to the local measures employed. Attention should be paid to the health, and predisposing causes, such as anemia, dysmenorrhea, should of course be removed as far as possible. Many drugs have been proposed as possessing a curative or beneficial action upon the disease, but they have met with no success in other hands than those of their advocates, and arsenic, iodide of starch (McCall-Anderson), iodide of potassium, and phosphorus (Bulkley) need only be mentioned to be condemned.

Our main prop in treatment, then, lies in the local measures at our command. The application will depend somewhat upon the stage in which the disease is seen, and in any case it is well to proceed systematically from milder measures to the more drastic. In an acute outbreak, attended with hyperemia, tingling, and burning, alkaline, soothing, and astringent washes, such as the lotions of calamine and zinc, acetate of aluminum (2 per cent.), or of lead are useful. The chronic being the form usually met with, these lotions are of limited applicability. *Lotio alba* (zinci sulphatis, kalii sulphureti, $\bar{a}\bar{a}$. ʒj, alcoholis ʒij, aq. rosæ ad ʒjv), with or without the addition of sulphur, is of service, and we have seen at least one case cured by it alone. Green soap, pure or in the form of its tincture, recommended by Hebra and Kaposi, is used with great success in chronic cases. It should be rubbed into the patch with a linen or flannel rag, and the rubbing renewed every few days until reaction and exudation take place, when soothing ointments or lotions should be employed. The process may require repetition, after which a cure may be completed with simple soap-washings. Tar (*e. g.* oil of cade), tincture of iodine, resorcin, or sulphur pastes, pyrogallie acid, and chrysarobin 10 per cent. in ointment, give rise to the same reactive inflammation. Plasters, resorcin, ichthyol, hydronaphthol, and mercury, the last particularly, are efficacious in certain cases.

When milder measures fail recourse must be taken to caustics. Pure carbohic acid painted on the lesion has effected a cure after one application. Cauterization with strong mineral acids, concentrated solution of caustic potash, chromic acid, etc., cannot be advised. It is difficult to limit their action. In obstinate cases linear cross-scarifications with a single blade or Veiel's scarification-knife are indicated, especially when the infiltration is deep. Only a small surface should be operated on at one sitting; the bleeding should be stopped by pressure, and caustic applications are sometimes used afterward. Electrolysis in multiple punctures occasionally produces a favorable result. Curetting and the cautery, Paquelin or galvano-, should never be resorted to until all other means have failed, as they produce disfiguring scars.

It should be kept in mind that any one or all of these measures may fail or all may be successful; that one application, useful at first, may lose its efficacy; and that this may be regained after a lapse of some time. We are powerless in the face of a recurrence as regards its prevention, but a case once cured may fortunately remain so.

MYCOSIS FUNGOIDES. (J. A. FORDYCE, M. D.)

Synonyms.—Granuloma fungoides; Inflammatory fungoid neoplasm; Lymphadénie cutanée; Multiple sarcoma of the skin; etc.

Definition.—A chronic affection of doubtful nature, generally characterized by a stage of erythema with intense itching, which becomes scaly or moist, and is followed by circumscribed or diffuse infiltrations in the skin, and later by fungoid ulcerating tumors, some of which may disappear without leaving a scar.

Symptoms.—Following Bazin's description, three stages are generally recognized, although one or more may be absent in an otherwise typical case:

First Stage.—This period of the disease is spoken of by various writers as the erythematous, eczematous, or premycotic stage. It manifests itself by round, somewhat sharply defined, or irregularly-shaped patches of erythema, which may remain circumscribed or coalesce with other patches until the redness is almost universal. These patches may come and go for several months or years before the formation of tumors begins. The spots may clear in the center, forming annular or gyrate outlines. The epidermis covering the patches is slightly scaly at times, again it is smooth. Erysipelatous or scarlatiniform types of eruption have also been met with, followed by desquamation of large flakes of epidermis.

Itching is an almost constant symptom of this stage, causing the patient to scratch the lesions until they become eroded and thickened or the seat of eczema-like papules or vesicles, from which a scanty moisture may exude and dry in the form of crusts. The color of the lesions, at first pink or bright red, becomes later brownish red. Circumscribed or diffuse pigmentation sometimes follows the disappearance of certain areas of hyperemia or results from scratching.

Second Stage.—This stage is referred to by Bazin as the *période lichén-oïde*, and by Köbner as the *stadium infiltrationis*. After an indefinite duration the patches previously described become infiltrated, and at the same time small, hard, sharply-defined nodules, from the size of a pea and larger, appear over the plaques and in the otherwise normal skin, generally attended by marked pruritus. These nodules and infiltrations have an irregular distribution, and vary in color from a light brownish red to a bluish red, or differ little in color from the surrounding integument. They may become confluent, forming extensive masses of infiltration, which sometimes assume annular outlines from central atrophy and peripheral extension of the lesions. The individual nodules and patches of infiltrations may disappear and reappear for months or years, as the erythema of the first stage, leaving behind normal skin or pigmented areas.

Third Stage.—The development of tumors, or the *fungoid stage*, follows more or less closely upon the second stage, or the tumors arise without any of the conditions previously described, constituting that type of the affection known as *mycosis d'emblée*.

The three stages may occur coincidentally, or in other respects the evolution of the affection may depart from the normal.

The tumors which constitute the salient feature of this stage vary in size from a pea to an orange or larger. They are lobulated, usually bright red or bluish red in color, and are sessile or slightly constricted at the base. They have a firm, elastic, or soft consistence, and may grow smaller under pressure. They spring from the normal skin, from the erythematous spots, or from the thickened plaques. Similar lesions have been met with on the mucous membranes of the uvula, soft palate, and urethra (Blanc).

Diffuse patches of infiltration several inches in diameter may occur here and there over the body, which extend peripherally and may clear in the center or spread in a serpiginous manner. Either spontaneously or as a result of scratching the tops of the tumors become abraded, giving rise to an offensive watery or bloody discharge. Many of the larger growths soften centrally or slowly ulcerate, producing superficial or deep excavations from which papillary or nodular growths may spring. The ulceration is at the expense of the new growth rather than of the normal constituents of the skin, as the tumors seldom leave any trace of a scar after disappearing.

The most curious feature of the affection is the rapid appearance and disappearance of the tumors, leaving only pigmented spots behind. Tumors of the largest size may come and go within a few days without ulceration. The round, ulcerated, and fungoid tumors and masses of infiltration have been compared by Alibert to the cut surface of a tomato, which in certain instances they resemble; in other cases a comparison has been made between them and a mass of hemorrhoidal tumors.

While enlargement and suppuration of the lymphatic glands are sometimes met with, they are by no means of constant occurrence. Kaposi wrongly states that such glandular enlargement is always absent.

The general health—which does not, as a rule, suffer materially during the early stages of the disease—becomes markedly impaired during the ulcerative period. The appetite fails, sleep is disturbed; the discharging tumors cause a drain on the system which results in a state of marasmus that ultimately leads to the death of the patient. Fever may be present as a result of local infective processes, and may accompany an acute outbreak of the tumors. Death may be preceded by a prolonged diarrhœa or may take place from sepsis, pulmonary, or other complications.

Etiology.—The duration of the affection varies from six months to fifty years, the average being from three to six years. The disease is of rare and sporadic occurrence. The majority of the cases have appeared in men from thirty to sixty years of age. Women are, however, by no means exempt. No instance of contagion has ever been observed. Animal inoculations have been negative.

Pathology and Anatomy.—The majority of writers agree in describing the histological structure of the diseased tissue as made up of small cells, having the appearance and size of lymphoid cells, enclosed in a delicate reticulum of connective tissue. The scanty supply of blood-vessels is supposed to be the reason the tumors so readily undergo degenerative processes. The anatomical changes are limited in the early stages to the papillary and subpapillary region of the derma.

The writer has recently examined two cases of the affection. In tissues removed during the erythematous stage, with slight infiltration, there was found considerable thickening of the epidermis, with prolongations of the rete-pegs for some distance into the cutis. The infiltration, which was pronounced, was made up of round-cells, together with numerous "plasma"-cells (Unna) arranged in thin columns. In the deeper tissues of the derma numer-

ous foci of round- and "plasma"-cells were grouped around the blood-vessels. In a well-developed tumor the infiltration was composed in great measure of single and multinucleated leukocytes. Micrococci have been found by numerous observers, which have not been demonstrated to have an etiological relationship to the affection. Stelwagon and Hatch, among the later investigators, found micrococci in the capillaries and among the cells, which presented different appearances on culture media from the ordinary pyogenic cocci, and which they believe may be pathogenic.

In a few instances nodules, apparently metastatic, have been found in the lungs, liver, spleen, kidneys, and peritoneum. Paltauf observed changes in the tonsils, lymphatic glands, the liver, and spleen similar to those met with in leukemia and pseudoleukemia. He believes the disease to be allied to pseudoleukemia. A condition similar to, if not identical with, mycosis fungoides has been met with in pseudoleukemia, and this association, together with the histological appearances of the growth, has led many of the French writers to consider it a local symptom of the general disorder.

It has been strongly held by certain German observers and others that mycosis fungoides is a form of sarcomatosis. Funk upholds this view, and quotes an instance in which tumors having all the appearances of mycosis fungoides developed from a nevus.

Those who believe in the infectious nature of the disease cite in support of their view the presence of the micro-organisms in the tissues, the similarity of the growths to other infectious skin-diseases, and the nature of the tissue, which histologically is like that of the infectious granulomata. It is not improbable that in time the affection will be included in this group.

Diagnosis.—Before the stage of infiltration or tumor-formation the diagnosis is sometimes difficult or impossible. The localized, sharply-defined patches of erythema, with exudation or scaling, may be mistaken for certain varieties of eczema or psoriasis; there is less discharge, as a rule, than in eczema, and the desquamation is not so marked a feature as in psoriasis. When the erythema is universal it may be confounded with some one of the forms of generalized exfoliating dermatitis. The shedding of the epidermis is more pronounced in the latter group of diseases, while in mycosis fungoides the stage of infiltration soon becomes evident. In this stage of erythema, with infiltration, mycosis may readily be mistaken for leprosy, as in both affections the patches of erythema may come and go and finally become the seat of a nodular eruption. The history of the patient, the presence or absence of anesthesia, and a microscopic examination would render a differential diagnosis easy.

In the fungoid stage the features are so pronounced that it could scarcely be mistaken for any other condition, especially if the preliminary stages had been present. In multiple pigmented sarcoma, ulceration, if it occurs at all, is a late manifestation, and there is no history of an antecedent eruption.

Prognosis.—With the exception mentioned the disease has proved invariably fatal. *Mycosis fungoides d'emblée* is more malignant than the usual type of the affection. The entire duration of the disease varies from three months to fifteen years.

Treatment.—With the exception of arsenic, no drug has been found to exert the slightest influence in checking the morbid process. Köbner observed one cure follow the administration of this remedy. It has been used in many cases since without result. An instance of spontaneous recovery after erysipelas has been reported by Bazin. The erysipelas toxines might be employed with some hope of success.

In the stage of ulceration with offensive discharge antiseptics should of course be used, as local septic processes frequently arise and death may take place from septicæmia. Iodoform, aristol, ichthyol, and remedies of this class fulfil the indications for local treatment.

SARCOMA CUTIS. (J. A. FORDYCE, M. D.)

Definition.—Sarcoma is a malignant new growth composed of some one or several of the types of embryonic connective tissue.

The cells of which sarcomata are composed have the power of indefinite growth, whereas those resulting from inflammation have but a temporary life. Sarcoma may appear as a primary growth of the skin or subcutaneous connective tissue, or result from metastasis of a visceral or glandular sarcoma. Several types of these malignant growths are described which differ in their symptomatology, prognosis, and, to some extent, in their treatment.

Melanotic Sarcoma.—Unna¹ believes that all the malignant new growths starting from pigmented moles are probably carcinomatous. In the light of his investigations it is impossible to say at present whether any tumors having such an origin are sarcomata.

The term *melanoma* has been proposed for such tumors, as not indicating their histological structure.

Symptoms.—These growths may start from warty or vascular nevi, other pigmentary deposits in the skin, or from the apparently normal skin. Cases have been reported where the primary condition consisted of a bluish pigmentation of the skin of the face, followed by metastatic deposits. The primary tumor has been observed on the labium majus, the hands, feet, and trunk. It has been noted by Hutchinson and others as a discoloration at the margin of the nails of the hands or feet, from which a fungating, slightly pigmented tumor subsequently arose. The name "melanotic whitlow" was given by Hutchinson to the affection in this locality.

The uveal tract is the origin of about one-half of the pigmented sarcomata of the skin. When primary the initial tumor is small, of a bluish-black, gray, or brown-black color; it may have little color at first and become afterward deeply pigmented. A mole which undergoes malignant change may ulcerate or become the seat of a fungous outgrowth, exciting little suspicion until metastasis has taken place. The primary tumor may attain the size of a cherry, hickory-nut, or, exceptionally, a larger size before secondary growths develop. It may remain stationary, ulcerate, discharging a brownish-colored fluid, or in rare instances disappear. Excision of the primary growth is usually quickly followed by a dissemination of the disease and hastens the fatal issue. Metastasis occurs along the lymphatics or through the veins, the secondary tumors appearing as bluish-black nodules of the size of a pea or larger. Lobulated adherent masses of a dark-blue color may form in the communicating lymphatic glands.

In the last stage of the disease a general melanosis is at times met with which manifests itself by a discoloration of the skin and by dark-colored urine.

Etiology.—Traumatism or the irritation of congenital warts or moles may act as exciting causes. Such tumors develop, as a rule, from tissues which normally produce pigment.

Pathology and Anatomy.—Many tumors of this class, which were formerly considered to be sarcomata, were undoubtedly examples of pig-

¹ *Die Histopathologie der Hautkrankheiten*, Berlin, 1894.

mented carcinoma. In the present state of our knowledge it is impossible to say from the clinical appearances of a pigmented growth whether it belongs to the cancer or sarcoma group. The cells composing the tumor may be small or large round-cells or spindle-cells; they may arrange themselves in alveola. The pigment occurs in the cells and in the surrounding tissue as dark-brown or black amorphous granules. The secondary tumors may contain a greater amount of pigment than the primary one. The origin of the pigment is not definitely determined, but probably takes place in the cell itself. No satisfactory explanation has been given as to why these tumors should possess a greater degree of malignancy than the non-pigmented growths.

Diagnosis.—Any noticeable increase in the size of a congenital wart or vascular nevus should excite the suspicion of a malignant growth. A diffuse bluish discoloration of the skin has been mentioned as the initial stage of the affection.

Prognosis.—These tumors are more rapidly fatal than any other variety of malignant growth. Death usually takes place within a few months after metastasis occurs. Dissemination of the diseased cells takes place by the lymphatics or veins.

Treatment.—All operative procedures have been followed by rapid dissemination of the growth. Lassar has lately observed the disappearance of a nodule which developed on a pigmented nevus after the use of arsenic.

IDIOPATHIC MULTIPLE PIGMENTED SARCOMA (KAPOSI).

This variety was described by Kaposi in 1879 as a separate clinical type.

Symptoms.—It usually develops simultaneously on the extremities, and is a symmetrical disease from the beginning. The first tumors are pea-sized or smaller or diffuse infiltrations seated in the derma. The affection extends to the legs, arms, thighs, and forearms; at the end of two or three years it may involve the trunk and face. Large patches of infiltration may result from the confluence of smaller lesions. The hands and feet are sometimes swollen, and their movements impaired by the presence of the tumors and the accompanying edema. A condition of the legs and feet not unlike elephantiasis may be met with. The tumors on the lower extremities are dark brown or almost black, while those on the trunk and upper extremities have a bluish or purple color. They are firm and elastic to the touch, and sometimes slightly painful. Some of the tumors look not unlike angiomas, and can be made to grow smaller and paler by pressure. Other nodules and masses of infiltration show a central depression; some disappear spontaneously, leaving pigmented scars. Ulceration may take place late in the disease, although rarely met with. Similar tumors may develop after two to five years on the mucous membranes, and here show a greater tendency to break down. At this time the general health of the patient becomes markedly impaired by the bloody diarrhea, hemoptysis, fever, and marasmus, which lead to a quickly fatal result. Metastatic tumors similar to those on the skin have been found in the lungs, liver, spleen, and the intestinal tract. Enlargement of the lymphatic glands is not a constant feature of the affection.

Etiology.—The simultaneous occurrence of the tumors on the extremities, independent of a primary growth, would suggest some infection through the blood-stream. Most of the cases reported have occurred in men of the lower classes between forty and sixty years of age.

Pathology and Anatomy.—The tumors are made up of small round-

cells or spindle-cells. The blood-vessels are greatly increased in number and size; vascular channels with thin walls exist among the newly-formed cells; others communicate directly with the cells of the tumor. The bluish-red color of the early tumors is due to their richness in blood-vessels, while the darker color of the older ones depends upon the pigment left by the hemorrhages within the growth, and not to a true pigment formed by the cells, as in the variety first described. The endothelium of many of the vessels shows active proliferation, and it is quite probable that these tumors have a vascular origin (see Fig. 255).

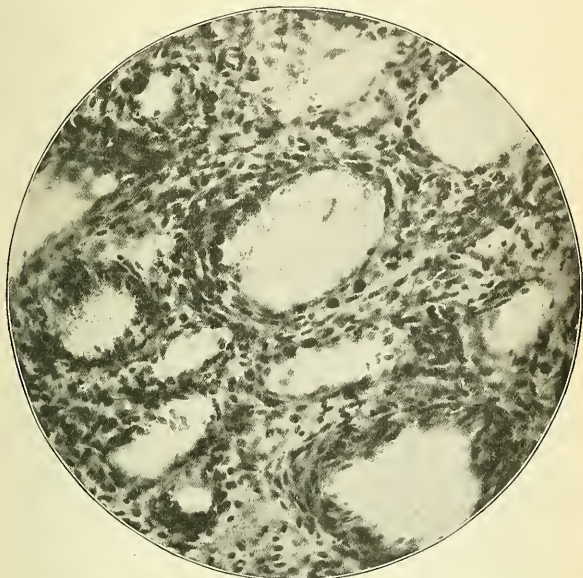


FIG. 255.—Newly-formed blood-vessels in multiple pigmented sarcoma of the skin. The proliferating endothelium is also shown (\times circa 400).

Diagnosis.—When confined to the hands and feet it would be possible to mistake the tumors for a *papular* or *papulo-squamous syphilide*. *Gummata* are not so symmetrical, nor usually so widely distributed; they are lighter in color and show a greater tendency to ulcerate. *Mycosis fungoides* differs in having a primary stage like eczema, with intense pruritus; the tumors rapidly ulcerate and have a bright-red color, which is quite unlike the darker color of this type of sarcoma. *Leprosy* has been confounded with multiple sarcoma. The patches of anesthesia, bullous eruption, and characteristic facies of the former are sufficient to establish the diagnosis.

Prognosis.—The majority of the cases have proved fatal in from two to eight years. Hardaway noted the spontaneous disappearance of the disease after sixteen years. Brayton observed a case which had existed for twenty-five years, during which time a number of the growths had disappeared,

while others developed. In both of the instances of long duration the diagnosis of sarcoma was confirmed by microscopic examination.

Treatment.—The internal and subcutaneous use of arsenic has been without decided results. Köbner obtained temporary improvement in one case from its hypodermic employment. The painful infiltration of the hands and feet demands proper local treatment in the way of bandaging and emollient applications.

GENERALIZED SARCOMATA IN LEUKEMIA AND PSEUDOLEUKEMIA.

In connection with true and false leukemia, which are probably closely related conditions, a number of instances are on record where multiple cutaneous and subcutaneous tumors have developed with or without other changes in the skin. In Kaposi's case of *lymphoderma pernicioso*, described in 1885, localized and diffuse patches of scaling, moist and pruritic lesions, followed by thickening of the implicated portions of the skin, were noted. Cutaneous and subcutaneous tumors afterward developed, which were succeeded by



FIG. 256.—Pseudoleukemia of the skin, showing sharply-defined masses of small round cells (\times circa 60).

enlargement of the spleen, lymph-nodes, by an absolute increase in the number of white blood-corpuscles, and death. Other cases are reported where the number of tumors amounted to several hundred and varied in size from a pin's head to that of a cherry. In true leukemia generalized redness of the skin, in connection with intense pruritus and followed by tumor-formation similar to that met with in mycosis fungoides, has been observed.

Pseudoleukæmia Cutis.—Arning, Joseph, Touton, and others have lately reported the development of cutaneous and subcutaneous tumors, attended by intense itching, in connection with Hodgkin's disease. Wagner, Funk, and others have made similar observations. The tumors are from pea- to walnut-sized; they may form adhesions to the skin and break down with central ulceration or sloughing. They have a waxy transparency or a dark-red or bluish color.

Pathology and Anatomy.—The changes met with in the lymphatic tissue of the skin are of the same nature as those which take place in the glands and viscera. The skin-tumors are made up of small round cells which in their early stages are sharply defined from the surrounding tissue (Fig. 256). The lymph-cell infiltration has been observed to make its first appearance about the coil-glands.

Diagnosis.—Persistent itching, sharply defined cutaneous tumors in connection with leukemia or Hodgkin's disease, should at once arouse suspicion of the affection in question.

Treatment.—All treatment has proved unavailing in true leukemia of the skin. In pseudoleukemia Touton obtained a cure by arsenic, and Arning a marked improvement.

GENERALIZED NON-PIGMENTED SARCOMA.

Multiple tumors may be encountered in patients who present no evidences of leukemia or pseudoleukemia which closely resemble those which develop in connection with such affections. Metastatic sarcomata may also appear in or under the skin, following sarcoma of the lymph-nodes, the testicle, parotid, or of other organs. As the original growth easily escapes observation, the secondary tumors have been looked upon as primary in the skin. They vary in number from a few scattered ones to several hundred. The overlying integument may be normal or dark blue in color. These tumors may or may not be painful. They sometimes adhere to the skin and ulcerate, or a number may form a confluent mass with a central depression somewhat resembling the tomato-like tumors in mycosis fungoides.

Pathology and Anatomy.—The multiple primary tumors are made up of round-cells or mixed round- and spindle-cells. The metastatic skin-sarcomata correspond in structure to the primary growth. It is probable that there is some connection between mycosis fungoides, the lymphatic tumors of the skin, and the variety in question, as transition forms are sometimes met with.

Diagnosis.—In mycosis fungoides the tumors start in the superficial layers of the derma, while in the other varieties the deeper layers of the skin are first implicated; the growths can sometimes be felt before they can be seen. In mycosis fungoides a patch of eczema or scaling erythema, as a rule, precedes the tumor development.

Treatment.—Arsenic internally or subcutaneously should be employed in the treatment of these cases, as a number of instances are on record in which it has resulted in a complete cure.

PRIMARY SINGLE SARCOMA.

The skin or subcutaneous tissue may be the seat of a localized growth which slowly enlarges for months or years before giving rise to metastatic tumors or undergoing ulceration.

Symptoms.—The primary tumor may assume a great variety of forms,

and range from the size of a pea to that of an orange. It may be encapsulated, pedunculated, mushroom-shaped, appear as a diffuse infiltration or as a small nodule covered by capillaries. As a rule, sarcomata are softer than cancers, and at times may be pulsatile from the unusual development of blood-vessels. The tumors may have a pale-red or bluish color or differ little in tint from the surrounding skin. The curious affection described by Hutchinson, Crocker, White, and others by the names "infective angioma," angioma serpiginosum, etc. has been shown by the microscopic investigations of Bowen, Councilman, and Darier to be in reality an angiosarcoma in which congenital vascular nevi in certain cases were the starting-points of the spreading affection.

Etiology.—These localized tumors may follow a traumatism, a vascular or other nevus, occur at the site of an old skin-lesion, sebaceous cyst, or arise in the previously normal skin. In 7 cases collected by Perrin 6 were in women. Sarcoma may occur at an early age, and the influence of heredity has been shown in a number of instances related by Funk. Numerous attempts have been made to associate bacteria or protozoa with the etiology of sarcoma, but thus far without any definite proof. It is quite probable that certain tumors having such an origin are included at present in the sarcoma group.

Treatment.—These localized sarcomata are more readily cured than any other form by early and radical extirpation. Arsenic is the only drug from which any benefit can be expected. Malignant growths, as well as some varieties of infective granulomata of the skin, have disappeared after a spontaneous attack of erysipelas. Fehleisen some years ago inoculated several cases of sarcoma and cancer with cultures of the erysipelas coccus, with successful results. The method was abandoned, however, because of several fatal results. Coley and others have lately revived the method in a modified form, using the combined toxins of the erysipelas coccus and of the bacillus prodigiosus. A few cases of sarcoma have been cured by these inoculations, a number have been benefited, but in cancer the method seems to have been a failure. The ulceration resulting from the breaking down of sarcomatous tumors is best treated by applications of iodoform, aristol, or drugs of similar character.

LEPROSY. (ISADORE DYER, M. D.)

Synonyms.—Lepra; Elephantiasis Græcorum; Elephantiasis Hebræorum; Satyriasis; Leontiasis; Spekalsked (Norweg.), Radesyge (*ibid.*); La Lèpre (Fr.); Zaraath (Heb.); Ophiasis; Leprose (Ger.), Aussatz (*ibid.*).

Definition.—Leprosy is an endemic constitutional contagious disease of malignant type, characterized by alterations of the cutaneous, nerve, and bone structures, resulting in anesthesia, ulceration, necrosis, atrophies, and deformity. Leprosy is a well-defined affection due to the development in the economy of a special bacillus.

Symptoms.—Leprosy is a chronic disease, lasting years and seldom spontaneously recovering. The *bacillus lepræ* in its development gives rise to neoplasms or, as Leloir¹ calls them, *lépromes*. When these neoplasms are developed in the skin or mucous membranes they give rise to the tubercular type, or cutaneous leprosy. When the neoplasm involves the nerves especially, the result is the type known as nerve-leprosy or trophoneurotic leprosy, or the anesthetic variety.

¹ *Traité de la Lèpre*, 1886.

PLATE 21.



Macular stage of leprosy (Chatelain).

These are essentially the two clinical divisions of the disease, although a third variety is sometimes described, the macular. This, however, is only a stage in the development of either the tubercular or the trophoneurotic type. While it is most often the precursor of the latter type, this is by no means invariable. It is not uncommon for the two varieties to appear concurrently, giving rise to the mixed or "complete" type of the disease. So intimately, in fact, are the processes of leprosy blended that it is only for clinical purposes that any division at all is made, the pathology being identical in all stages and in all types. This is evident in the frequent disappearance of either one or the other type, followed by its congener, which in turn may become involuted and be substituted by the first or former type.

Preceding the characteristic clinical determination of leprosy into its well-marked types there is a *period of incubation*. This is variously estimated at from two to twenty years. It is apparent that the exact period of time between a possible infection and the appearance of the disease cannot be fixed. Insidious at best, the disease may be unwittingly contracted, and the victim have changed his domicile many times before the appearance of the symptoms. *The period of invasion* is marked by recurrent fevers, irregular in period and in type. Attacks of malaise, associated with anorexia and dyspepsia, may occur. Epistaxis, dryness of the respiratory tract, headaches, exaggeration of the functions of the fat- and sweat-glands are among the notable symptoms.

There may be pruritus and hyperesthesia of the skin, with neuralgic pains in all locations. Rheumatic pains, articular especially, with swelling of the lower extremities, are not uncommon. In most cases there is a premonitory eruption of vesicles or bullæ, affecting the extremities chiefly, finding especial localization at the knees and elbows, the articulations of the fingers and toes, always appearing on the extensor surfaces. These bullæ appear rapidly, are usually painless, break spontaneously, and often heal as ulcers, leaving behind a pigmented spot, pinkish, brown, or almost black. A white scar may remain, with a pigmented periphery, in size varying with the size of the bullæ, which may be as large as an inch in diameter. Successive crops of these bullæ form in the same location, making the scar and pigmentation more and more pronounced.

As introductory, now the macular eruption appears. Spots gradually make their appearance, now on various parts of the body. The favorite locations are the extensors of the arms and forearms and of the thighs and legs. The buttocks, the knees, the elbows, the cheeks, the chin, and the temporal regions of the forehead are often selected.

The lesions come almost imperceptibly as rosy-red macules with irregularly rounded outlines. They deepen in color, becoming purple even, or brown or a dusky red. The borders appear white at first, and are occasionally thickened. The border changes after a time, growing deeper in color toward the periphery. These lesions may fade, even rapidly at times. The skin becomes normal in the center, leaving only the pigmented border to mark the site of a former macule. This ring of color may fade as well, with nothing to mark the spot. Some of these macules are fading while new ones develop (see Plate 21).

After a lapse of time, months or years, the symptoms of confirmed leprosy are manifested. These may be characteristic at the start. While the bullous eruptions persist, recurring all the more rapidly as the disease progresses, there may appear small tubercles, which grow in size, become confluent, and so develop. Oftenest, however, the first eruption consists of erythematous

patches averaging the size of the palm. These are hyperemic, pale-red or wine-colored, violaceous, or even yellowish. As with the macular stage, these may disappear, only to reappear in the same or other places. Gradually, however, the patches become infiltrated and elevated.

Nodosities may form on these, or, as is usual, the patches grow thicker at certain points than others. These soon are elevated above the rest of the patch, become bunched, and form nodosities irregular in size, dependent upon the amount of tissue involved in the process, usually the size of a pigeon's egg. Nodosities are seen to appear, scattered over the skin, independent of any antecedent patch, attended with a rise of temperature which may leave abruptly. The *lepra tubercule* may be evident from the beginning. This lesion is a rounded, hemispherical nodosity, varying in size from a pin's head



FIG. 257.—Tubercular leprosy in a negro.

to a hazelnut, hard and elastic to the touch, pale red or brown in color. It may be copper-colored, smooth, and telangiectatic. These tumors are discrete nodosities which may become confluent, forming irregular rounded oblong masses.

The most frequent locations of this type of leprosy are the face, the forearms, the elbows, knees, and legs. On the face the forehead, nose, lips, chin, and cheeks suffer most. The nose is flattened, enlarged, thickened, and infiltrated. The cheeks are bunched and thickened, lobulated, the skin folding on itself, forming deep sulci, giving rise to the "leonine" expression. The ears, the lobules especially, are thickened, leathery, and pedunculated. They are often prodigiously hypertrophied to three or four times their normal size, tumors developing in the hypertrophic mass as large as hazelnuts (see Fig. 257).

The hands and feet may be covered on their dorsi with grouped tubercles, dirty yellow in color, lobulated or nodular in appearance, arranged along the fingers and extending above the wrists. Exactly similar lesions develop around the knees and elbows, none larger than a hazelnut, symmetrical in their distribution and in their arrangement.

Once developed, the tubercles do not remain stationary. They may continue to grow, becoming confluent, and form enormous bunches. They may exfoliate or become complicated with edema. Spontaneous retrogression sometimes occurs. The lesions soften, then grow pale, sink into the skin, shrivel up, and finally disappear, leaving behind a spot with a yellow-white center and a pigmented, brownish-yellow periphery. The lesions more often become inflamed, suppurate, open on the surface, and slough in part or entire.



FIG. 258.—Case of anesthetic leprosy with mutilation.

They may simply ulcerate, without marked destruction of tissue, leaving small superficial ulcers covered with greenish or brown crusts, destroying by degrees the adjacent tissues, tendons, ligaments, and finally the bones. Developing on the mucous membranes, the tubercles ulcerate in much the same manner, disturbing the function or producing destruction of the parts involved. Almost from the beginning the senses are disturbed.

The trophoneurotic form of leprosy, the anesthetic, or, as Leloir calls it, the systematic nervous leprosy (Fig. 258) presents the same period of invasion as the tubercular or cutaneous form. The bullous eruption, however, occurs in single lesions in the trophic form, while it expresses itself in multiple lesions in the tubercular. Here the single lesion incessantly re-forms, leaving behind a scar, pigmentation, or a persistent ulcer.

Coming on the ends of the fingers and toes, obstinate ulcers are left, causing marked loss of tissue, involving the bones even (*vide* Morvan's Disease).

The lesions of most importance, and usually considered as characteristic of this stage of anesthetic leprosy, are patches smooth and shining, with well-defined periphery, free from color and atrophied in the center. The edges are colored red or brown or brownish-yellow, and may or may not be prominent or elevated. These patches are often serpiginous, suggesting a previous confluence. There are often in these patches disturbances of sensation. The discolored parts are always anesthetic, and the most pigmented are the most anesthetic. In exceptional cases the reverse is the case—namely, the patches are markedly hyperesthetic. The sensitive regions are sharply defined, the anesthetic area limited to the edge of the patch, with the adjacent normal skin strikingly hyperesthetic. The anesthesia may occur at points free from lesions or apparently free. In such event it is suggested that the seat of the anesthesia is on the forgotten site of an injury, bruise or burn.

Gradually the nervous system is invaded. Leloir¹ speaks of two divisions of the leprosy nerve effect. First, the period of invasion. This corresponds with the period of the cutaneous manifestations, when hyperesthesia is common, when paroxysms of neuralgic pains, rheumatic or arthritic pains, occur, and it is possible to observe marked thickening of certain nerves, notably the ulnar.

Secondly, a period of nerve-degeneration, marked clinically by anesthesia, paralysis, atrophies, and distinct trophic disturbances. With the anesthesia there appears a muscle-atrophy, which attacks, first of all, the muscles of the hand (causing contraction), the extensors and flexors of the forearm, causing the characteristic "*griffe*," or claw-hand. There is loss of power, sense of touch, of heat and cold, and even pain.

The muscles of the feet and legs are likewise and similarly affected. At times the muscles of the face and trunk are affected. Then come the atrophy of the skin, the shortening of the muscles, and a general senile aspect. There is a variety of trophic disturbances at this stage—shedding of the nails, loss of pigment of, or falling of the hair, loss of teeth, ulceration of the nasal passages, ulceration of the gums. There appear in due procession dimness of vision, blindness even, due to the presence of the leprosy in the optic nerve itself. There may be perforating ulcers of the feet and hands. These are painless, anesthetic, beginning over the joints, gradually deepening, and ending by extending to the articulations, causing the phalanges of the fingers and toes to fall. Where this occurs in other than the terminal phalanges contraction is the result. Dry gangrene, necrosis, with abscesses, occur; absorption of the bone and a final deformity of the patient result.

The trophic ulcer has a favorite location on the heel or on the fleshy part of the great toe, and is characteristic in its clinical appearance. It is rounded, deep-seated, foul-smelling, with a thickened, almost indurated edge, elevated above the normal skin, and fully one-fourth inch outside of the ulcerated part.

With these occurrences trophic leprosy reaches its last stage. Marasmus is established, with general listlessness, and the patient dies from pure exhaustion or death is hastened by an almost necessary septicemia. Often a complication with pneumonia, pleurisy, albuminuria, or a persistent diarrhea carries the patient off.

The "mixed" or "complete" is really the typical form of leprosy (see Fig. 259). In this the tubercular and trophic are combined. In

¹ *Op. cit.*

other words, the cutaneous and the nerve-leprosy are fully developed. It may begin as the "mixed," or, starting as the tubercular, it may assume the anesthetic form, or *vice versa*. The symptoms of both types are present; the course, the history, and the end are the same. All forms may vary, so as to deceive, and only a small part of the symptoms be present. In this, however, leprosy does not differ from other diseases, and the exceptions do not digress too far to disprove the recognized elements of the disease.

Etiology.—The cause of leprosy is the *bacillus lepræ*, the bacillus of Hansen or the bacillus of Neisser.

The contagiousness of leprosy is not yet conclusively proven, though the almost unanimous opinion of the Berlin Lepra Conference, held in October, 1897, goes far to establish this as the method of spread.

Climate is no factor in the development of leprosy, pro or con. Norway and Sweden, Iceland and Russia, develop the disease, as well as Mexico and West Africa; and even in the salubrious Sandwich Islands the disease has grown disproportionately. Individual susceptibility, as with other constitutional contagious diseases, must play an important part, and in this the question of race may enter as a factor.

Diet, poverty, exposure, malarial predisposition or impression, and antecedent conditions, as syphilis or tuberculosis, etc., must be looked upon as contributing, but not as determining, causes. Fish-eating is argued as a factor in the causation of leprosy, but this cannot account for the disease among people with whom this diet is almost impossible. The fact remains that, if introduced into a community, in due time the disease will spread.

In the sixteenth century leprosy almost disappeared from Europe. Since that time the geographical spread can almost positively be traced to the introduction of the disease from countries affected with it.¹

Pathology.—The lepra bacillus is found in all leprosy lesions, whether located in the skin or mucous membranes, nerves, or internal organs. It is readily recognized only after staining or in section (Fig. 260).

The bacilli are found in the lepra-cells. These are the result of the inflammation set up by the development of the bacilli, giving rise to alterative



FIG. 259.—Mixed leprosy.

¹ Neisser: in *Ziemssen*, 1885.

changes in the exudation-cells, constituting, with certain changes in the blood- and lymph-vessels, the "giant"-cells of the leprous lesions, which determine the pathology.

The staining is done customarily with fuchsin or methyl-blue. The bacillus is a straight or slightly curved rod one-half to three-fourths the length of a red blood-corpusele (Neisser), in breadth about one-fourth, or less than the length (Fig. 261).

Anatomy.—The chief anatomical changes are in the corium. In the tubercle the mass of the growth is made up of granulation-tissue, consisting of small exudation-cells in masses or scattered, varying in size up to the "giant"-cell. The process of change from the exudation-cell to the giant-cell is owing to the influence of the bacilli present (Neisser). Begin-

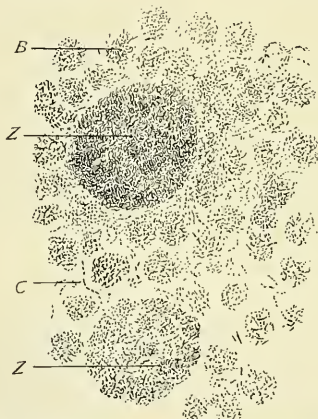


FIG. 260.—Bacilli shown in a section of a tongue in a case of tubercular leprosy; $\times 600$. The bacilli are extra-cellular: B, bacilli in groups; Z, Z, zoögleic masses, large rounded masses of bacilli; C, bacilli in chains (Leloir).

ning in the corium, the granulation-tissue gives rise to marked infiltration. This extends, especially marked around the glands, vessels, and follicles. The cells of the sebaceous glands are very much enlarged, and finally degenerate or are destroyed. The hair-follicles are but little altered. The sweat-glands undergo change from the start, at first hyperplastic, then degenerative, and then atrophic.

The infiltration presses upon the rete and causes proliferation of all the epithelial elements.

In the trophoneurotic type the exudation-cells penetrate the nerve-sheath and stimulate the nerve-function at first. The increasing exudative process finally destroys the function by producing a neuritis, resulting in ultimate degeneration.

Diagnosis.—From syphilis, leprosy is diagnosed by the color of the lesions, their course of development, the anesthesia, the deformity, and, finally, the microscopic finding of the Hansen bacillus.

It is diagnosed from morphea and circumscribed scleroderma by the location, general distribution of the lesions, and the ulceration. Further,

the lesions of leprosy are usually anesthetic, while those of these affections are exceptionally so.

Prognosis.—The prognosis of leprosy is always bad. The disease may be arrested or temporarily relieved, but cures are rare. The disappearance of all evidences of the disease may be followed years later by a new manifestation and with manifold energy.

The tubercular is more rapidly fatal than the other form. According to Hillis,¹ 38 per cent. die of leprosy and its direct consequences. The rest of the fatal cases die of nephritis, pneumonia, diarrhea, anemia, fevers, peritonitis, in the order named.

Treatment.—Leprosy may get well spontaneously. The disease, how-

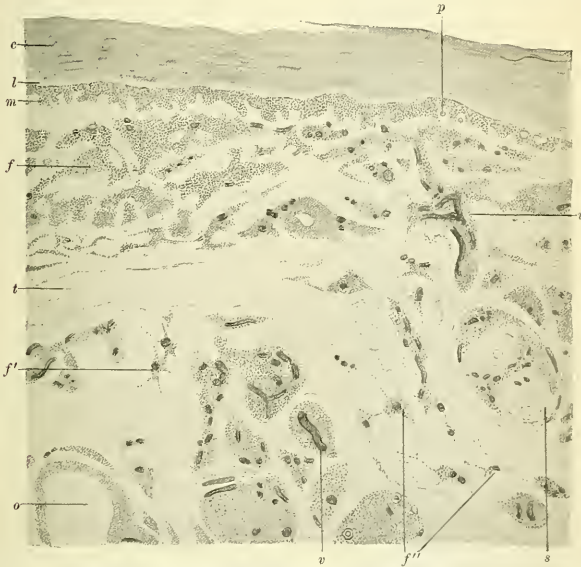


FIG. 261.—Histologic skin-lesions in tubercular leprosy ($\times 60$): *c*, horny layer of epidermis; *l*, stratum lucidum; *m*, mucous layer; *p*, papillary vessels (injected); *f*, leprosy infiltration; *v*, *v*, vessels enveloped in leprosy infiltration; *t*, connective tissue; *f*, *f*, *f''*, *f'''*, lymph-spaces in the skin filled by *lepromes*; *s*, obliterating arteries, much thickened (Leloir).

ever, is generally considered incurable. The treatment of leprosy is tonic. A change of climate is advisable, and the plainest possible diet; regular tonic baths, cold douches, showers, and alkaline baths. Numerous remedies have been suggested, but most of them are only palliative, excepting in a very few cases. Of the remedies used, chaulmoogra oil is the most popular. It is given internally, beginning with five drops three times a day after eating, and gradually increasing. It is best given in capsule or in cold tea or in milk.

Hoang-nan is a remedy much used in South America. It is given in pill

¹ Ziemssen.

form in doses of three grains three times a day after meals. Arsenious acid, sulphate of strychnine in tonic doses and long continued, are given. Salicylate of soda, quinine, salol, iodine, and bromide of potassium are also given. Unna of Hamburg has succeeded in two cases with the use of ichthyol internally and externally. Internally, he gave the drug in increasing doses to a point of tolerance, beginning with five drops three times a day. Externally, it was used in ointments and plasters, alone and combined with resorcin, with pyrogallic acid, etc. The author has cured one case with chlorate of potash in large and increasing doses. One case has been cured and three materially improved under hypodermic injections with "antivenomous serum," practically attenuated snake-venom.¹

The external treatment of leprosy should be based on two essential principles: First, the removal of the lesions with caustics or cautery; and, second, promotion of the absorption of the lesions with suitable applications. For the tubercles in their early stage iodine, nitrate of silver, blisters, mercurial ointments, electro-cautery, etc. may be used.

Balsam-of-Peru ointment, iodide-of-lead ointment, salicylic-acid ointment, gurjun oil, etc. may be rubbed into the lesions.

When there is ulceration, ordinary antiseptic methods should be applied. Iodoform, salol, boric acid, aristol, etc. may be dusted on after thorough cleansing with antiseptic solutions.

Where the lesions of anesthetic leprosy are conveniently confined to one member, it is advisable to stretch the principal nerve or even to make an excision of the nerve.

MORVAN'S DISEASE. (ISADORE DYER, M. D.)

Synonyms.—Syringomyelia; Panaris analgésique (Morvan).

Definition.—Morvan's disease is a type of syringomyelia, which is defined as an affection of the spinal cord with more or less destruction of gray matter, giving rise to multiform symptoms, among them the "analgésic whitlow," resulting in peripheral destruction of tissue, loss of phalanges, deformity, and interference with sensation.

Discovered in Brittany by Morvan,² and described as the analgésic whitlow, this disease was identified with syringomyelia by Charcot and Joffroy.³

Symptoms.—Certain well-defined clinical features mark the existence of syringomyelia. It is truly a trophoneurotic disease, in which there are trophic cutaneous disturbances, atrophy of muscle, and troubles of sensibility, glossy skin, red or violaceous skin, thickening, fissuring, ulceration, and alteration of the nail-substance, perforating ulcers of the hand and foot, eczematous eruptions, herpetic, bullous, and vesicular eruptions, with consequent ulceration and pigmentation or atrophy of pigment. On the hands or feet one or more whitlows may occur, long intervals elapsing between such lesions.

All of one extremity, upper or lower, is involved. The whole of one side may be affected and the upper half of the body, or both upper and lower extremities can be attacked at one and the same time. The sense of heat and cold and pain is lost, while that of touch remains—the dissociation test of Charcot. There is muscle-atrophy, resulting contractures, all progressing slowly. Claw-hand is usual, and mutilation results from trophic ulcers persisting at the joints. The tendon reflexes are diminished, sometimes lost,

¹ *N. O. Med. and Surg. Journ.*, Oct., 1897.

² *Gaz. hebdom. de Méd. et Chirurg.*, Paris, 2 se. vol. xli., 1883, p. 457.

³ *Archiv. de Méd. exper.*, 1890, p. 540.

never exaggerated. The skin reflexes are variable. Scoliosis is common. Inco-ordination may obtain. The disease progresses slowly, and is most frequent in the upper extremity.

Etiology.—Syringomyelia may be congenital or acquired. Heredity is not necessarily a causal factor (Dana). Acquired syringomyelia may be due to trauma, pregnancy, exposure, prolonged illness, alcoholism, infectious diseases, such constitutional diseases as leprosy and syphilis. In fact, any factor capable of producing the central pathologic lesion is to be considered among the possible causative elements. The condition occurs oftener in men than in women, and develops early in life, as a rule, while the limits are from twelve to sixty years. Fishermen, tailors, laborers, all who do manual labor, are especially prone to the disease.

So strongly does syringomyelia resemble the nerve-type of leprosy that attempts have been made to overthrow Morvan's claims to a discovery by including Morvan's type of syringomyelia among the varieties of leprosy. Morvan's cases were drawn from a leprous community, where true types of leprosy exist and from which leprosy had never been eradicated. Except for the finding of the lepra bacillus, the cases of Morvan have no distinguishing features from comparative cases of nerve-leprosy.¹

Pathology and Pathological Anatomy.—The pathologic origin of syringomyelia is considered due to the formation of a cavity just outside and near the spinal cord, the result, probably, of a degeneration of masses of neuroglia or of gliomata. Morvan's type may have its origin in a peripheral neuritis, beginning as such. More frequently, however, there is clinical assurance of the central origin. In pathologic examinations there is always evidence of the peripheral neuritis. The glioma is found most often in the cervical region, but the cavity consequent upon the degeneration process may extend the entire distance of the cord (Church).

The walls of the cavity (M. A. Starr) consist of a thick felt-like substance which extends into the cord for some distance beyond the blind end of the cavity. The cavity is filled with fluid, thin and serous, or bloody, thick, and gummy, or even by a hyaline mass.



FIG. 262.—Syringomyelia (Morvan's type).

¹ See author's cases in *N. O. Med. and Surg. Journ.*, Aug., 1893.

In the peripheral nerve, sclerosis has been demonstrated and marked neuritis is common (Joffroy).

Diagnosis.—The diagnosis of syringomyelia will present no difficulty if leprosy is accepted as a causal factor. Otherwise, the diagnosis must rest upon the autopsy for its confirmation. *The bacillus lepræ* diagnoses leprosy, but even in well-marked clinical types of anesthetic leprosy this is not always easy of demonstration. The dissociation test of syringomyelia is not conclusive,¹ as true leprosy gives the same negative responses as syringomyelia. Though the differentiation offers these difficulties, they are not enough to warrant the position taken by Zambaco-Pacha, who argues the identity of Morvan's disease with leprosy. The argument, however, certainly claims the consideration of leprosy as a causal factor in producing the glioma and its consequences.

Prognosis.—The occurrence of the multiform manifestations may extend over years. The deformity and mutilation are gradual. The longevity of the patient is lessened, but the disease may continue for fifteen or twenty, or even (as in Prouff's case) more than forty, years before death occurs.

Treatment.—Constitutional treatment seems to accomplish little more than a delay in the completion of the morbid process. Strychnine, arsenic, nitrate of silver, and general tonics are indicated, while electricity in alternating currents may be systematically employed along the spinal column as well as along the main nerves in the affected area. Locally, ordinary antiseptic dressings, with good surgical judgment, is the rule. Nerve-stretching, massage, and even amputation, may be resorted to.

COLLOID DEGENERATION OF THE SKIN. (ISADORE DYER, M. D.)

Synonyms.—Colloïdome miliare (Perrin); Cystadénomes à la dégénérescence colloïde du derme (Phillipson); Colloid degeneration of the skin (Fordyce and Liveing); Colloid-cysten (Zittner); Colloid milium (Wagner); Hyalomes (Leloir et Vidal); Hydradénoma (Darier et Jacquet); Syringo-cystadenom (Török).

Definition.—The presence of colloid change in the skin gives rise to certain well-defined nodules, benign in character, which tend to disappear spontaneously.

Symptoms.—Wagner in 1886 first described colloid milium, and, following him, Liveing reported cases of the same condition. The upper half of the face is the usual seat of the disease, but the eruption may occur on other parts of the face, particularly on the cheeks and chin. Phillipson located the disease on the chest, neck, and shoulders besides. The lesions are nodules, from pinhead to strawberry in size, vesicular in appearance, translucent, but of solid consistency, irregular in distribution, but discrete and disseminated or arranged in groups. They are rounded, flat, or slightly elevated, and may be umbilicated. The color is yellowish or pale lemon color, bright and shiny in appearance. Fox says the lesions are dull red, but they are usually described as yellowish in color. There is apt to be some telangiectic tendency. When the lesion is pricked there escapes a yellowish gelatinous substance.

There are no subjective symptoms.

The lesions form slowly in groups, without any tendency to coalesce.

Etiology.—It is generally held that the disease is not congenital nor

¹ Quinquaud: *Le Progrès méd.*, May 19, 1890.

hereditary. It is usually of recent development, and occurs in both men and women from the age of sixteen and upward. The sun may be responsible, as several of the cases reported occurred in those exposed in their daily work. Beyond this the occasion of the disease is not known.

Pathology and Pathological Anatomy.—The pathologic process seems to begin in the corium, the colloid degeneration infiltrating the derma, leaving the epidermis intact and surrounding the sebaceous glands which lie in the mass (Brooke).

These colloid masses are separated from above (Perrin) by bands of connective-tissue fibers, which also protect the glands. The rest of the skin grows denser, but there seems to be no epithelial change.

The sheaths of the vessels are thickened to twice or three times their size through the increase in the connective-tissue element. The colloid masses seem to follow the striations of the connective-tissue fibers without breaking them down. The colloid masses themselves are irregular in dimensions, very small at times, oviform, fusiform in shape; again, very large, cubical, or rounded. The smaller masses are found continuous with the neighboring tissue, while the larger masses are easily separated. The masses are made up of secondary masses, fusiform or striated, elongated or irregular. The degenerative process is considered as confined to changes in the connective tissue.

Diagnosis.—*Xanthoma* is readily diagnosed by the absence of exudate on pricking and the solid consistency of its lesions, which present a dull-yellow color, not shiny.

Multiple benign cystic epithelioma is differentiated by its cystic appearance, the well-defined contour, and the tendency to increase in its size.

Prognosis.—The lesions may disappear spontaneously, without scarring, but the process is slow, leaving a mark behind.

Treatment.—Treatment is aimed at removal, and is accomplished best with the curette and cautery, other surgical methods being employed for the same purpose.

ADENOMA SEBACEUM. (ISADORE DYER, M. D.)

Synonyms.—Adénomes sébacés (Balzer); Végétations vasculaires (Rayer); Nævi vasculaires et papillaires (Vidal); Nævus adénomateux sébacé (Brocq); Nævi vasculaires verruqueux (Darier).

Definition.—Balzer¹ first gave the name adénomes sébacés to a disease characterized by the appearance of neoplasms papular in character, of congenital origin, but appearing at or before puberty.

Symptoms.—These find localization on the face, with a symmetrical distribution referred to the eyelids, cheeks, base, tip, sides, and angle of the nose, the *alæ nasi*, the naso-labial folds, the under surface of the lower lip, the chin, and occasionally the forehead. The tumors peculiar to this disease are arranged in clusters, lines, and groups, but may be discrete or sparsely scattered on the forehead. The size varies, but is commonly described as from a milletseed to a split pea. Some of the lesions are flat-topped, others rounded, convex, acuminate, while some are warty-looking and may be pedunculated, though the customary papule is sessile. Although they may be thickly aggregated in places, there is a distinct outline to each lesion, and coalescence is unusual.

Geber² states that the tumor may become the size of the fist, and the

¹ *Archiv. de Physiolog.*, July 15, 1886, No. 5, Paris.

² In *Ziemssen's Handbook*, 1885.

shape and contour will vary according to the size of the growth and the degree in which the adjacent tissues are involved.

Caspary observes that the lesions are elastic and firm to the touch. There is an absence of duct-orifices, but on pricking the tumor a white matter, found to be inspissated sebum, can be readily expressed. The presence of this fatty matter often determines the dirty-white color of the lesion. Telangiectatic development in networks, often stellate, over the tumors and forming a boundary about them, at times involves the growth deeply and gives rise to a bright-pink or red currant-jelly color (Pringle). These vessels may become sufficiently pronounced to present the appearance of an angioma. The neoplasms tend to increase in number up to puberty, but remain stationary thereafter.

The condition is benign in character unless complicated with other affections. There seems to be no inclination to degenerative changes, but there is a tendency to involution, the lesions slowly disappearing, leaving behind shallow scars which tend to fill (Pringle).

Etiology.—The disease is congenital in origin, is exaggerated at puberty, and may be associated with other diseases occurring at this physiologic crisis. It is often found together with other hypertrophic or degenerative nevoid conditions, as warts, fibromata, pigmentations, or even true nevi.¹ The subjects of the disease are of inferior intelligence, a large proportion being epileptics or imbeciles. Poverty is among the etiologic factors, although neither this nor inferior intelligence is invariable. Females are more commonly affected than males.

Pathology and Pathological Anatomy.—The tumors are found in the walls of sebaceous glands or cysts or may develop independently. The hyperplastic process occurs in whole divisions of glands, while a single gland is rarely the starting-point of the pathologic condition (Geber). The lesions are made up of an hypertrophy of fibrous type, with enormous dilatation of the papillary vessels and the subpapillary branches. While the hypertrophy is primarily of the *pars papillaris* and the fat-glands are involved, Crocker insists upon the implication of all the appendages, making the disease really a pilo-sebaceous hidradenoma.

The anatomy has been investigated by Balzer, Geber, Pringle, Caspary, Pollitzer, and Crocker. Adenoid changes were found by all in the sebaceous glands. Balzer discovered similar changes in the sweat-glands also, and small cysts as well. The number and size of the sebaceous glands were noticeable. The papillary vessels were conspicuous, and there was some increase in the connective tissue.

Crocker comments upon the replacement of large numbers of hair-follicles and sebaceous glands by fibrous tissue, of which the tumors are largely composed.

Hutchinson (J., Jr.) found a suggestion of calcification in a case examined by him.

The individual cells of the gland seem to undergo no alterative change, either in function or development (Pollitzer). Pringle reports extensive interpapillary hypertrophy.

The **diagnosis** is made from the location, the appearance of the smooth, elastic, rounded or flattened, telangiectic, solid, firm papules, arranged in groups or clusters, occurring about puberty in subjects ordinarily under the average intelligence.

Hidradenoma is differentiated by its irregularity of distribution and

¹ Crocker: *Dis. of the Skin*, 193.

PLATE 22.



Perry's case of adenomata.

arrangement. *Colloid milium* or *colloid degeneration of the skin* is recognized by its yellowish color, translucent appearance, and comparative absence of telangiectasis.

Prognosis.—Involution may occur, but the tendency is to persistence, the lesions recurring in spite of removal and even *in situ*.

Treatment.—Local measures are alone indicated. Jamieson suggests the local application of

Ry. Resorcin,	gr. xx ;
Zinc oxide,	gr. xl ;
Kaolin,	gr. ij ;
Benzoated lard,	gr. xxviii.

Surgical procedures are, however, usually practised.

Hallopeau and Pringle used the curette, with only temporary effect. Excision is effectual in small areas.

Crocker has employed electrolysis successfully, three or four milliamperes being used.

ADENOMA OF THE SWEAT-GLANDS. (ISADORE DYER, M. D.)

Definition.—While contention is still entertained regarding the relationship between benign cystic epithelioma and adenoma of the sweat-glands, it is difficult to make an exact definition of the latter condition. As early as 1863, Thierfeldner¹ reported a case of adenoma of the sweat-gland. In 1879, Henriet² discussed the same condition under the title of *l'épithéliome sudoripare*.

Verneuil recognized three or four varieties of this affection: (*a*) cystic adenoma, or hypertrophy of the gland; (*b*) with the epithelial element exaggerated, causing the gland to hypertrophy, so as to lose its outlines and characteristics; (*c*) with the hyperplastic condition extending to the adjacent tissues, which become involved or affected.

Barrett³ reports multiple sudoriparous adenomata in three members of the same family, a mother and two daughters. Ovion⁴ describes a growth, the size of a pea, below and behind the right ear of a woman aged eighteen, which had always been present.

Symptoms.—The tumors which occur in this disease are described as ovoid in shape, unequal in surface, nodulated, movable over the subcutaneous tissues, with the skin at the borders of the lesion as normal. According to Barrett, the tumors begin as pinkish raised spots, painful at first, but causing no inconvenience whatever after the nodule has developed. The lesions are subcutaneous, varying in size up to a small tomato or even to the size of an adult head (Domee). Some of the growths are pedunculated. The color of the lesions is rosy or a yellowish white. The larger tumors are a dirty-white or yellow, with violaceous spots. They are glossy, telangiectic, cystic, and lardaceous in appearance. The principal sites for the growths are the face and scalp, the back and neck. Any part of the body, however, may be affected (see Plate 22).

Pathology and Pathological Anatomy.—In section the tumor is found to be a whitish yellow, calcified in places, made up of a mass of gland-tissue enclosed in a hard, fibrous capsule. The microscopic examination

¹ Leipsic, 8vo, 1863.

² *Trib. méd., Paris*, 1879, xi. 125 *et seq.*

³ *Brit. Med. Journ.*, Lond., 1892, 1-27.

⁴ *Rév. mens. de Méd. et Chir.*, Paris, 1879, iii. 60-64.

shows the growth to be made up of small nucleated cells, fat-granules, pigment-deposit cells, and other ovoid and hexagonal cells.¹ The cells are arranged in spheres and cylinders, the whole giving the appearance of a solid adenoma. Some connective-tissue and elastic fibers are found at times. The whole process is considered as starting with a proliferation of the sweat-gland epithelium, which finally invades the connective tissue.

Etiology.—In Domec's case² the new growth was determined by a previous injury in the shape of a blow. Burns, the habit of furuncles, previous illness, and a lymphatic temperament are suggested as factors in evidence. Old persons are more often affected, and women more than men.

The **diagnosis** is made from the age of the patient, the color, size, cystic character, and the hard, fibrous capsule of the individual tumor.

Prognosis.—Spontaneous disappearance is possible, and the tumors may recur after removal. Disintegration occurs by the distention of the skin, perforations occurring at one or more points of least resistance, purulent secretion resulting, followed by gradual healing process. Injury usually determines this process.³

Treatment.—Removal by surgical methods is the only indication for the treatment.

MULTIPLE BENIGN CYSTIC EPITHELIOMA. (ISADORE DYER, M. D.)

Synonyms.—*Nævi épithéliaux cystique* (Besnier); *Cystadénomes épithéliaux bénins* (*ibid.*); *Epithéliome bénin kystique* (Jacquet); *Hydradénomes éruptifs* (Darier); *Céllulome épithélial éruptif cystique* (Quinquaud); *Syringocystadénome* (Török); *Gutartige epitheliom, etc.* (Phillipson); *Lymphangioma tuberosum multiplex* (Kaposi); *Epithelioma adenoides cysticum* (Brooke); *Multiple benign cystic epithelioma* (Fordyce, White).

Definition.—Classed with the new growths, the disease to which so many names have been applied is characterized by the appearance of well-defined tumors.

Symptoms.—Beginning as small papules or as black dots (Brooke), these gradually increase to the size of a pea, or, at best, to twice this size in exceptional instances. In some cases the primary lesion is a scaling papule.

Little or no inconvenience is felt in the presence of the lesions, occasional pricking and itching being the only subjective symptoms, while the general health is in no way affected. The increase in number of the lesions and cosmetic annoyance usually determine the demand for treatment. The individual lesion has certain physical characteristics, differing with different observers. The lesion is described as translucent, pearly-looking, in color from a rosy café-au-lait or attenuated yellow to a waxy white. Even a bluish tinge is noticed in some cases.

Some observers distinguish no difference in the color of the tumor from the surrounding skin, while attention is called to black points beneath the skin. Telangiectasis, either around or in the growth, is generally accepted. In localization there is a marked predilection for the face, while the forehead, eyelids, root of nose, cheeks, chin, interpalpebral spaces, and ears are the particular sites. The shoulders, interscapular spaces, arms, hands, even the legs, are sometimes affected.

The lesions are usually discrete or grouped irregularly, occasionally confluent. The tumors are solid to the touch, tense and shiny, movable in the

¹ Domec: *Gaz. hebdomadaire de Méd. et Chir.*, Paris, 1880, xvii. 597.

² *Loc. cit.*

³ Geber: *op. cit.*

PLATE 23.



Multiple benign cystic epithelioma (J. C. White).

skin, though imbedded and elevated. Some are flattened, but for the most part they are rounded and acuminated. The appearance of whitish milium-like bodies suggests the cystic nature of the tumor, and these are quite common—numerous, in fact—in the larger lesions. Puncturing only causes the lesions to bleed. Brooke notes occasional central depression in some of the growths.

Etiology.—The majority of the cases reported have occurred in women, and in Fordyce's cases and those of Brooke there is a family history of the same condition. In almost every case reported the growths began about puberty, from which an hereditary, or at least a congenital, origin is argued (Darier).

Török insists upon the embryonic origin from a sweat-gland which has maintained its embryonic type. Quinquaud contends for the evolved epithelial cell. The evidence of contagion has never been remarked. The slow growth, with little tendency to involution and no disposition to degeneration into an inflammatory process (excepting in White's case; see Plate 23), argues for a benign neoplasm where inflammatory process is remarked; this was limited and resulted in a healthy scarring (see author's case, *N. O. Med. and Surg. Journ.*, March, 1898).

Pathology and Pathological Anatomy.—Attempts have been made, especially in the early examinations of this condition, to associate the pathologic process with changes in the glands (Heurteaux) and in the hair-follicle (O. Israël); but the weight of evidence has been rather a demonstration of the epithelial character, independent of either the fat- or sweat-gland or hair-follicle.

In the microscopic examination some sections show masses of epithelial cells lying in the upper part of the corium, without any distinct arrangement. In the sections made from larger lesions (Bowen) these epithelial masses were found arranged in islands and in elongated tracts. With lower power these seemed to show a lumen, suggesting the course of a sweat-gland. Higher power, however, demonstrated the lumen to be made up of compact masses of cells less strongly stained. Cysts found in the masses and islands of epithelial cells contained colloid substance occupying the center of the cyst. In some cysts the colloid substance was combined with a corneous matter. Here the corneous cells were concentrically arranged about a colloid center. Other cysts contained the corneous matter alone. Cell-nests, as found in carcinoma, can be seen (Fordyce).

The development of the cell-masses gradually forces the outermost cells to the periphery. Those cells become more and more flattened and condensed until they form the cyst-wall. The pressure of the contained colloid matter seems to be an essential factor in the formation of the cysts. It determines the cyst-wall, and, if continued, accounts for the confluence of the lesions (Brooke).

Diagnosis.—The diagnosis is made from molluscum contagiosum by the deep-seated lesion, the slow development, color, location, and the absence of the history or the likelihood of contagion.

From colloid degeneration of the skin (*q. v.*) the differentiation is established by the course and history of the individual lesion. It begins as a papule or black dot—gradually progresses, with no retrogression. Colloid degeneration begins as a yellowish translucent nodule which tends to retrogress without scarring (Brooke).

Prognosis.—After removal recurrence has not been observed.

Treatment.—The treatment is purely surgical. The methods employed

are excision, ablation, electrolysis, the galvano-cautery, and the curette. Fordyce states that a simple incision and light pressure will often result in the ready expression of the tumor.

CARCINOMA CUTIS. (A. R. ROBINSON, M. D.)

Carcinoma of the skin, using the term separately from malignant epithelioma, sometimes occurs as a primary disease of the skin, but is usually secondary to carcinoma of the breast or of some part of the alimentary canal. It occurs either in a lenticular or a tuberosus form.

Carcinoma lenticulare is almost always a secondary affection, and is most commonly seen on the skin covering a breast affected with the same disease. It is generally seen after the breast has been amputated, and has its starting-point near the scar-area, and arises in consequence of an incomplete operation, especially as regards the cutis. It appears as variously sized hard, smooth, pinkish, or glistening papules, nodules, or tubercles, flat or raised above the general surface. The number of lesions varies: they are at first discrete, but may coalesce or by growth form larger tubercular masses, and when the lesions are numerous the whole integument becomes irregularly indurated and thickened and its surface glistening. Extensive cases, in which the new growth infiltrates large tracts of tissue on the thorax, form the *cancer en cuirasse* of Velpeau. Sooner or later, in the majority of cases, softening and ulceration occur, and the patient suffers from marasmus, soon followed by death. In some cases there may be large areas affected without the patient suffering greatly or much ulceration occurring. In these cases the lymph-vessels may become obstructed and the disease be accompanied by great edema of the arm. I have seen one case in which the tubercles first formed after existing several weeks disappeared, whilst new ones formed exterior to them, and these in turn disappeared. After probably about fifty had thus grown and disappeared the disease pursued the usual course and terminated fatally.

Carcinoma tuberosum is more rarely seen. It may be a primary or a secondary disease, and usually occurs in middle life or at a later period. It appears as circumscribed, flat or elevated, rounded nodules or tubercles deeply seated in the skin, and varying in size from that of a pea to that of a small hen's egg. The overlying skin may be normal in color or of a dull-brown or violaceous hue. The nodules may be disseminated over the entire surface, and usually remain discrete. Finally, they break down and ulcerate if death does not supervene.

Anatomy.—The anatomy of both varieties is similar. A collection of epithelial cells, without intercellular substance, within alveoli the walls of which are composed of connective tissue, either normal or sclerosed, is the characteristic condition. The epithelial cells travel through the lymph-spaces to form new foci.

Diagnosis.—The diagnosis is to be made between this disease and sarcoma and molluscum fibrosum. The number of tumors, their location, situation, and course usually suffice for a correct diagnosis. Sometimes in the tuberosus form a microscopical examination is necessary.

Prognosis.—The duration of the disease is different in different cases, but two years is a long period even in the mildest cases, and in the severe ones a few months is the limit.

Treatment.—At the present time we have no knowledge of any treatment that offers the least encouragement, unless it be in the earliest stage of

the tubercular form, when destruction of the individual lesion or, if there is tissue enough, excision, may be of service.

EPITHELIOMA. (A. R. ROBINSON, M. D.)

Cutaneous malignant epitheliomata are usually described as occurring in three clinical forms—the superficial discoid, the papillary, and the deep-seated or infiltrating. With our present limited knowledge of the etiology of malignant epitheliomata this division is of value, although it is not an absolutely correct one, as the primarily superficial cancer may have become a deep one before coming under the observation of the physician, or a primarily deep-seated one may have become superficial, or either may have become papillomatous. The view that the seat of origin gives a type of form to this growth, the deep-seated or nodular arising from the glands and follicles of the skin, and the superficial discoid ones from the epidermis proper, is not always correct, as many of the deep-seated, rapidly-infiltrating epitheliomata arise from the rete. Furthermore, clinical observation does not enable the physician to state in a given case the structure from which the disease started. The clinical forms rather depend upon the seat of growth, the rapidity of the epithelial proliferation, the direction of its extension, the resisting power of the surrounding tissues, as well as the inflammatory or other changes occurring in the structures of the affected parts.

In all cases of malignant epitheliomata there are—

1. An abnormal and excessive proliferation of epithelium.
2. The proliferation is an atypical one, and with it is associated directly or indirectly the production of a poison which injures tissue.
3. Changes, usually of an inflammatory character, occur in the surrounding tissue, lessening its resisting powers to invasion.
4. Invasion of surrounding tissues by the new epithelial elements by way of the lymph-channels, and a tendency, in the majority of cases, to secondary infection of lymphatic structures.

It seems that carcinomata contain a poison which injures connective tissues, differing in this respect from benign epitheliomata. The more rapid this epithelial proliferation and the deeper seated the growth the sooner the surrounding tissue is likely to be invaded and lymph-gland infection to occur, since the amount of poison formed is in proportion to the rapidity of proliferation, and the injury to the tissues in proportion to the amount of poison. As the *pars reticularis corii* offers considerable resistance to invasion as compared with the deeper and looser connective tissue, the deeper seated the cancerous growth the more rapid the invasion through the lymph-channels.

The epithelia of cancer can travel through lymph-channels without causing any appreciable sign of inflammation in the part or requiring a condition of inflammation to precede the invasion, as is shown particularly in connection with secondary invasion of the skin following mammary carcinoma, and also in some cases of slowly-progressing superficial discoid epithelioma the circulatory disturbance is very slight.

Lymph-gland infection never occurs in rodent ulcer, and sometimes a superficial flat epithelioma may exist twenty years or longer without invading the lymph-glands. When the disease is situated upon the penis, lips, certain parts of the face, or just in front of the ear, infection is certain to occur, and takes place, as a rule, earlier than when the lesion is seated upon the nose, ear, or eyelid.

From these general considerations let us consider the manner in which

the disease extends at the seat of a primary lesion. In Fig. 263 is shown the manner of extension in mammary carcinoma. The drawing represents a terminal acinus, and shows the epithelium filling up the greater part of the

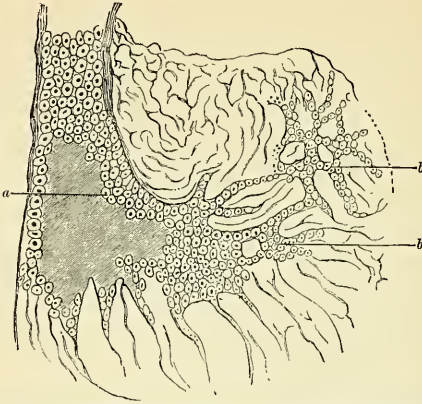


FIG. 263.—Acinus of a mammary gland, showing growth of cancer and infiltration of surrounding tissue; *a*, lumen of acinus with proliferating epithelium; *b*, epithelia travelling through lymph-channels and infiltrating periglandular tissue (after Waldeyer).

lumen in an irregular, abnormal manner. The basement-membrane at the blind extremity of the acinus has disappeared and the epithelium has invaded the periglandular tissue. The drawing shows how the epithelium travels, no

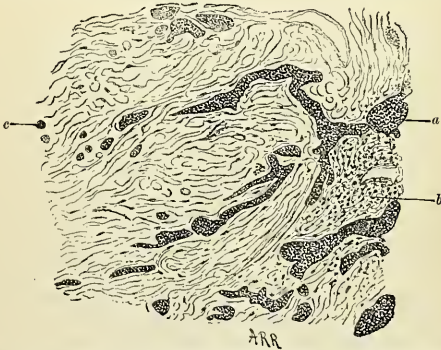


FIG. 264.—Section of peripheral part of a rodent ulcer (cylindrome): *a*, columns of epithelia in lymph-channels; *b*, small-celled infiltration; *c*, small column cut transversely.

longer being sharply limited, as before destruction of the basement-membrane, but extends in an irregular manner far into the connective tissue in the form of columns or single cells. The same method of extension occurs in cutaneous cancer, where, with the exception of the glands, there is no

basement-membrane to be penetrated. The majority of cutaneous epitheliomata start from the epidermis proper, and not from the glandular structures. At first the growth is sharply limited, but sooner or later there is invasion of the corium and subcutaneous tissue.

In the superficial forms there is at first an atypical proliferation of epithelium—later, an invasion of the corium, slow at first, on account of the strong resisting power of the *pars reticularis corii*, and rapid when the deeper tissues are reached.

In the primary deep-seated nodular epitheliomata the growth is much more rapid and the invasion of the corium much earlier than in the superficial discoid form.

In rodent ulcer there is always atypical epithelial proliferation and invasion of the corium, as shown in Fig. 264.

In these cases the epithelial proliferation is slow and secondary lymph-gland infection does not occur.

We shall now briefly consider the different clinical forms of epithelioma.

The superficial form can arise as a warty lesion, papule, erosion, or a scaly, eczematous-like patch, and remain many years without attaining a greater size than that of a pea or bean. It shows a marked tendency to extend in a lateral direction instead of in depth, and in rare cases may disappear spontaneously. The superficial discoid epithelioma begins as one or more neighboring pale-red or yellowish-white and waxy hard nodules. Their surface is shining, and they are usually aggregated into irregular, wart-like masses. They early show a disposition to fissure and excoriate, and become covered with thin dark crusts, beneath which is seen a surface secreting a scanty viscid fluid. In this stage the lesion looks much like a wart that has been irritated by scratching. It spreads slowly at the periphery, taking years, perhaps, to attain the size of a bean. As it becomes older it grows more rapidly, and soon the center breaks down and an ulcer forms. The ulcer slowly increases in extent, until it may attain a large size, covering an area sometimes of several inches in diameter, although such a size is unusual without any cicatricial tissue-formation. An epitheliomatous ulcer has special characters that enable an expert to make a diagnosis with great certainty. At the edge is proof of epithelial proliferation, and also at the base, in spite of the overlying necrosis. It is rounded or irregular in shape; the edges are sloping, raised, indurated, transparent, waxy-like in color, and transversed by few or many dilated blood-vessels; the base is indurated, reddish, and uneven, and bleeds easily; a scanty viscid, varnish-like or yellowish secretion covers its surface. As a rule, the disease finally involves the deeper tissues and assumes the character of the deep-seated form, but, if situated upon the forehead or cheek, may remain years confined to a small area. If an otherwise slowly-growing superficial epithelioma is injured by a traumatism or irritating treatment, it may quickly take on rapid growth, penetrate deeply, and soon assume a dangerous course.

When the superficial form commences as a scaly patch, it may not be elevated upon the surface for some time, but finally signs of epithelial proliferation appear and the characteristic edge forms.

The majority of European and American writers regard the so-called rodent ulcer as a variety of this flat form. With this I cannot agree, and if the term is to be retained, it should be restricted to a very definite process, very distinct from ordinary epithelioma both in its clinical course and appearance. As Paget states, it is not like ordinary cancer in "aspect, rate, or mode of progress; the base and walls never contain structures other than

those often met with in the walls of chronic ulcers." "The ulcer is irregular in shape, but usually oval or circular. The base, however deeply or unevenly excavated, is usually not warty or nodular, or even granular; it is comparatively dry and glossy, with very little discharge; the borders are slightly if any elevated, and if elevated are smooth, rounded, or slightly tuberculated. The base and border feel hard, as if bounded by a layer of tissue about a line in thickness." This description of Paget's agrees with my own view, and describes a purely degenerative process—not a new formation, as in epithelioma. It is met with in elderly people, and is especially liable to attack the upper half of the face beneath the eyes or the side of the nose. The section represented in Fig. 264 is from a flat epithelioma, and not from a true rodent ulcer, according to my view.

Papillary epithelioma is usually secondary to one of the other varieties, but may appear as a primary form. Generally, it appears as a raspberry-like mass, elevated above the general surface, and varying in size from that of a pea to that of a nut. In other cases it forms large, lobulated, and spongy masses. Its surface may be covered with a thin layer of dried, yellowish epidermis or it may be macerated and moist; it is often bathed in a viscid, bloody secretion. Later, fissures and excoriations occur; an offensive fluid is poured out, and brownish crusts cover part of the growth. Finally, an ulcer occurs, as in the other forms of cancer.

These growths are not papillary in structure, but assume a papillomatous form on account of rapid epithelial proliferation. If they form as a primary growth or in connection with the superficial form, they are not so malignant as when formed in connection with the deep-seated nodular variety, as in the latter case a large amount of poison is formed from the rapid proliferation of the epithelium, and invasion of the connective tissue is, as a consequence, early and extensive, and secondary lymph-gland infection soon occurs. The papillary form is frequently present when the growth is seated upon the lips or extremities.

The deep-seated nodular epithelioma commences in the form of rounded or conical tubercles varying in size from that of a split pea to that of a bean. Usually a number of them are closely packed together. They are deep seated, hard to the touch, semi-transparent, though slightly reddish or purplish in color. Usually the entire growth is elevated, but may appear as a diffuse, flat infiltration. In the course of months or years the mass of nodules have grown to perhaps the size of a nut, and forms a prominent, rounded, hard tumor, whose shiny, waxy surface is covered with dilated blood-vessels. The margins of the growth are steep, and often exhibit pearl-like collections—the so-called caneroid corpuscles. These "pearls," however, are more frequently seen in the very superficial forms of epithelioma. Sooner or later, ulceration occurs, and there arises a deep, rounded, or irregular excavation, with steep, puffed-out, everted, purplish edges, from which cheesy-like masses—caneroid corpuscles—can be expressed. The ulcer secretes a yellowish fluid and bleeds easily when touched. The infiltration spreads with varying degrees of rapidity, and the ulceration progresses correspondingly. The lymphatic glands become involved, and the patient finally dies from exhaustion.

Some of the deep-seated nodular epitheliomata when situated upon the scalp are difficult to diagnose at an early stage, as they resemble somewhat sebaceous or fibroid tumors. They have a peculiar clinical history. The growth first appears as a small nodule, deeply seated, sharply limited, and somewhat movable. It gradually increases in size, feels hard, firm, or elastic; the skin over it is at first perfectly normal and non-adherent to the

growth; later it becomes pinkish or reddish in color, traversed by dilated vessels, and adherent. The base is deep seated and extends to near the periosteum. It is very liable to be followed by lymph-gland infection unless early and thoroughly removed.

Chimney-sweep's cancer and that met with in workers with paraffine belong to the superficial forms, commencing usually as a warty growth.

Epithelioma may appear upon any part of the body, but it is most frequently seen upon the face. It is very rare on the upper lid. When situated upon the extremities I have found it usually on parts subjected to much irritation.

Etiology.—The direct cause of epithelioma is not known. Future research will, I believe, show that at present we are describing under the term cancer several distinct diseases, some depending upon organisms and others as the result of degenerations. As predisposing causes irritation and traumatism often play a part. An hereditary influence is undoubtedly frequently present. I have seen many clear proofs of this. Advanced age is also a factor.

Pathology and Anatomy.—These have already been sufficiently discussed under Symptoms.

Diagnosis.—When commencing as an eczematous lesion or as a wart the diagnosis may be impossible at that stage. Also, the deep-seated forms situated on the scalp cannot be diagnosed at first without the aid of the microscope. Usually the disease is not seen until the process is well marked, and should always be diagnosed. Unless there is distinct evidence of epithelial proliferation at the margin or base, epithelioma should not be diagnosed. If it is present, that excludes syphilis and tuberculosis (*lupus vulgaris*), the two diseases with which it may be confounded by the inexperienced; commencing in advanced age excludes *lupus*. The papillary form is sometimes difficult to diagnose from an ordinary condyloma.

Prognosis.—With the use of the caustics I will mention, and of the knife in proper cases, a favorable prognosis can be given in most cases of cutaneous cancer when seen at an early stage, or even later, especially in the flat form. If lymph-gland infection has already taken place, the prognosis is unfavorable. In advanced rodent ulcer treatment is usually valueless. Altogether, the disease is not the incurable one too often supposed by physicians.

Treatment.—Cancer is at first a purely local affection, and not a manifestation of a constitutional condition; therefore a complete removal of the primary growth before it has invaded other parts of the body is equivalent to a cure of the disease. In some parts of the body, as the scrotum, front of neck, etc., parts from which it is possible to remove a large amount of tissue without injury to the patient, the knife is the agent to be employed. *With these rare exceptions* the treatment by suitable caustics should always be employed in preference to excision, on account of the greater certainty of success and the slighter deformity remaining after the removal of the disease. The use of toxins from erysipelas organisms, either pure or mixed with others, has given very unsatisfactory results, and should not be relied upon in any case. The use of any substance making a profound impression upon the general nutrition-condition of the patient has an inhibitory action upon the growth of a cancer, and temporarily there may be diminution in the size of the growth; but in time the epithelia or the organisms causing their growth accommodate themselves to the existing conditions, and active growth commences again. As proof of this statement, cancers have been known to disappear after an attack of typhoid fever, and I have seen epitheliomata disappear without sur-

gical aid. Such agents as nuclein, chelodinum, arsenic, iodide of potassium, given internally, are, in my experience, absolutely valueless.

The use of electricity, except as a caustic, should not be relied upon. When the tumor is situated on the roof of the mouth or close to the inner or outer canthus of the eye, and is small, the cautery or electrolysis can be employed to advantage.

Scraping or curetting is often employed, but, used alone, I am firmly convinced that it is an injurious method. As the operator cannot remove all of the pathological epithelia at a single operation, and in the intervals of treatment the part is in a condition of reaction after injury, there is more blood brought to the part, and the cancer-epithelia will grow with greater rapidity than if the part had not been operated upon; furthermore, as the lymph-channels are also enlarged, there is danger of early extension to distant parts.

Curetting, and then cauterizing, the base with a suitable caustic can be used to advantage in some cases of epithelioma, especially the superficial pearly form, in which case the scraping should be merely preparatory to the application of a proper caustic.

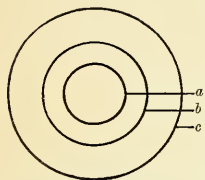


FIG. 265.—Diagram illustrating the use of caustics.

No caustic should be used that does not rapidly and effectually destroy, either directly or indirectly, the epitheliomatous tissue. The caustic agents which have been employed in this disease are, particularly, nitrate of silver, nitric, sulphuric, and hydrochloric acids, acid nitrate of mercury, carbolic and acetic acids, chloride of zinc, caustic potash, and arsenious acid. Some of these, as nitrate of silver and carbolic acid, act very slowly and to a slight degree, whilst others, as caustic potash, act quickly and cause rapid necrosis. The objections to some and the advantages of others of these caustics are illustrated by the accompanying diagram (Fig. 265).

Suppose we have to deal with an epithelioma occupying macroscopically as large an area as that enclosed within the circle *a*. Outside this area, and extending to *b*, we will assume there are pathological epithelia and circulatory disturbance, whilst outside *b*, and extending to *c*, one or more cancer-epithelia are present without circulatory disturbance. We will suppose that outside of *c* the tissue is normal. If such a tumor were operated upon with the knife, it would be necessary to remove all the tissue within *c*, or the disease would return, and in many parts of the face, for instance, that would mean much mutilation, especially when it is remembered that the growth extends in depth as well as horizontally. If one of the weak caustics be employed, only a portion of the tumor can be destroyed at the time of treatment; this leaves the remainder but slightly injured, and it is soon in a condition of reaction after the injury, with the consequences already described from such a reaction-process. The use of mild caustics therefore leaves the patient in a worse condition than if the disease had not been interfered with. I have seen many cases of cancer of the lip and other parts much injured by this meddling, injurious, and inefficient method of treatment. What holds true of nitrate of silver holds true of all other mild caustics: they do not destroy with sufficient rapidity, and consequently indirectly favor the process of proliferation and invasion.

Caustic potash quickly liquefies tissue, and with this agent one can at a single sitting destroy a large amount of tissue, and produce the following changes in the surrounding part. Suppose the cancer occupied the area

already described in connection with Fig. 265. With caustic potash all of the area within the circle *a* can be destroyed in a few minutes, and should be, but not beyond that line. The action of the caustic extends farther than the part completely necrosed, and its use is followed by marked inflammatory changes in the surrounding part, and the intense inflammatory process may lead to destruction of all the tissue lying within *b*. The tissue within *c* will also be much inflamed, and the inflammation should be sufficiently intense as to destroy any cancer-epithelia there without destroying the normal structures—an attainable object, as pathological is more vulnerable than normal tissues. The operator must produce the requisite intensity of inflammatory action if a reappearance of the disease is to be avoided. Suppose the result of the caustic has been that all the tissues within *b* have been destroyed, and the inflammatory process destroys all pathological epithelia beyond that line: a result is obtained equal to that from an incision made at *c*, at the same time the open wound produced extends only to *b*. This gives the advantage of such a caustic over a cutting operation. Some of the good effects following the use of caustic potash probably comes from the action of a toxalbumin generated which is destructive to the organisms of cancer, if such exist. Caustic potash should not be used where large tumors exist, nor in the papillomatous forms, on account of a possible severe hemorrhage. It is useful in an early stage of epithelioma of the lips and in small tumors of the hard palate. It can be used in stick form, or in solution with a piece of absorbent cotton, or with a glass tube drawn to a fine point.

Chloride of zinc can be used in stick form or solution or as a paste. It destroys both normal and pathological tissue, although not in an equal degree, and its use is rarely indicated. I employ it in the papillomatous forms until the base is approached, and then use another caustic. It can also be injected into small tumors where caustic potash or arsenious acid cannot be employed.

The formula usually employed is that known as Bougard's paste, and is as follows:

R. Farinæ tritici (wheat flour),	
Amyli,	āā. ʒj;
Acid. arsenos. pulv.,	gr. viij;
Hydrarg. sulph. rub.,	ʒij;
Ammon. chloridi,	ʒij;
Hydrarg. bichlor. corros.,	gr. iv;
Zinci chlorid. cryst.,	ʒj;
Aquæ fervid.,	ʒiiss.

The first six substances are finely ground and then mixed in a glass mortar. The chloride of zinc is dissolved in the boiling water, the contents of the mortar being kept rapidly moving with the pestle until all the solution is added; then let it stand for about twenty-four hours, and the paste is ready for use. To this paste I add 10 to 20 per cent. by weight of cocaine. This should be added in the form of a saturated solution after the paste has been made. The paste is spread thickly on a piece of muslin and left upon the part about twenty-four hours. If the application has been successful, all the cancer-mass should appear to be necrosed. If the growth is large, several applications may be necessary.

Arsenious acid in the form of a paste, made by mixing together the acid and powdered gum acacia with water, is our most valuable agent in the treatment of epithelioma of the skin. The paste should have the consistence of

firm butter. *The strength and duration of application should vary according to the character of the cancer to be treated if the best results are to be obtained.* Marsden employed two parts of acid to one of acacia, but I prefer to regulate the strength according to the case, never making it weaker than equal parts and never stronger than that employed by Marsden. It can be applied to any cutaneous cancer, and with proper precautions gives also most satisfactory results in many cases of epithelioma of the lip. A study of its action on such a tumor as already described as existing in Fig. 265 will give an idea of the result obtained when the treatment is properly conducted. If the epidermis is unbroken, it should be destroyed or injured with some agent, as caustic potash, before applying the paste, as arsenious acid has comparatively little action on normal tissue. The paste should always cover an area considerably beyond the apparent limit of the tumor, as that is never the real extent of the growth, and should be left on from eight to twenty hours, depending upon the vulnerability of the part and the strength of the paste. From what I have already written you know the result that should be obtained, and you must use the paste in such a way as to get that result, either by making it stronger or leaving it on a longer period. The operator, however, is not justified in allowing too much destruction of normal tissue to occur. If the action has been satisfactory, all of the tissues within *a*, and some if not all within *b*, will appear to be necrosed, and beyond that area an inflammatory process of much intensity next the necrosed area will exist, and extend with gradually diminishing intensity into the surrounding tissue; thus, if the tumor is situated upon the lower part of the nose and it be somewhat deeply seated, the application, if properly applied as to strength and duration of time, usually causes closing of the eye on the same side from inflammatory edema.

As the action of the arsenic is elective in character in this disease, it follows that with it the best results are obtained with the least destruction of normal tissue, and it is to be used in all cases when not contraindicated. Clinical experience shows that the best results, both as regards cure and scarring or deformity, are obtained by the judicious use of this agent. If the part is examined when the paste is removed and the desired result has not been obtained, another application should be made at once, and, as the part now is probably more vulnerable than before the first application, the next paste should be weaker or left on a shorter period of time. The proper procedure is to watch the action of the paste and be guided by the effect upon the tissue. *The action desired must be obtained or the patient is injured instead of benefited.* If the action is satisfactory, the part is to be treated as a simple wound, and should heal quickly under proper dressings. Make no effort to treat the part antiseptically, as the toxins from pus-organisms and the inflammatory process in connection with their presence are of service in destroying organisms and pathological epithelia: at the same time, plenty of granulation-tissue helps to the restoration of the normal form of the parts. If the tumor is seated just below the eye, the lachrymal secretion may soften the paste too much, and it may be necessary to make a fresh application many times during the eight to twenty hours of treatment. In the superficial forms the paste should be applied over a large area if a reappearance of the disease is to be avoided. If marked ulceration exists, the strong preparation should be used, as that lessens the danger of poisoning.

In the small, deep-seated pea- or bean-sized lesions the use of a cutaneous punch to remove the central part, and then the application of the paste, filling the cavity and covering the surface, has given me very satisfactory results.

Deep nodular cancers on the scalp should be excised and a paste applied to the base.

For the successful use of the caustics the physician must recognize the form of cancer; he must appreciate the manner of extension of the growth in the different forms, and have a definite idea of the action of the caustic employed and the result necessary to be obtained. Some cases demand considerable experience, whilst others are easily handled. A fault which is frequent with physicians is the neglect to treat the case energetically until in their opinion the disease is removed.

PAGET'S DISEASE. (A. R. ROBINSON, M. D.)

Symptoms.—This disease, which is almost invariably confined to the breast, was first described by Paget, and at the suggestion of Mr. Eriehsen is now known as Paget's disease. It is almost universally regarded as a form of malignant epithelioma, and can very properly be discussed in this place. It occurs mostly in women between the ages of forty and sixty years, although it may appear at an earlier or a later period of life. It rarely occurs in both breasts simultaneously, but not infrequently both are attacked sooner or later. Its great resemblance at an early stage to an ordinary eczema of the nipples led to the belief that possibly it is at first an eczematous process, but later observations lead to other views. At first it is limited to the nipple-area, commencing as acanthosis, causing corneous concretions and crusts situated on the summit of the nipple that are adherent and rebellious. The process is a very slow one, and as it progresses is attended with more or less itching or burning feeling and shooting neuralgic pains. The crusts are usually of a grayish color, and when removed soon form again. Excepting this crusting the epidermis may remain for a long time about normal in appearance, or there may be an erythema with the burning and itching sensations above mentioned. It may remain confined to the nipple for years, then spread over the areola or invade the gland beneath. As it proceeds from the nipple to extend over the general surface, it does so by very gradual peripheral extension. When the areola is occupied the general surface is a bright red, with a moist, eczematous-like appearance. The edge is almost invariably slightly elevated, but I have seen a case in which there was no perceptible elevation. The patch is covered in places with scales and crusts, and excoriations soon form, and later ulcers. The nipple becomes retracted, and the whole affected area gives a feeling of superficial hardness when examined. The extent of the changes varies from slight desquamation to ulceration, the changes being greatest at the center and least at the periphery. The patch is always sharply limited and irregular in outline, with a marked tendency to a polycyclic disposition. Outside of the patch the skin is quite normal. The disease may cover the whole breast, and has been observed as extending into the axillary region.

At the period when the nipple is strongly retracted or destroyed deep nodules may already have been formed in the gland beneath, and the disease assume, in addition to the characters already described, those of ordinary mammary carcinoma.

Etiology.—As with ordinary cancer, the exciting cause of this disease is not positively determined. Wickham regards it as a psorospermosis, and the probabilities are, in the opinion of many, that he is correct. Among predisposing causes it is probable that age and a previous pathological condition, as eczema or fissures, play a part. It has been suggested that organisms may

have been rubbed into the ducts in the process of washing the breasts. If the disease is parasitic in origin, the organisms must be rare, as the disease is so seldom observed.

Pathology.—The disease is primarily an affection of the superficial epithelium of the nipple-epidermis and lacteal ducts. Some authors think it can also commence in the sebaceous or sweat-glands or the hair-follicles. The epithelium undergoes atypical changes, and very soon there are increased proliferation of the cells and thickening of the epidermis. The changes are more of an inflammatory character than is usually observed in cancer either of the general surface or of glandular structures. As the disease occurs on other parts of the body than the nipple, it is not properly a disease of that special locality.

Anatomy.—At first the lesions are of inflammatory origin, and later are associated with the changes occurring in carcinoma mammæ. A section of the margin of invasion shows atypical proliferation of the rete-cells, with probably an increase in thickness of the epidermis. The cells are irregular in shape, deformed, broken down, or showing a nucleus with a hyaline space around not staining with ordinary coloring agents. There are other clear spaces filled with round-cells—emigrated leukocytes. Sometimes the epidermis sends proliferations into the corium and shows signs of epithelioma. The corium is inflamed and soon sclerosed throughout. The ducts of the glands are filled with proliferating epithelium and the lumen enlarged. Retraction of the nipples is due to the sclerosis of the corium. So-called psorosperms are present at an early stage, both on the general surface and in the ducts. In a late stage the rete-cells become very irregular in shape, detached from each other, and appear as irregular protoplasmic masses at the same time the corium is invaded. The disease is invariably followed by mammary carcinoma with all its complications.

Diagnosis.—The disease is to be diagnosed from eczema. The induration throughout the entire area affected, the sharply-limited margin, the long duration before the areola is occupied, the slow spreading at the periphery, and the presence of so-called psorosperm bodies enable a diagnosis to be made with certainty. In any doubtful case a microscopical examination of the crusts and superficial scabs should be made by a competent microscopist, as I have known amputation of both breasts recommended by a consulting surgeon in a case of galactorrhea at the climacteric period owing to neglect of this precaution.

Prognosis.—If mammary carcinoma is already present, the prognosis is unfavorable, as there is much danger of involvement of the glands of the neck, perhaps more than that of the axilla. That was the cause of a fatal result in a case lately under my observation.

Treatment.—In old persons, if the course is very slow, it may be advisable to abstain from severe treatment and rely upon mild agents, which sometimes are of much benefit, as methylene-blue solutions. At an earlier age the proper treatment is amputation of the breast. The incision should be made wide from the nipple, and it is not necessary to clear out the axillary space unless the disease is far advanced.

FRAMBESIA. (H. TUHOLSKE, M. D.)

Definition.—Frambesia, or yaws, derives its name from the French framboise, a raspberry. It is an endemic disease of the tropics, caused by the inoculation of a specific virus, and characterized by an eruption forming rasp-

berry-like nodules, and generally by constitutional disturbances, though the latter may be insignificant or entirely absent.

The disease is limited to tropical countries, and is now endemic on the West Coast of Africa, in Madagascar, Ceylon, in the East and West Indies, and in certain portions of North and South America and other tropical countries.

Yaws was formerly considered by many observers to be a modified form of syphilis, but it is now generally conceded to be a disease *sui generis*.

Symptoms.—The disease may be divided into four stages. The *period of incubation* lasts from three to ten weeks, and is marked by prodromic symptoms, such as anorexia, palpitation, vertigo, insomnia, pains in the arms, legs, back, and joints, slight fever, general malaise, etc. These prodromes are often entirely absent in adults, but in children they are usually marked.

The *primary period* is characterized by a small papule which in about a week becomes yellow at the apex, and about a week later discharges and dries up. It may appear on the lip, breast, groins, genitals, or perineum.

The *secondary period* is ushered in by febrile symptoms of an intermittent type and of greater or less severity. It usually begins about a month after the appearance of the initial sore. An eruption of small red papules appears on the face and neck and rapidly covers the entire body. The eruption is preceded by itching, and after it makes its appearance the fever subsides. After a week the papules become yellow on top and increase in size, especially in breadth. They develop into tubercles, and the crust falls away, exposing a papillary growth which discharges a foul-smelling, sticky fluid of a dark-yellow color. The lesion now presents the appearance of a raspberry, which is characteristic of yaws. The papules sometimes appear on the mucous membranes, and are sometimes arranged in rings around the eyes, nose, mouth, and genitals. The ulcerated papules are not very sensitive, and healing is usually complete at the end of the second month after the appearance of the rash. Pale spots, which are usually permanent, are left. In more serious cases the papules may extend and coalesce, thus forming deep ulcers which may cause death by septicemia or exhaustion.

The *tertiary period*, which occurs in unfavorable cases, consists of nodular infiltration of the subcutaneous tissues. The lesion resembles that of a syphilitic gumma, and breaks down, leaving an ulcer. The most favorite seat of these lesions is the leg below the knee, though they may be met with in any part of the body. Among other lesions of this period are nodes on the clavicle, sternum, ulna, and tibia, and ulceration of the pharynx, soft palate, and septum. If this tertiary period is severe, fatal anemia may ensue.

Etiology.—Frambesia is a contagious disease, though the specific micro-organism has not yet been definitely determined. One attack usually confers immunity, though two or more attacks have occurred in the same individual. Among the predisposing causes may be mentioned tropical climate, childhood, unhealthy hygienic surroundings, race (it is more common in natives, on account of exposure to infection).

Pathological Anatomy.—The location of the pathological process is in the cutaneous tissue, and Charlonis has shown that it is a dermatitis limited to the papillary layer, gradually penetrating into the corium and involving the appendages of the skin. The characteristic nodules, which have the qualities of tubercles, may be found in the various organs of the body.

Diagnosis.—The diagnosis usually presents but little difficulty. Syphilis is the most important disease from which it must be differentiated. Frambesia is mostly a disease of childhood; the primary lesion is not indurated, and is

usually extragenital: there are itching, absence of alopecia, and iritis, and the eruption is neither symmetrical nor polymorphous. The lesions of yaws are auto-inoculable.

Prognosis.—The prognosis of the disease, as regards recovery, is good. Unless the hygienic conditions are unfavorable, the disease tends to spontaneous recovery, though there may be many recurrences.

Treatment.—The principal therapeutic agent in the treatment of this disease is hygiene. Frequent baths, good ventilation, and a wholesome and nutritious diet are of the utmost importance. The inoculation-sore should be treated antiseptically. Quinine to allay the fever, and diaphoretics to promote the function of the skin, are indicated. In the eruptive stage calomel fumigations and sulphur baths are recommended. Mercury and iodide of potassium are also useful, especially in the later stages. A host of other remedies have been advised, but their usefulness is doubtful.

VERRUGA. (H. TUHOLSKE, M. D.)

Definition.—Verruga is an acute, specific disease, transmissible by inoculation. It is limited to certain valleys of the Peruvian Andes, and all cases occurring outside of this territory are imported. It is characterized by an eruption which has somewhat the appearance of warts, and which is preceded by febrile symptoms of an irregular type. It occurs more frequently among white people than negroes.

Symptoms.—The period of incubation of this disease usually varies from eight to forty days. The invasion is gradual, and is characterized by malaise, depression, gastric irritation, and, later, by fever and pain.

The pains are rheumatoid in character, and appear in the muscles, bones, joints, and spine; they are usually articular, are more severe in cold climates, and are subject to nocturnal exacerbations.

The fever is usually of a malarial type, and is an index to the intensity of the infection. The paroxysms are ushered in by a chill, which is followed by fever and an exacerbation of the pains, and, after about twelve hours, terminates in profuse sweating and a diminution in the intensity of the pains.

The skin and mucous membranes become pale, the heart-sounds feeble, the spleen and liver are enlarged, and the patient presents the appearance of one in an advanced stage of anemia.

The eruption appears in from three weeks to a year after the appearance of the first symptoms. It begins on the face and limbs, and gradually extends to the rest of the body. It is attended with an abatement of the general symptoms. It begins as small, pea-sized red spots, which increase slowly in size, and finally develop into round or conical tumors of variable size, which are usually pedunculated. These tumors appear on the surface, in the derma, and on the mucous and serous membranes. They are sometimes small, and may dry up and disappear. On the other hand, they may grow to the size of an orange or larger, disintegrate into ulcers, and cause serious hemorrhage. Their most usual seat is the face, head, and neck, and the number may be few or many.

When the tumors are subcutaneous they can be detected only by the touch, small, round, movable bodies being felt under the finger. The skin covering them may remain normal in appearance, and they may not give rise to any suffering or inconvenience. They may remain painless and indolent, and finally disappear by absorption or atrophy. On the other hand, they

may increase in size, the skin over them becoming inflamed and adherent, and finally giving way, when a small quantity of bloody, ichorous pus is discharged. They may become softened before breaking through the skin, thus simulating an abscess, or they may form a mushroom-like growth which is joined to the skin by a small pedicle. The size of these subcutaneous tumors varies from that of a pea to that of an orange, and their most favorite seats are the knees, elbows, legs, and posterior portion of the malleoli.

The termination of the disease varies with the course taken by the tumors.

Diagnosis.—It is often difficult to arrive at a diagnosis in the early stages of the disease. It is especially likely to be confounded with malarial fever, as the two diseases abound in the same locality. The presence or absence of the *plasmodium malarie* will in most cases settle the diagnosis. The fact of whether or not the patient has recently travelled in an infected region is an important factor in diagnosis.

Etiology.—The disease has been proved to be inoculable, though the essential verrugenic agent has not been definitely determined. One attack does not render the patient less liable to a second. A prolonged residence in the verruga country is not essential for one to contract the disease, one night often being sufficient. The lower animals are not exempt from the disease, the bovine, equine, and porcine species being especially predisposed. Among the predisposing causes may be mentioned a debilitated condition and want of acclimatization.

Pathology.—Dr. Yzquierdo, who has made a most exhaustive study of this disease, says: "The tumors known as verrugas are neoplasms of connective-tissue origin, and not warts in the anatomical sense of the word. Their structure resembles that of the sarcomata. In many of these so-called warts cavernous tissue predominates. Sometimes the intercellular substance assumes the adenoid type. Micro-organisms, presenting distinct morphological characteristics, are found between the anatomical elements of the neoplasms, and also inside the blood-vessels, which they sometimes completely obstruct."

Prognosis.—The disease is a serious one, and the prognosis should always be guarded. It is more favorable if the initial symptoms are light and the patient can be removed from the mountain-region to the sea.

Treatment.—A great number of remedies have been used in this disease, but the results have been proved unsatisfactory. The indications are to favor the appearance of the eruption, to sustain the vital forces, and to remove the patient as soon as possible from the mountains to the seashore.

ALEPPO BOIL. (H. TUHOLSKE, M. D.)

Definition.—Aleppo boil (Delhi boil, Biskra button, endemic boil, etc.) is a tropical disease of a local nature, occurring chiefly on exposed parts of the body, especially the face, unattended with constitutional disturbances, and characterized by the formation of papules which enlarge, ulcerate, and finally cicatrize.

The disease is endemic only in certain foci of infection, and does not prevail beyond 23° to 45° north latitude and from 80° east to 2° west longitude.

Symptoms.—The disease is divided into three separate stages: (1) The period of formation or tumefaction; (2) The period of ulceration; (3) The period of cicatrization.

There are no prodromal symptoms. The disease begins with itching, which is followed by the appearance of a red papule, which has been described as resembling an irritated mosquito-bite. This increases very slowly in size,

and after four or five months is as large as a common furuncle. It attacks the roots and sheaths of the hair while extending.

The second stage begins after four or five months with softening of the enlargement. The surface is covered with yellowish-white points, and it discharges a serous or sero-purulent substance of a characteristic offensive odor. A scab is formed, and ulceration goes on beneath the crust. Sometimes healing takes place without ulceration, but this is rare. Typical single ulcers are about the size of the thumb-nail, though Bretheraud reports a case in which the ulcers had coalesced and the whole gluteal region was one raw surface.

The third stage is that of repair. Healthy granulations appear in the center of the ulcer. The scab is thrown off at intervals, and each time discloses a healthier sore; and, finally, when the last scab has been shed, a firm, livid cicatrix is left. This cicatrix gradually becomes white, and finally resembles the scar left by a burn of the third degree, and, like it, remains permanently. This stage lasts usually three or four months.

The period of incubation varies, though three months' residence in an infected locality is about the time required by the unprotected to contract the disease. The number of boils varies greatly. There may be only one or there may be six or seven dozen. The usual seat of the boils is the exposed parts of the body, as the fingers, hands, forearm, elbow, face, leg, and thighs. The average duration is six or seven months. One attack usually confers immunity, though the disease may manifest itself several times in the same individual.

Etiology.—The disease is inoculable in both men and animals, but the particular germ to which it owes its origin has not been definitely determined. There are some grounds for the belief that the microbe is water-borne. It may be introduced into the system in a variety of ways, but most observers believe in its direct inoculation through an abrasion in the skin.

Pathology.—The pathological anatomy is that of tubercle. "It is a neoplasm which is seated in the derm, of an inflammatory character, which does not resolve spontaneously, and which tends, consequently, to the total and partial destruction of the tissues in which it is developed, and contains a pathogenic micro-organism" (Leloir).

Diagnosis.—The history of the case, the slow evolution of the disease, its endemic prevalence in certain localities, and the general condition of the patient usually render the diagnosis easy.

Prognosis.—The disease is not dangerous to life, and its tendency is to recovery, though the boils, when seated on the face, leave behind permanent scars which cause serious disfigurement.

Treatment.—**Preventive.**—"Cleanliness of person, clothing and habitation, good food, the use of pure drinking-water, and a careful attention to the sanitary condition of the locality, avoiding overcrowding and contact with the disease in men or animals, are the best means of prevention" (Sir Joseph Fayrer).

Curative.—Hygienic, dietetic, and therapeutic measures which tend to improve the tone of the organism are of the first importance in the treatment of this disease.

The parasitic origin of the disease suggests the utility of antiseptics, and iodoform, tincture of iodine, and the preparations of mercury have been used with advantage.

In the severe cases cauterization with Vienna paste, nitric acid, or the Paquelin cauterium may be employed. When the eruptions are discrete they may be totally extirpated.

TROPICAL ULCER. (H. TUHOLSKE, M. D.)

Definition.—Tropical ulcer (*Phagedæna tropica*; Aden ulcers; Malabar ulcer, etc.) is a disease of tropical countries, and is more common in low-lying, swampy, malarial regions. It has its point of origin in some breach in the continuity of the skin, and from this, as a center, it extends rapidly both in area and in depth.

Symptoms.—The ulcer has its starting-point in some breach in the continuity of the skin which allows the entrance of the specific microbe. A vesicle or bulla first forms, and from this the phagedenic process extends. The parts surrounding the primary lesion become red and edematous, and then slough away, leaving an ulcer which secretes an abundant, sanious, purulent discharge. The activity of the process now diminishes, the borders of the ulcer become hard and resisting and have the characteristic appearance of an ordinary chronic ulcer, which, after a number of weeks, gradually cicatrizes. It may break down again if the patient's vital powers become depressed. This is what is known as the *mild type*.

In the *malignant type* the symptoms are of much greater severity and manifest themselves with greater rapidity. In two or three days the affected part is covered by a slough, the surrounding tissues become involved in the gangrenous process, and the ulceration extends rapidly in area and in depth. The soft tissues rapidly yield to the destructive process, the skin, subcutaneous tissues, vessels, and nerves being destroyed, the articular cavities opened, and even the bones may become involved in the later stages.

Etiology.—Boinet, who has made an exhaustive study of the disease, believes it to be due to a microbe which inhabits mud and water in the infected districts. It is always worse in swampy, low-lying districts where malaria is prevalent. It occurs most frequently in the natives of the tropics, though foreigners are not immune. Anything which lowers the vitality and resisting power of the organism may be considered as a favoring factor.

Pathology.—According to Boinet, the pus of the ulcer is inoculable, and he claims to have discovered the specific microbe and to have successfully cultivated and inoculated it into animals.

Prognosis.—This depends upon the type of the disease and the general condition of the person affected. In the mild form the ulcers usually heal, though they may remain in an atonic condition for weeks or months before cicatrization takes place.

Treatment.—Rest, nutritious diet, and good hygienic surroundings are the principal indications for treatment. In the milder forms simple antiseptic dressings, such as iodoform and corrosive sublimate, are sufficient for local treatment. When the phagedenic element is marked cauterization with some one of the various caustics or the actual canterly is indicated.

CLASS VI.—NEUROSES.**HYPERESTHESIA.** (ARTHUR VAN HARLINGEN, M. D.)

Hyperesthesia is an exaggeration of the sensibility of the skin. Hyperesthesia differs from dermatalgia in that, while in the latter the pain is spontaneous, in hyperesthesia some external influence, however slight, is required to excite the painful symptoms. Hyperesthesia and dermatalgia, however, often coincide.

There are two varieties of hyperesthesia. The first is perhaps more an ideal than a practical variety of the disease. It consists in such a modification of sensibility that the perceptive centers receive more acute impressions from contact with external bodies and judge with more delicacy the character of their impressions (Leloir). This variety is observed most characteristically in hypnotic sleep, particularly in that condition which Charcot designates by the name of the somnambule state. The sensitiveness becomes then remarkably acute. The least breath or the slightest current of air causes shivering. Similar symptoms are shown in the course of certain mental diseases as a result of the action of drugs, etc.

The second variety of anesthesia, which is more common and of more importance to the practitioner, is the painful hyperesthesia which is characterized by a more vivid impressionability of the skin, coupled often with less power of distinguishing the qualities of the agents producing the impression. The greater acuteness of sensibility is manifested here, as Leloir says, by pain, and not by tactile impressions, which, on the contrary, are more or less blunted. As soon as the hyperesthesia appears the tactile sense loses its acuteness.

Hyperesthesia may affect a small or a considerable portion of the surface of the skin. It may involve the whole of one side of the body, as is observed in hysteria, or become general, as in certain cases of spinal irritation and neurasthenia.

Leloir quotes from Cazenave the case of a man whose entire skin was in such an irritable condition that he could endure only very loose and light clothing. He also gives, from his own experience, the case of a man who had become neurasthenic from excess of mental work and sorrow, whose skin was the seat of the most intense hyperesthesia, appearing in paroxysmal attacks. In the intervals of these attacks the hyperesthesia, which had involved the whole body, except the head, the neck, the legs, and the feet, was relatively endurable, and consisted of a sensation of heat, which contact with objects would increase more or less. But when the attacks appeared (and these came on irregularly), the hyperesthetic symptoms became unbearable. They were located generally in the abdominal region, but at times were felt with greatest intensity on the back and upper limbs, very often on the buttocks and thighs; and in such cases they rendered all manual labor practically impossible. These paroxysms of hyperesthesia came on suddenly like an electric shock. All at once the parts affected, as the result of the least touch or the slightest pressure, would become the seat of prickings, dartings, and sensations of burning so intolerable that the patient writhed with the pain, at the same time uttering pitiful cries. The only thing which temporarily soothed these paroxysms was an immersion for one or two hours in a lukewarm bath. The patient was finally cured by the application of chloroform compresses upon the hyperesthetic parts, by lukewarm spinal douches, by the prolonged use of valerianate of ammonium, quinine, the bromides, and arsenic, by hygiene, mental rest, and electro-therapy.

More frequently the spots of hyperesthesia are of limited area. Sometimes they are accompanied by patches of anesthesia. This is particularly the case in leprosy and locomotor ataxia.

The **causes** of hyperesthesia are very numerous. It may depend upon a functional trouble or upon various lesions of the central or peripheral nervous system. It frequently occurs in the course of hysteria, neurasthenia, etc., mental diseases, lesions of the peripheral nervous system, affections of the brain and of the spinal cord. Chronic poisoning by lead, arsenic, alco-

hol, carbonic acid, etc. is sometimes accompanied by hyperesthesia. In some cases hyperesthesia is due to peripheral neuritis. The ingestion of certain poisons is said by Leloir to be followed sometimes by intense hyperesthesia, and this affection constitutes one of the principal symptoms of acrodynia.

The **treatment** of hyperesthesia must, of course, include removal of the cause wherever this can be ascertained and when such a result is practicable. The local treatment is similar to that of dermatalgia.

PRURITUS. (ARTHUR VAN HARLINGEN, M. D.)

Pruritus is a functional cutaneous affection, manifesting itself solely by the presence of the sensation of itching, without structural alteration of the skin. The various forms of itching encountered in the course of many diseases of the skin accompanied by organic changes have been mentioned elsewhere in this work in connection with the diseases in which they occur.

Symptoms.—Pruritus, it must be remembered, is a distinct affection. The first thing that occurs is itching, and any lesion of the skin visible later is the result of the scratching to which this symptom gives rise. The feeling varies in different cases. Sometimes the patient describes it as being as if a piece of rough flannel were in contact with the skin. At other times it is said to be like the crawling of insects or like a tingling sensation, with a desire to scratch. It may be slight or so severe as to be almost intolerable. It is most frequent in middle life and old age (the latter is one variety of the "prurigo senilis" of old writers, the other being lousiness).

The itching arouses an irresistible desire to scratch and rub, with the result that the surface is generally seen to be somewhat roughened, hyperemic, and excoriated in a slight or marked degree. In other cases the external signs are slight, so that, were it not for the statement of the patient, the presence of any marked disorder might be doubted. The itching is usually intermittent, and is always worse at night. Pruritus rarely invades the whole body at one time, though various regions may in turn be attacked. In most cases it occurs in certain localities, and chiefly the trunk, scalp, genitalia, and anus.

Pruritus vulvæ must not be confounded with other itching affections of the female genitals. The itching may be seated in the labia, vagina, or clitoris, and is an exceedingly distressing affection. It is more apt to occur in middle life or in old age. In children it is often caused by the presence of ascarides in the rectum and about the anus.

Sometimes pruritus vulvæ is accompanied by occasional nervous sensations, starting from the clitoris and neighborhood and radiating through the body. The sensation is not, strictly speaking, one of itching, but rather a nervous crisis.

Pruritus scroti is the form of genital pruritus generally met with in the male. It may involve this region alone or may extend along the perineum to the anus. The orifice of the urethra may also be the seat of the disease. The sensations are usually intensely annoying, and cause the patient to rub and scratch violently. It is worse at night, and is aggravated by warmth. In pruritus scroti the same radiating nervous impression is at times observed as that which occurs in pruritus vulvæ.

Pruritus ani occurs in both sexes, and in children as well as adults. The itching may be around the orifice or just within the rectum. In middle-aged or elderly persons it is often associated with hemorrhoids. It is, if possible, more intolerable than any other of the local varieties. Sometimes it is con-

stant, but more often it comes and goes from time to time, and is also worse at night.

The **causes** of pruritus are extremely varied, and it is important to keep this in mind, for the cause must in most cases be removed to obtain a cure. Gouty subjects and persons in whom the lithemic diathesis is more or less marked are predisposed to attacks of pruritus. The disease may be caused by physiological changes, as gestation, or by any irregularity of the menstrual function in young women. Occasionally it is associated with hysteria, and it is sometimes met with at the climacteric period. Leukorrhœa is a common cause of vaginal and vulvar pruritus, and hemorrhoids of pruritus ani. Organic diseases of the uterus and ovaries are at times accompanied by it. Pruritus is likewise met with in many cases of jaundice, and is sometimes a distressing symptom. Various diseases of the nervous system are accompanied by pruritus. Gastro-intestinal derangement, constipation, genito-urinary diseases in both sexes, and, finally, the ingestion of certain medicines, and notably of opium, may give rise to the affection. It would hardly be necessary to add, were not the mistake so often made, that true pruritus is in no way caused by either vegetable or animal parasites. When these are present it is by accident or the disease is not pruritus.

The **diagnosis** of pruritus presents no difficulties. It is a disease of the skin, without any primary sign of alteration in its structure. Whatever lesions may be present are secondary and the result of scratching or of strong applications made by the patient. The diagnosis depends upon the patient's statement as to the subjective symptom of itching. Pruritus is most apt to be confounded with pediculosis, the secondary symptoms of the two diseases, scratch-marks and excoriations, being similar. These, however, are more marked and definite in character in pediculosis. The finding of lice will settle the question. They are to be carefully looked for in the clothing, and every case of so-called pruritus should be suspected to be pediculosis until the absence of the parasite is demonstrated.

The **prognosis** of pruritus should be guarded. The disorder, as a rule, is obstinate, often extremely so. The prognosis often depends largely upon the cause and our ability to remove it. In grave cases melancholic symptoms may be present. Occurring in the aged, the prospect of ultimate cure is poor. The local forms of pruritus, depending, as they often do, upon well-defined and removable causes, are much more easily managed.

The **treatment** of pruritus is a matter demanding careful consideration and study in each individual case. A successful result will, in most cases, only be obtained by recognition and removal of the cause. Constitutional and local remedies are both demanded. The internal remedies are to be directed against the cause, whatever the nature of this may prove. If constipation exists, the bowels are to be suitably regulated, salines being usually preferable. If there is flatulence or dyspepsia of any kind, such a diet is to be prescribed as shall overcome the digestive difficulty, and coarse, irritating, and indigestible foods are, in all cases, to be avoided. Exercise and fresh air are beneficial. A sojourn at some mineral springs, as Saratoga, Richfield, or some of the Virginia Springs, may at times be recommended.

As regards drugs, the usual tonic and alterative medicines are to be employed. Irregular menstruation must be treated by the judicious use of iron or other remedies, cod-liver oil, etc. Quinia and strychnia are sometimes of use. Recourse may be had to bromide of potassium and chloral, alone or together, in order to subdue general nervous symptoms. Morphia should in no case be used, as it tends to aggravate the itching.

External treatment affords great relief, and is to be used in all cases. Cold and hot douches, used alternately, or hot water, applied as hot as it can be borne, or plain vapor-baths, are often useful. Medicated baths, containing three to six ounces of bicarbonate of sodium or two to four ounces of carbonate of potassium or borax, to thirty gallons of water, will at times afford relief. Besnier recommends starch-baths and sponging the whole body with a mixture of aromatic vinegar two hundred and fifty parts and carbolic acid five parts. After this application the surface of the skin is to be powdered with ninety parts of starch and ten parts of salicylate of bismuth or salicylic acid. Sulphuret of potassium and sulphur vapor-baths are sometimes used with success. Inunctions with a bland oil, as almond oil, may be practised after these baths.

Lotions of various kinds are the most generally useful applications in pruritus, and those containing carbolic acid are by far the most generally efficient. Carbolic acid, in fact, is worth all the other remedies put together as an antipruritic, and should always be preferred to begin with—unless some reason exists against its use. It may be employed in lotion, in the strength of five to twenty grains to the ounce of water, with a little glycerine. In the following lotion the antipruritic action of potash is added to that of carbolic acid:

R̄. Acidi carbolici,	ʒj;
Potassæ fusæ,	ʒss;
Aquæ,	fʒviiij.—M.

Bronson¹ recommends the following "antipruritic oil," which he has largely employed for some years both in the local and in the so-called universal forms of the disease, with no more untoward results (although much stronger than the lotions ordinarily employed) than now and then a trifling dermatitis when through oversight the patient has been allowed to make the applications too frequently or has continued them too long. The former is:

R̄. Acid. carbolic.,	ʒj-ij;
Liq. potass.,	ʒj;
Ol. lini,	ʒj.—M.

An alkali and an effective keratoplastic agent (the linseed oil) serve both as adjuvant and corrigent to the action of the carbolic acid. To correct the disagreeable odor of the linseed oil a drop or two of the oil of bergamot may be added.

When other remedies fail, oil of peppermint or menthol may be applied, especially over circumscribed itchy localities, avoiding the mucous and mucocutaneous surfaces, where such applications are apt to give pain. Morphia in solution, one to three grains to the ounce; cyanide of potassium, fifteen to thirty grains to the pint; dilute hydrocyanic acid, from one to four drams to the pint; chloroform; chloroform and alcohol, a dram to the pint; lead-water; dilute ammonia-water; dilute nitric acid, ten minims to the ounce of water, acetic acid, or vinegar; chloral lotion, ten to thirty grains to the ounce of water,—are all serviceable remedies which may be tried alone or in succession in troublesome cases. "Liquor picis alkalinus" is an excellent remedy; it is composed as follows:

R̄. Picis liquidæ,	ʒij;
Potassæ causticæ,	ʒj;
Aquæ,	fʒv.—M.

¹ *N. Y. Med. Record*, Oct. 14, 1893.

The potash is to be dissolved in the water and gradually added to the tar with rubbing in a mortar. It should be used at first in the strength of two or more drams to the pint of water, gradually increasing.

In some localized forms of the disease ointments are to be used in preference to lotions. The following is a good formula :

R_y. Acidi carbolici, gr. xv-xx ;
Ung. zinci oxidi, ʒj.—M.

In pruritus of the female genital organs water as hot as can be borne, sponged upon the parts, forms an admirable anesthetic, and should be used in all cases, whatever other treatment is added. Sponging with hot water may be followed by the application of one of the following lotions: carbolic lotion, as given above ; sulphurous acid or solution of alum in barley-water. A lotion containing a dram of the sulphite of sodium, four drams of water, and an ounce of glycerine may be painted on. Sometimes emollient poultices, particularly a poultice of freshly-made almond meal, which evolves a small quantity of hydrocyanic acid, will be found very soothing. Such poultices should always be sprinkled with boric acid.

Injections of sulphate of zinc, five to ten grains to the ounce of water, used on alternate days, with similar injections of bichloride of mercury, 1 : 2000, while the external genitals are bathed once or twice daily with one of Eichoff's corrosive-sublimate soaps, form together a useful adjuvant to any treatment which may be employed.

When the affection is marked by nervous crises, starting from the clitoris and radiating through the body "like a shock," as patients describe it, a little finely-powdered cocaine hydrochlorate dusted over the clitoris and neighboring parts will give instant though temporary relief, and will afford time for the use of other remedies. The following formula may be employed :

R_y. Pulv. cocain. hydrochlorat., ʒj ;
Pulv. acid. boric., ʒiij.—M.

Pruritus ani is usually connected with congestion and enlargement of the hemorrhoidal veins. The bowels should be kept open, and the following injection should be used after each stool :

R_y. Pulv. zinci sulphat.,
Pulv. aluminis, āā. ʒj.—M.

Heat in an earthen vessel until all the water of crystallization is driven out. Then divide into eight powders. Dissolve one in an ounce of water for each injection.

L. H. Adler, Jr., of Philadelphia, recommends the daily injection into the rectum by the physician of the following :

R_y. Ext. hamamelis fld., f ʒj ;
Ext. ergotæ fld., f ʒij ;
Ext. hydrastis fld., f ʒij ;
Tinct. benzoini comp., f ʒij ;
Olei olivæ carbolat., f ʒj.—M.
(5 per cent. carbolic acid).

Sig. Shake well before using. One to two drams as an injection.

In addition to these injections, pruritus ani is usually best treated by oily preparations or ointments. An oil containing one hundred grains of carbolic acid to the ounce of oil of sweet almonds I have found very efficacious.

The following ointment, suggested by Dr. J. V. Shoemaker of Philadelphia, I have also found of value:

R̄. Sulphur. præcipitat.,	ʒj;
β-naphthol.,	gr. x;
Morphiæ sulphat.,	gr. ss;
Bismuthi subnitrat.,	ʒss;
Ung. zinci oxidi,	ʒss.—M.

Cocaine in 10 per cent. solution gives temporary but complete relief. It is useful for patients to keep on hand in case of emergency when the usual remedies cannot be applied.

In pruritus scroti the following prescription will be found useful:

R̄. Bismuthi subnitrat.,	ʒij;
Acidi hydrocyanici dil.,	fʒij;
Mist. amygdalæ,	fʒiv.—M.

In the pruritus of jaundice mercurial ointment is said to be of value. Also lotions of chloroform (one dram to five of glycerine), cyanide of potassium (one dram to the pint of water), and acetic-acid baths or lotions in the strength of half a pint of the acid to three gallons of water, or about two quarts of strong vinegar to an ordinary thirty-gallon bath. I may say here that a solution of benzoic acid alone or with an alkali is known to aid in the dispersion of bile-pigment, and may therefore aid in the relief of this form of pruritus.

DERMATALGIA. (ARTHUR VAN HARLINGEN, M. D.)

Under the designation dermatalgia or dermalgia an affection, or rather a condition, of the skin is described in which pain is experienced without any appreciable lesion. It is analogous in this respect to pruritus, in which sensation is likewise perverted without any perceptible change in texture.

Symptoms.—Arnozan, in his article on "Dermalgie" in the *Dict. Encyclopædique*, remarks that to feel pain spontaneously, and to suffer it in consequence of a slight impression which in a normal state would produce no effect, are two different physiological acts. The one will always be announced by the patient himself; the other can frequently be discovered only by methodical investigation. Doubtless they often come together at certain points; often, also, it will be difficult to discern whether the pain in a given case is truly idiopathic, or whether it is dependent upon a very feeble excitation (contact with the air, temperature, etc.).

The pain in dermatalgia is peculiar. It includes continuous sensations of burning, stinging darting pain, varying, however, in degree at different times, and usually much aggravated by touch or pressure. Even the slightest pressure of the clothing may bring on agonizing pain. Other modifications of cutaneous sensibility are frequently associated with dermatalgia, in particular anesthesia. When, says Leloir, a nerve is inflamed, irritated, or cut, the resulting stimulus causes a pain which is referred, as all other sensations, to the periphery (dermatalgia); but it has become impossible to transmit to the centers through this injured nerve-trunk any sensitive impressions (anesthesia).

Dermatalgia is rarely generalized. Usually only a small area of the skin is affected; it is usually seated upon the hairy portions of the surface, the scalp, and the lower limbs. In dermatalgia resulting from nerve-wounds, the "causalgia" of Weir Mitchell, the palms of the hands and the dorsal

aspect of the feet are chiefly affected, and the affection may be accompanied by the condition known as "glossy skin."

Cases of intermittent dermatalgia have been reported, but usually (unless in the case of nerve-injuries, to which allusion has just been made) the affection lasts for some days or weeks, and then disappears. Brocq cites a case of dermatalgia limited to the external surface of the left thigh in an old syphilitic. It had lasted some months, but was relieved by antisyphilitic treatment.

Dermatalgia may be symptomatic of some precedent injury or some systemic disorder, as syphilis, diabetes, polyuria, possibly malaria, hysteria, anemia, etc. It is at times the result of exposure to cold, and cases of causalgia in connection with frost-bite of long standing have been reported. Dermatalgia is frequently a symptom of trophic lesions of the skin. As Arnozan has remarked, the trophoneuroses are often accompanied by pains disproportionate to the anatomical lesion.

Dermatalgia occurs in connection with rheumatism. In addition to the pain manifestly dependent upon lesions of the skin, rheumatism may excite dermatalgia without there being any other symptom than the pain to reveal its location in the skin. Such cases occur especially in the obscure forms of rheumatism. "Some of these patients," says Besnier, "feel painful sensations of a shooting character, and especially multiple prickings, which invade all or a part of the integument, like sparks travelling through the skin. In others there is a true dermatalgia, transitory or permanent, localized most frequently upon the head, the trunk, and the lower limbs."

In some cases dermatalgia is a symptom of some affection of the nervous system, as locomotor ataxia.

The **diagnosis** must be made between dermatalgia and the deeper-seated painful affections resembling it, as ordinary neuralgia, muscular rheumatism, etc. It must be remembered that the painful sensations are very superficial in well-defined areas of the skin itself, and not deep seated, as in the other affections.

The **treatment** of dermatalgia must be general and directed to the patient's constitutional condition. The rheumatic or gouty condition, if present, must be combated; anemia, chlorosis, digestive and uterine disorders, in fact, whatever condition is likely to arouse reflex nerve-irritability, must be inquired after and if present treated. Local treatment is not usually very efficacious, but of course all means must be tried. Galvanism, the application of a blister to the part, morphia and other sedatives, may be applied. Tincture of aconite, pure with caution, or diluted, would seem likely to give relief. This should be applied on compresses firmly bound to the part, for firm support by bandages seems itself to assuage the pain.

ANESTHESIA. (ARTHUR VAN HARLINGEN, M. D.)

Anesthesia is characterized by a complete abolition, or by a diminution, of the sensibility of the skin. It is rarely complete, but is commonly partial, distributing itself according to the lesion which causes it. The various forms of anesthesia will be found described in the text-books on diseases of the nervous system. The very brief space allowed for these articles will not permit any full description, but I desire to call attention to the importance of understanding the symptoms of anesthesia in its various forms in order to the intelligent study of the large class of neuroses of the skin, and, in particular, of the hysterical forms of skin-disease.

Anesthesia occurs in connection with leprosy, hysterical disorders of the skin, chronic poisoning by bisulphide of carbon, lead, mercury, alcohol, etc. Certain systemic affections, some of the continued fevers, and affections of the spinal cord and cerebral cortex are likewise accompanied at times with anesthetic symptoms.

CLASS VII.—DISEASES OF THE APPENDAGES OF THE SKIN.

A. DISEASES OF THE SWEAT-GLANDS.

I. FUNCTIONAL DISORDERS.

HYPERIDROSIS. (LOUIS HEITZMANN, M. D.)

Definition.—By the term “hyperidrosis” is meant a disturbance in the functions of the sweat-glands by which their secretion, the perspiration, is increased to a greater or less amount, and this is continued for a varying length of time entirely distinct from high temperatures, excessive bodily exercise, or general systemic affection, such as fevers of any kind.

Symptoms.—Excessive perspiration may be either general, affecting the whole body, or localized, confined to certain regions: the former is due either to one of the conditions above mentioned or to obesity, or is found in nervous and excitable individuals at the slightest cause. Its treatment must be directed principally to the primary lesion.

Of much greater importance to the dermatologist is a localized hyperidrosis which may affect almost any part of the body, but is most frequently found on the palms of the hand, the soles of the feet, under the axillæ, around the genitals, and on the face and the hairy scalp. It may be symmetrical or unilateral, taking up only one side of the body. The amount of perspiration exuded greatly varies, being sometimes only slight, at other times excessive. It is especially on the palms, the soles, and the axillæ that the amount is sometimes so large as to cause the greatest distress, interfering in the former instance with the patient’s occupation. Upon the soles it is even more disagreeable and distressing than upon the palms. The sweat is exuded continually, so that the stockings, and even shoes, soon become saturated with moisture. The epidermis becomes macerated and peels off, leaving a tender surface exposed, so that fissures, especially between the toes, which are very painful, may result. In the most pronounced condition such patients are entirely unable to walk.

Etiology.—The real cause of hyperidrosis is as yet unknown. An increased amount of perspiration is always accompanied by a dilatation of the capillary blood-vessels, especially of the sudoriparous glands and the papillæ. As the secretion of sweat depends upon a nervous influence, being probably under the direct action of a special nervous apparatus, in that various nerves contain fibers which act upon the epithelia of the sweat-glands, any disorder of this apparatus may cause the affection. The local apparatus is

under control of the central nervous system, and it may arise from a paralysis of the sympathetic or an irritation of the cerebro-spinal nerves.

The **prognosis** should be guarded: although we will succeed in curing a large number of cases, especially if not of too long standing, some will resist all treatment.

Treatment.—In every case of long standing the constitution of the patient will be found to be more or less affected, and in such cases it is of greatest importance to build up the system by means of tonics, such as iron, strychnine, arsenic, cinchona, or the mineral acids, and to regulate the mode of living. In nervous individuals the bromides may also have a good effect. Belladonna or atropine frequently has a direct influence in checking the secretion for a short time, and can be given either in the form of a pill or a solution; the dose of atropine should vary according to necessity from $\frac{1}{120}$ to $\frac{1}{50}$ of a grain, given one to three times daily.

Although we can in this manner benefit the constitution of the patient, and thus help in relieving the affection, it is the local treatment which will do the greatest amount of good and should invariably be employed. In the milder cases dusting-powders or astringent applications will work well. Salicylic and boric acids, oxide of zinc, starch, talcum, naphthol, tannin, alcohol, and alum may all do good. One of the best is a dusting-powder composed of salicylic acid, oxide of zinc, and talcum:

℞. Acid. salicylic.,	ʒss to ʒijss;
Zinc. oxidī,	
Talc. venet.,	āā. ʒj.

This should be dusted on freely every few hours.

Astringent applications—consisting of 1 part of tannin to 250 parts of alcohol or water: ℞. Acid. tannic., gr. viij; Alcohol. fort. or aquæ destillat., ʒjv, or hypermanganate of potash in $\frac{1}{2}$ to 1 per cent. watery solutions—are good.

In hyperidrosis pedum of mild degree these remedies will also be sufficient. In the severer forms, however, we must resort to stronger means, and among these the diachylon ointment of Hebra is still the best. The ointment is made by mixing litharge—that is, oxide of lead—and pure olive oil, 1:4, together in a water-bath over a slow fire and adding to it some lavender oil. The mode of application is the following: A piece of linen large enough to envelop the foot is thickly covered with the ointment and applied to the foot after the latter has been thoroughly cleansed and dried; the toes are each separately enveloped with smaller pieces, and clean stockings are put on. The ointment is left on for twenty-four hours, after which time the pieces of linen are removed, the foot thoroughly rubbed with a dry piece of cotton and powdered, and fresh pieces immediately applied. This is continued for ten days or two weeks, after which the foot is simply powdered with starch, talcum, or salicylic-acid powder. Within a few days the epidermis exfoliates in thick crusts or scales, leaving a white, healthy skin, the hyperidrosis being cured. Now the foot can be washed, though it is advisable to immediately powder it again for a number of days. Should the first course of treatment not be sufficient for a perfect cure, it can be repeated a second and even a third time.

Another good treatment for hyperidrosis of the feet is the application by means of a brush of a 3 to 5 per cent. chromic-acid solution in water, the foot having previously been well cleansed and dried. Two or three applications are usually sufficient for a cure, or this can be repeated after two weeks. As

long as there are no fissures or ulcers present there is little danger of absorption of the chromic acid, although albuminuria has been observed once or twice; where fissures are found, they must be first cured, since lymphangitis or dermatitis may otherwise result.

ANIDROSIS. (LOUIS HEITZMANN, M. D.)

Definition.—Anidrosis is the opposite of hyperidrosis, being characterized by a diminution or total cessation of the perspiration, which is accompanied by a dry and rough condition of the skin and a disagreeable sensation of pricking, itching, or tension. The skin in such cases easily becomes cracked and fissured.

Symptoms.—A diminution of perspiration can be found in certain individuals, either congenitally or acquired, as a functional disorder of the sweat-glands, which in them are very inactive: these persons will secrete less perspiration under conditions in which the sweat is usually increased in healthy individuals, such as warm weather, active exercise, or a Turkish bath. Anidrosis proper, however—that is, a total cessation of perspiration, which may be either localized or general—is found only as a secondary condition to other affections, both cutaneous and constitutional, such as ichthyosis, chronic indurated eczema, psoriasis, leprosy, xeroderma pigmentosum, diabetes, cancer, and tuberculosis or injuries to the spinal cord, and disorders of the nervous system in general.

It is still an unsettled question whether the perspiration has really ceased for the time being in places affected with such cutaneous disorders, or whether the parts only feel dry on account of the pathological conditions of the skin. The affection in these cases will last as long as the disease producing it, disappearing with its cure. It extends over the same area as the original disorder. In diabetes, tuberculosis, and fevers it is general, in the other conditions local.

Treatment.—In all disturbances in which anidrosis is only secondary the original disease must of course be treated. In addition, we must try to stimulate the glands by sweat-producing remedies, such as the ingestion of hot water, hot baths, external application of heat, and jaborandi or its alkaloid, pilocarpine, which latter can be given subcutaneously. Massage will also stimulate the glands.

BROMIDROSIS. (LOUIS HEITZMANN, M. D.)

Definition.—Bromidrosis, osmidrosis, or stinking sweat is a functional disorder of the sweat-glands which is characterized by the production of an offensive, badly-smelling perspiration.

Symptoms.—The regions most frequently affected are those in which the sweat is secreted in excess, especially the axillæ, the genitals, groin, and feet. The perspiration of every individual has a more or less characteristic odor, as can easily be seen by the ability of a dog to trace a certain person. It is especially pronounced in certain races, such as the negro race, as well as in certain systemic diseases, such as the exanthemata; and this has frequently enabled physicians to diagnose the case before examining the patient. After the taking of different medicines, too, there is often a peculiar odor to the perspiration.

All such cases, however, do not properly belong to bromidrosis, which term is applied only to a continuous fetid smell, which is most pronounced in

the regions above mentioned, and is due to a decomposition of the sweat and the sebaceous matter after secretion, intensified by the warmth and moisture always present around these parts. In some cases the odor is particularly repugnant, and this is perhaps most frequently found with an increased perspiration of the feet—the hyperidrosis pedum. In all such cases, if a microscopical examination is made, we will find a large number of different bacteria present, which undoubtedly intensify the odor to a marked degree, hastening the process of decomposition.

The **cause** of the affection is frequently nothing but uncleanness, especially in persons affected with bromidrosis of the feet who have to stand or walk considerably, thus naturally increasing the amount of perspiration. In the severer cases, however, the nervous system is often at fault. Emotional disturbances, or even sexual excitement, can be the cause in some cases.

Treatment.—Should any cause be discovered, it is of primary importance that this should first be treated. Extreme cleanliness is of the utmost importance. All remedies advised for hyperidrosis, but more especially antiseptics, such as salicylic acid, boric acid, weak corrosive-sublimate solutions, or chromic acid, will be of great benefit.

CHROMIDROSIS. (LOUIS HEITZMANN, M. D.)

Definition.—Chromidrosis is a functional disturbance of the sweat-glands in which the perspiration is variously colored. It is a rare disease, consisting of a more or less profuse perspiration, which may have a red, yellow, blue, black, or green tint.

It is not so very infrequent that the perspiration in certain regions of the body, especially the axillæ and genitals, assumes a reddish color, especially in a warm, moist climate: this is caused by different micro-organisms, and cannot properly be called a disease.

Symptoms.—Chromidrosis proper may occur on any part of the body, but is more frequently seen on the face, chest, abdomen, axillæ, hands, arms, and feet, and is more common in females, especially the unmarried, than in males. The color has been attributed to various chemical substances, such as indican, Prussian blue, cyanogen, iron, as well as to different parasitic vegetations. In many cases the persons affected are weak and debilitated or have some nervous or sexual disorder. It has also been known to follow great excitement and shock. Some cases have been reported in which it has occurred regularly every month with the menstrual periods, and disappeared again with the stoppage of the flow.

Some interesting cases of this disorder are on record. In one, affecting an old man of seventy-two years, who suffered from paralysis, the right half of the scrotum and inner side of the right thigh secreted a bluish-black sweat. The color adhered to the epidermal scales, and was free from bacteria, but was found to contain indigo. In another, affecting a healthy woman of twenty-four years, a brownish-yellow coloration was noticed upon the backs and palms of the hands, affecting first the right and then the left hand, commencing with the beginning of menstruation and invariably disappearing with the periods. In other cases the eyelids were affected, secreting a bluish-black sweat. In some, especially those occurring in the axillæ, the hairs were found to be thin and brittle, and to contain small hard masses in which numerous bacteria, especially cocci in zoöglea form, were found.

Cases of so-called accidental chromidrosis, in which the color is due to the excretion of substances taken into the system, have also been known to occur.

Here the colored sweat may be very abundant for a short time, but will disappear with the removal of the cause.

The **treatment** must be directed to improving the general condition of the patient and removing any cause which might be found. In females the anemia, chlorosis, hysteria, or uterine disorders, if any are present, must be treated, and this will of itself usually cause the affection to disappear.

URIDROSIS. (LOUIS HEITZMANN, M. D.)

Definition.—Uridrosis is a functional disorder of the sweat-glands in which the perspiration contains some urinary elements, especially urea.

This is a very rare affection, though urea in small quantities has been found in the sweat of otherwise healthy persons. When these urinary elements are present in large amounts the perspiration has the odor of urine. The affection shows itself in the formation upon the skin, especially the face and hands, of whitish or colorless scales or a crystalline deposit, which is adherent to the surface, and upon chemical examination is found to contain urea.

Such a condition has occasionally been found in severe constitutional affections, such as cholera Asiatica or advanced renal diseases, especially atrophy of the kidneys or suppression of urine, with uremic symptoms. Under the influence of jaborandi large quantities may also be secreted. Frequently the affection has preceded the fatal result of the case. It requires no treatment of itself, since the removal of the cause, if this is possible, will be sufficient to stop the symptoms.

Other abnormal conditions of the perspiration have from time to time been noticed. Of these *hematidrosis*, the so-called sweating of blood, where the blood is probably extravasated into the sweat-glands and exuded upon the free surface of the skin without traumatism, as well as *phosphorescent* or *luminous sweat*, perhaps due to the action of bacteria, simply require mention.

II. ORGANIC AFFECTIONS.

HIDRADENITIS SUPPURATIVA.¹ (LOUIS HEITZMANN, M. D.)

Definition.—Hidradenitis suppurativa is a suppurative inflammation of a sweat-gland, resulting in its destruction and the production of a scar.

Symptoms.—The lesions may be single or multiple, and occur most commonly in the axillæ, anus, nipple, scrotum, and labia majora, where they are generally single, and on the face, neck, extremities, or trunk, where they are multiple. The affection begins as a deep cutaneous nodule, which does not at first involve the subjacent tissue, feels like a bird-shot imbedded in the subcutaneous tissues, is painless on pressure, and occasions no subjective symptoms. It enlarges slowly, and by the end of one or two weeks attains the size of a pea and produces the appearance of a small round tumor. The skin over it is now reddened and pressure is slightly painful. If the tumor is incised, a drop or two of pus will exude; if it remains undisturbed, the middle of the tumor appears yellowish in the course of a few days, the epidermis breaks down, and one or two drops of a creamy pus, with some blood

¹ S. Pollitzer in *Morrow's System of Dermatology*.

and small shreds of tissue, flow from one or more minute openings. If the secretion be not removed, a discolored adherent crust forms, which falls off after a few days, and a dark, reddened skin under it remains pigmented for many weeks, a slightly depressed scar ultimately marking the site of the tumor. Sometimes several nodules develop simultaneously close to each other, coalesce, and form firm, flat tumors. The disease is chronic, lasting sometimes for years.

Etiology.—Nothing is known as to the cause of the disease, although uncleanness, irritating applications, and some systemic affections have been considered as etiological factors.

Pathology.—The pathological product is an acute diffuse inflammation of the sweat-gland and periglandular tissue, terminating in suppuration and destruction of the gland. Whether the disease is of infectious origin or not is not determined. The tumors consist of a dense aggregation of small, round bodies and epithelia and large multinuclear masses resembling so-called giant-cells. The round bodies are distributed throughout the entire tumor, but are most abundant at its periphery. The giant-cells are numerous, greatly varying in size and shape, and occur in clusters. Sweat-glands are absent from the middle of the tumor. The hair-follicles are unaffected.

The **diagnosis** can be easily made from the course of the disease: it might at first be confounded with syphilis, furuncles, or acne, but its character will soon be cleared up.

The **prognosis** is not bad, because the affection tends to spontaneous cure, even if only after the lapse of years.

The **treatment** must be conducted on general principles, as we have no definite knowledge of its cause. Tonics, such as iron, quinine, and arsenic, may be useful. As to the local treatment, it will be well to incise each nodule as it forms, and to wash the affected region with a lotion of salicylic acid or corrosive sublimate in alcohol, though at best the disease will last for a considerable time.

MILIARIA AND SUDAMINA. (A. R. ROBINSON, M. D.)

Synonyms.—Miliaria rubra; Miliaria alba; Lichen tropicus; Prickly heat; Miliaria crystallina.

Much confusion exists in the use of these terms both in America and in Europe. In America miliaria and prickly heat (*lichen tropicus*) are generally used to signify the same disease, whilst in Germany sudamina (dewdrop-like eruption) and prickly heat are synonymous. Kaposi uses the term miliaria crystallina for the dewdrop-like eruption, and sudamen for our miliaria or lichen tropicus. The latter he regards as an eczema, the lesions depending on sweat or serum. Tilbury Fox states that miliaria and sudamina are the same disease, the intensity of the inflammation causing the difference in symptoms. If I continued to quote other well-known authorities, it would be clear that the greatest amount of confusion exists in reference to these diseases. One author thinks the dewdrop-like eruption an exudative disease, and calls it miliaria; another thinks it arises from retention of sweat in the epidermis, and calls it sudamina; one regards miliaria as a form of eczema, with the exudation arising from the papillary vessels; and another considers it an inflammatory affection of the sweat-glands, and the contents of the lesions as consisting of sweat; and a third regards lichen tropicus as a different disease from miliaria rubra or alba. A description of the different forms of eruption included under the several terms used, together with an

account of the pathological process connected with the formation of the lesions, will, I trust, lead to less confusion in the future. In 1884, I described the changes occurring in the tissues in these diseases, and endeavored to show that the dewdrop-like eruption depended upon retained sweat lying between the corneous layers after rupture of the sweat-duct at that part; also, that no inflammatory process accompanied its formation, and therefore the term sudamina should be used for this disease; that in lichen tropicus (prickly heat) there is a true inflammatory process from the commencement of the disease; and that sweat may have or have not a part in the lesion-formation, and therefore the term sudamina is inappropriate. From this standpoint I will use the term sudamina for the dewdrop-like eruption, and miliaria as synonymous with lichen tropicus.

SUDAMINA.

Definition.—A non-inflammatory affection of the sweat-glands, characterized by the formation of pinpoint- to pinhead-sized or larger, isolated, superficial, clear dewdrop-like vesicles.

Symptoms.—Sudamina occurs in connection with febrile diseases, as pneumonia, typhoid, rheumatism, and in diseases leading to cachectic conditions, as tuberculosis, pyemia, carcinoma, etc. It occurs especially upon the trunk, and particularly, in my experience, upon its anterior surface, but may occur upon the extremities and head. In puerperal fever it occurs especially on

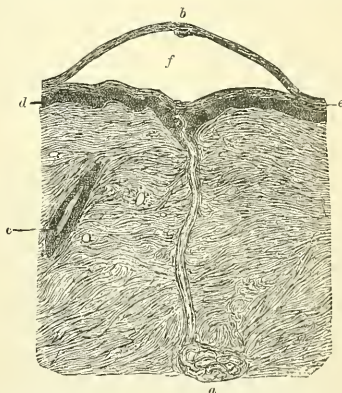


FIG. 266.—Sudamina vesicle: *a*, sweat-gland; *b*, roof of vesicle, showing at *b* the orifice part of the sweat-duct; *c*, hair-follicle; *d*, rete; *e*, corneous layer; *f*, vesicle.

the neck, breast, abdomen, and thighs—in typhoid on the abdomen, in pneumonia on the chest. It is most liable to appear where the epidermis is thin, but may occur where it is thick. A local application, as a water-compress, seems at times to have an influence in determining the site of eruption.

The lesions appear as isolated, pinhead-sized or larger, elevated, tense, clear, pearl-like vesicles; hence the resemblance to dewdrops. They form quickly, are isolated, do not coalesce, although crowded together, and disappear by evaporation of their contents and desquamation of the epidermic

covering. They usually disappear after a few days' existence, but new lesions may form. They never assume an inflammatory character.

Etiology.—The eruption is associated with grave conditions of the system, and the lesions are probably indirectly the result of nerve-disturbance, with histological changes in the parts the seat of the lesions. I have seen the eruption very extensive in a child that died the second day after birth.

Pathology.—The cause of the lesion-formation is not settled. It probably depends upon changes in the character of the epithelial cells of the corneous layer, either from the high temperature or from a change in the character of the sweat-secretion in consequence of the changed fluids of the body connected with the systemic disease present. The retention of sweat is not from stoppage of the duct by epithelial cells from the sweat-coil.

Anatomy.—The accompanying diagram shows the seat of the lesion and its connection with a sweat-duct. The lesion always forms in the corneous layer, and does not consist of a dilated sweat-duct, but by escape of sweat from the duct into the surrounding tissue. A somewhat similar condition is not infrequent in connection with excessive perspiration on the palms. The rete is normal, as also is the corium in all its parts. The sweat-gland coil is normal. The contents of the lesions is pure sweat.

Diagnosis.—The character of the lesions as described makes the diagnosis easy. In miliaria and varicella the lesions always show more or less inflammatory action to be present. In hidrocystoma the lesions are deeper-seated, have a longer life-duration, are situated upon the face, and are associated with excessive sweating and not with grave infective diseases.

Prognosis.—It has not been shown that the appearance of the lesions has any prognostic value in the case of such self-limited infectious diseases as typhoid fever, pneumonia, etc.

Treatment.—The lesions themselves call for no local treatment, as they in no way affect the patient injuriously and soon disappear spontaneously.

MILIARIA.

Synonyms.—Lichen tropicus; Prickly heat; Miliaria rubra; Miliaria alba.

Definition.—An acute inflammatory disease characterized by vesicles, papules, vesico-papules, and sometimes pustules, attended by pricking, burning sensations.

Symptoms.—The eruption commences with a burning, pricking sensation, and consists of small pinhead-sized or larger papules or vesicles or vesico-papules, and all three forms are usually present. They are generally present in large numbers, are elevated above the general surface, almost always isolated, even when situated closely to each other, and in favorable cases disappear in a few days, followed by slight desquamation. The individual papules are bright red, acuminated; the vesico-papules are also acuminated, while the vesicles are somewhat less pointed in shape. In the papular and vesico-papular form the lesions may increase in size somewhat, although they rarely acquire the size of a small pea, and the general surface between the lesions may become inflamed. In the pure vesicular form the lesions remain isolated, and have a pretty uniform size, with a slight areola around each lesion. In the retrograde stage they have a whitish appearance (miliaria alba). If the eruption, especially the papular form, continue a few days, the usual appearance of an acute eczema is observed: the part affected shows signs of catarrhal dermatitis, with papular and papulo-vesicular lesions and

exudation upon the free surface. Sometimes mixed infection occurs, and some of the lesions become pustular or pustules form directly from the skin. In connection with the eruption there is generally profuse sweating. The usual situations for the disease when papules predominate are the arms and trunk, and when the vesicle form exists the trunk, but they can be present on any part of the body. The severest case I have seen was upon the wrists and back of the hands of a lady. I saw a case last year, during the excessive hot spell—during which period the disease was notoriously frequent in New York City—in which the eruption was confined to the left half of the body, extending from the top of the head to the buttock. The eruption was papular or slightly vesiculo-papular in character and lasted over three weeks. The patient was a tall, well-built person about fifty years of age, and sweated a good deal, but equally upon both sides of the body. The inflammatory character of the lesions was well marked.

Etiology.—Excessive heat is a potent factor in the production of the disease. A moist atmosphere in connection with the heat is more liable to cause it than a dry air. Interference with rapid evaporation of the sweat in any way, as from wearing too much clothing, etc., favors its production. Materials that irritate the skin, as colored flannels, no doubt aid in the causation of the inflammatory process. In the markedly vesicular form a debilitated condition of the system is an important factor. Fat people and those of middle life are more liable than children or old people. Lowered alkalinity of the blood, I believe, is a predisposing condition, as in some years nearly all the cases I see are in excessive beer-drinkers.

Pathology.—The disease is an inflammatory affection of the skin, the lesions being almost always situated in the immediate area of the upper part of the excretory portion of a sweat-gland. In Unna's *Histo-pathology* it is described as a non-inflammatory affection, but for that view there are no grounds if the disease is the one I have here described.

Anatomy.—Space will not permit me to enter fully into all the changes

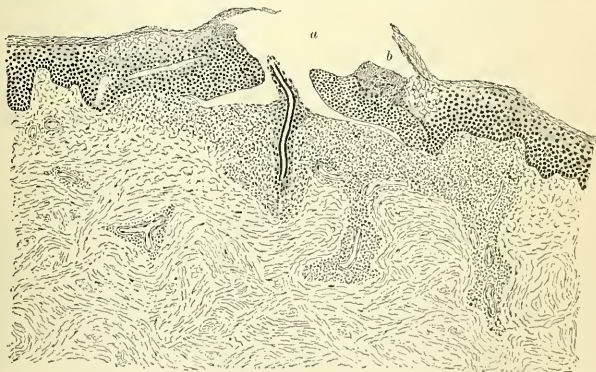


FIG. 267.—Lesion of miliaria; a vesico-papule: a, center of lesion, clear contents (sweat); b, necrosed rete.

occurring in this disease. In every case I have found signs in the sweat-glands of excessive functional activity. In no case examined was there a

catarrhal hidra-adenitis or any lesion depending upon retention of sweat alone, or from a collection of epithelial cells in the duct within the rete. A papule was always formed from an inflammatory process occurring in the rete and upper part of the corium, and was located around a sweat-duct, although I do not doubt lesions sometimes form in other parts independent of the sweat-apparatus. I have sections showing the lesion contains no sweat, and corresponding closely to an ordinary catarrhal dermatitic lesion, and in other sections there is a retention of sweat. In Fig. 267 is shown the changes in a vesico-papule I examined in 1884. The inflammatory changes in the rete are distinct, as also in the upper part of the corium and deeper down along the blood-vessels. The excretory duct is seen in the center of the lesion.

In one lesion examined there was an intense dermatitis, with fibrine exudate beneath the epidermis and necrotic changes in the overlying rete-cells. From my studies, as made at that time (1884), I can positively affirm that miliaria is an inflammatory disease of the epidermis, and not an affection of the sweat-glands alone.

In the purely vesicular form the inflammatory changes are of a much milder type and the lesions are all connected with the sweat-glands, but sweat alone never makes an inflammatory lesion, as we know from sudamina and hidrocystoma.

Diagnosis.—The symptoms given will enable a diagnosis to be made from other cases of dermatitis. To regard it as other than belonging to the eczematous group is against my judgment, but it has sufficient definite clinical characters to justify a special name being given it.

Prognosis.—The disease usually disappears quickly, but sometimes lasts several weeks or longer. It is most persistent when situated in natural folds of the skin and in fat persons.

Treatment.—As the high temperature cannot be removed, the proper treatment is to put the patient under the best conditions to enable him to resist its injurious effects. Proper clothing, avoidance of alcoholic drinks, the use of plenty of plain or alkaline water internally, and frequent cold bathing should be advised. Refrigerant diuretics, as citrate of potassium, are useful. Acid phosphate and lime-juice well diluted have acted well in my hands.

The local treatment should consist in alkaline solutions, as bicarbonate of potassium, in the most acute stage, and dusting-powders, as bismuth, oleate of zinc, etc., afterward.

HIDROCYSTOMA. (A. R. ROBINSON, M. D.)

This disease was first described by me in 1884, and from subsequent reports in journals, I judge it is a rather frequent affection both in Europe and America. It is most frequent in women in middle life or older, and usually in such as perspire much, especially in a warm, moist atmosphere. The disease is worse in summer than in winter, and in many patients disappears entirely in cold weather. The eruption usually appears upon the lower part of the forehead, the orbital region, the nose, the cheeks, and often the lips and chin. I have not seen it upon the lower jaw or neck or upon the rest of the body.

Symptoms.—The lesions are either discrete or situated closely to each other, although usually discrete, unless a large number is present. The individual lesions appear as tense, clear, shining vesicles, obtuse, round or ovoid in form, and varying in size from that of a pinhead to that of a pea. They

are at first deeply seated, and, according to their size and location, more or less elevated above the general surface. The smaller ones especially bear considerable resemblance to a boiled sago-grain. The larger lesions sometimes have a darkish-blue tint, most marked at the periphery. The skin over the lesion is not inflamed, and there are no signs of inflammation in connection with the eruption. There are no subjective symptoms, or there may be a slight sensation of tension or smarting. The contents of the vesicles are clear, and never change to a yellowish color, but dry up, and the lesion disappears without rupture after lasting one or more weeks, leaving the part

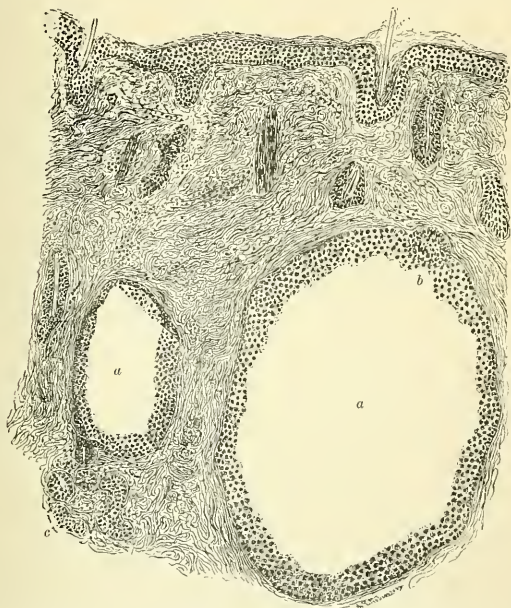


FIG. 268.—*a*, large and small cysts; *b*, excretory sweat-duct at place of obstruction; *c*, coil of sweat-gland.

in a normal condition or slightly pigmented. The contents of the vesicles are always acid and not alkaline.

Pathology.—The disease is an affection of the sweat-glands, the lesions depending upon a cyst-like formation of the excretory duct within some part of the corium, and occurs in connection with excessive sweating, associated with some unknown condition of the tissues of the skin. Some cases tend to show a close connection with the nervous system.

Anatomy.—The vesicles are usually situated in the lower part of the corium when first formed, and afterward may extend, from increase in size, to near the epidermis. The epidermis is normal, as also are the sebaceous glands and hair-follicles. The contents of the vesicles consist of retained sweat and the cyst-wall of epithelial cells arranged as two or more layers, having their

origin from the normal epithelium of the duct. In Fig. 268 is shown two lesions in different stages of development. On the left is seen a small cyst connected with the sweat-gland *c*, and on the right a larger cyst connected with the excretory duct at *b*. The illustration shows how the cysts arise from dilatation of the excretory duct within the corium. It is not, however, a simple passive dilatation, as whether the cyst be large or small there is such a rapid proliferation of epithelium lining the part of the duct affected that the entire cyst-wall is lined by layers of epithelium.

Diagnosis.—The disease is to be diagnosed from sudamina, pompholyx, eczema, and adenoma of the sweat-glands. In sudamina the lesions are very superficial, being situated within the epidermis and forming the so-called dewdrop-like eruption, and are rarely seen upon the face. The non-inflammatory character of the lesions, the absence of epidermic changes, and the chemical reaction of the contents exclude eczema. The location, isolated arrangement of the lesions, persistent transparency of the contents, and absence of inflammation easily separate this disease from pompholyx (dysidrosis of T. Fox). The nature of the contents and the clinical history make the diagnosis from adenoma of the sweat-glands easy, but in a photographic illustration there is much resemblance.

Prognosis.—If the patient continues to live under existing conditions, the eruption is liable to long continuance or recurrences.

Treatment.—The lesions can be punctured with a needle and the part dusted with a drying-powder, as bismuth. Drugs having a controlling influence on the sweat-apparatus are often indicated. Avoidance of excessive exercise, especially on humid days, or work in a moist atmosphere, as over washing-tubs, is a prophylactic measure.

MILIARY FEVER. (A. R. ROBINSON, M. D.)

The term miliary fever, *sudor Anglicus*, is used to denote a disease which has appeared at different periods in various parts of Europe in epidemic form. It has occurred usually as localized epidemics, and when extending over large areas has appeared nearly simultaneously in the various places invaded. The disease is of an infectious nature, seldom begins suddenly, usually has a prodromal stage of two or three days, and runs its course in two typical stages, the first characterized by profuse sweating, lasting one or two days, with a feeling of compression at the epigastrium, precordial anguish, and violent palpitation; the second stage follows with an eruption like measles, the spots showing in their center a vesicle and lasting two or three days. The disease is accompanied by a feeling of general *malaise*, and in some epidemics by bronchitis and diarrhœa. In some epidemics the mortality is slight; in others it reaches as high as 20 per cent. When fatal there is an increase in the nervous symptoms. Warm or moist and very changeable weather seems to favor its existence, and, although the disease does not depend upon the condition of the soil, yet neglected drains, refuse in gardens, etc. contribute to its spread and to a severe form of it. Other diseases do not predispose to it, and vigorous persons, especially women between the ages of twenty-five and fifty, suffer more than ill-nourished persons or inmates of prisons. Post-mortem studies have shown no changes sufficient to explain the severe symptoms of the disease. The most striking is the early and rapid decomposition, commencing almost during life.

B. DISEASES OF THE SEBACEOUS GLANDS.

SEBORRHEA. (LOUIS HEITZMANN, M. D.)

By the term seborrhea or steatorrhea, also called fluxus sebaceus, we mean a disturbance in the functions of the sebaceous glands, by which their secretion, which is known as sebum or sebaceous matter, and consists mostly of cast-off epithelia and fat-globules, is more or less increased in quantity, and perhaps somewhat altered in quality. The secreted matter is mostly a product of the sebaceous glands, although the sudoriparous glands may also secrete a small quantity of fatty matter.

According as to whether the cast-off epithelia, together with epidermal scales, or, on the other hand, the fat-globules, predominate, two varieties of seborrhea can be differentiated—namely, *seborrhea sicca* or *squamosa*, dry seborrhea, and *seborrhea oleosa* or *adiposa*, oily seborrhea, the former being the more common of the two. Although both forms are clinically recognized as separate varieties of the affection, they are frequently found in the same individual on different parts of the body, either localized over small regions or, more rarely, generalized over the greater portion or the entire surface of the body.

Seborrhea can of course occur on any part of the body where there are sebaceous glands, but is most frequent on the hairy scalp, the face, chest, back, umbilical region, and genitals. It is seen at all periods of life from birth to old age. In new-born infants the vernix caseosa can be considered as a physiological increase of sebaceous matter, which soon disappears from the body, but frequently remains on the scalp for the first months, or even years, of life, where it constitutes the so-called milk crust—*crusta lactea*.

Seborrhœa sicca, or dry seborrhea, is the more common variety, and occurs both on the hairy and non-hairy parts of the body, though it is most frequently seen on the scalp, constituting the disease known as *pyriasis capillitii*, or *dandruff*. In its lighter form the scalp will be covered with whitish or grayish, dry or more oily, loose scales or plates, which are freely shed off from the surface, often covering the shoulders to a greater or less extent. This may go on for years without becoming more pronounced, and will sooner or later give to the hair a dryish, brittle appearance, frequently split at the ends. The hairs themselves become loose, easily fall out, and can be drawn out at the slightest pressure. If this continues, the individual so affected will soon notice a considerable thinning of the hair, and commences to become bald, *dandruff* being one of the most frequent causes of baldness. The vertex and the frontal regions are usually the first thus affected, although the loss of hair will in a short time spread over the entire scalp. In these cases the skin may look perfectly normal or appear somewhat paler than usual.

In the more severe forms the scales may be very thick and closely adherent to the surface of the skin. The hairs will frequently be matted together, and when removed the skin will be found reddened and irritated, the superficial layer of the epidermis being either thin or entirely absent. In very young children the same symptoms may be met with, but in them the scales are generally more oily in character, with a yellow or brownish color. There may also be larger or smaller, more pronounced, somewhat circular patches, covered with thick, oily crusts of a yellowish-red color.

In conjunction with seborrhea of the scalp, the same affection frequently occurs on the hairy portions of the face, especially the upper lip and chin.

On the upper lip there will generally be some irritation and redness of the skin.

In all these forms of the affection there is usually a certain amount of itching and burning, which is especially pronounced in warm and moist weather, and may in rare cases assume a serious character. The patient will scratch, and thus produce erosions or even localized eczema or dermatitis.

On the non-hairy parts of the body *seborrhœa sicca* is most frequently seen on the face and genitals, though it may occur on any part of the body.

Seborrhœa sicca faciei is quite often met with around the nose, the forehead, temples, and chin, where it appears in the form of thin or thicker scales or crusts of a yellowish or brownish color, which closely adhere to the skin and are the accumulations of sebaceous matter. On and around the nose, especially the wings, and on the chin, the lighter forms of the affection are very common; the follicles will appear enlarged, and on the slightest pressure small but often thick, whitish or yellowish plugs or scales will exude, which may be so abundant as to make the nose appear considerably larger than normally. These sebaceous plugs are seen to dip down into the follicles. The skin is usually normal, though it may be irritated and inflamed. After removal the pores will at once become smaller, though they easily fill up again. In many cases this form is associated with acne, as well as with a general oily appearance of the face—*seborrhœa oleosa*.

Localized dry seborrhœa is also quite frequent on the *genitals*—around the corona glandis of the penis and sulcus in the male, and the clitoris and labia in the female. In the male it is especially common with a tight prepuce, and is due more to a retention of sebaceous matter, frequently caused by uncleanness. The glands of Tyson normally secrete sebaceous matter, the smegma præputii, which, when retained or secreted in abnormally large amount, will, on account of the heat and moisture, become decomposed and offensive, and cause irritation, swelling, redness, and erosions, commonly known by the name of *balanitis*, or, if more extensive, affecting also the prepuce, *balanoposthitis*. The amount of the retained fatty matter may be slight or excessive, forming a hard, bad-smelling, cheesy mass, or there may be considerable purulent discharge, producing excoriations, edema, and even dermatitis. Such cases, in which the prepuce is tight, may at first sight resemble a gonorrhœa on account of the abundant purulent discharge pouring forth, and care must be exercised in arriving at a correct diagnosis: in them the excoriations and swelling are often very pronounced. The same symptoms, though usually less severe, may be seen around the clitoris of the female. In both sexes they may be met with in young children, and in the female may excite a suspicion of attempted rape.

In the *umbilicus* *seborrhœa sicca* is not rare. There is an accumulation of fat and epidermal scales, sometimes producing thick masses, and often causing an inflammation of this part on account of the decomposition and rancidity. It may also be seen localized on other parts of the body, especially around the clavicles and sternum and between the scapulæ. The patches are usually circumscribed or ill defined, of a pale-red color, and covered with yellowish or brown scales, usually not very abundant.

General seborrhœa sicca (*seborrhœa universalis*), affecting the entire body, is rare, but may be seen in children as well as adults. In the new-born it is known as *ichthyosis sebacea* or *seborrhœa squamosa neonatorum*, and is a sequel of the vernix caseosa. The whole body will be covered with thick, reddish-brown scales, the skin is extremely dry and surrounded by painful fissures, and the children usually die after a short time. In the adult it

is often the result of wasting diseases, is called *pityriasis tabescentium*, and covers the whole body with thick crusts or scales, more especially the extensor surfaces.

Seborrhœa oleosa is frequently seen in conjunction with dry seborrhea, though it may occur separately, especially on the face, but also on the scalp and other regions of the body. On the face the surface of the skin will be greasy and oily, and drops of oil may continually pour forth from the follicles and be wiped off with the handkerchief. The skin will have a glistening appearance, and in more pronounced cases has a dirty grayish look on account of particles of dirt easily adhering to the surface; it may be either reddened, congested, or pale. Around the nose, the chin, and the forehead the affection is quite common. On the scalp it is especially noticeable in bald individuals, giving the same appearance as on the face. On the hairy scalp there may be nothing else but a shining and glistening look of both the hairs and the scalp, being thus differentiated from pure *seborrhœa sicca*, in which the hair is dry and brittle. When more pronounced the hairs will adhere together and have a dirty appearance, and it is then often associated with dry seborrhea. It has also been noticed in other regions of the body.

Etiology.—The causes of seborrhea, though not always clear, are undoubtedly both local and constitutional. Among the former, especially in *seborrhœa capitis*, one of the most common perhaps is want of cleanliness. We often see dandruff in otherwise perfectly healthy persons, in whom apparently no cause whatever is discernible. We may be told, however, that the scalp is not washed oftener than once every few months, and could then easily understand how the constant secretion of the sebaceous glands, remaining on the scalp and hairs, would produce seborrhea. In such healthy persons frequent head-baths, either with plain water or castile soap and water, will be sufficient to keep the scalp free from dandruff. Local irritation or inflammation, such as eczema or acne, may also be a cause. Females are said to be more frequently affected than males, but this is probably more apparent than real, since it is a fact that in the latter baldness is more common than in the former, and this is produced by seborrhea in a large number of cases.

The constitutional causes are numerous. Any inflammatory affection whatever, or some nervous trouble—furthermore, dyspepsia, constipation, and derangements of the sexual apparatus—may be followed by seborrhea. Chlorosis, anemia; or severer diseases, such as tuberculosis, will cause it, as well as any breaking down of the constitution by over-work, excitement, or worry. It often commences at the time of puberty.

Pathology.—The pathology of the affection is very simple. It is a functional disturbance of the sebaceous glands, consisting of an enlargement of the glands with an increase of their excretion. The accompanying figure, which is a vertical section of the scalp of a new-born child suffering from *seborrhœa neonatorum* (Fig. 269), shows the enlarged glands with their ducts, well. The normal process consists in the epithelia of the sebaceous glands undergoing a fatty degeneration; they gradually become filled with fat, till finally the epithelia rupture and expel their contents. If the glands are enlarged, their functional activity becomes increased, and their contents, consisting of cast-off epithelia with nuclei and granules, fat-globules, debris, and cholesterol crystals, will collect upon the surface of the skin. According as to whether the cast-off epithelia and epidermal scales or the fat-globules predominate the affection will assume either a dry or oily character. The accumulated scales will naturally consist of the same ingredients, which may become decomposed, and thus give rise to fetid odors. Seborrhea is there-

fore entirely non-inflammatory in character; if inflammation sets in, it is due to secondary changes, primarily an irritation.

A number of writers, among whom Unna may be named, have of late years expressed their belief that seborrhea is of parasitic origin. This conception is entirely erroneous, as the simple pathology plainly shows. If bacteria are found at all, as may occasionally be the case, they are only secondary, and have nothing whatever to do with the cause of the disease.

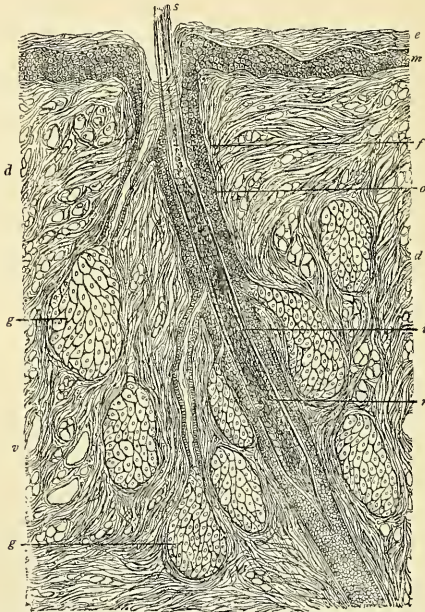


FIG. 269.—Vertical section through the scalp of a new-born child suffering from seborrhea neonatorum; magn. 250 diam.: *e*, epidermis; *m*, rete mucosum; *s*, shaft of hair; *r*, root of hair, cut obliquely; *i*, inner root-sheath; *o*, outer root-sheath; *f*, follicle of hair; *g*, *g*, sebaceous glands, with ducts; *d*, *d*, derma of the skin; *v*, veins in the derma.

Diagnosis.—In most cases the diagnosis of seborrhea is easy. Seborrhea of the scalp may, however, be mistaken for eczema, psoriasis, and ringworm. It should always be remembered that seborrhea is primarily a non-inflammatory disease, and that if any redness is present at all, it will be secondary and only slight. Squamous eczema of the scalp will never produce such an abundant scaling, nor are the scales as loose and easily detachable, as in seborrhea. In psoriasis of the scalp the scales are extremely thick, not greasy and glistening, and when detached a reddened, inflamed patch of skin will at once be noticed. Moreover, the psoriatic patches are usually sharply defined, rarely affect the scalp uniformly, and we will generally, though not invariably, find other plaques on different parts of the body. Ringworm of the scalp usually occurs in more or less circular, sharply-

defined patches, the hairs easily break off, and microscopical examination of the scales will at once show us the characteristic conidia and mycelia of the trichophyton tonsurans.

On other parts of the body also the non-inflammatory character will generally be sufficient to make a diagnosis in doubtful cases. On the face it may perhaps be mistaken for a commencing lupus erythematosus, but the latter is usually sharply defined and inflamed, and there is always a certain amount of atrophy of the skin associated with it. As before alluded to, seborrhea of the genitals may be mistaken for a gonorrhœa or even a chancre; careful examination, however, will at once clear up the diagnosis.

Prognosis.—With the exception only of universal seborrhea, the prognosis is very favorable, since, even though the disease may last for a long time, it will sooner or later disappear with proper treatment, and can invariably be improved after a short time. As regards the accompanying alopecia in seborrhœa capitis, the prognosis should be guarded, although even here we may expect a favorable result in most cases. Balanitis can usually be cured within a few days. The rare cases of universal seborrhea, however, are extremely hard to cure, and in new-born children often result fatally.

Treatment.—In the treatment of seborrhea we must not only resort to local means, but wherever there is a constitutional disturbance also use internal remedies, as well as general hygienic measures. Iron, strychnine, arsenic, or quinine, or a general tonic treatment, will be indicated in persons with a debilitated constitution. Dyspepsia and constipation, also derangements of the sexual apparatus, must be attended to.

The local treatment is, however, in most cases, of far greater importance, and, since dry seborrhea of the scalp or dandruff is the form in which the affection is met with in the largest number of cases, this will first be considered.

The first indication to be met with is of course the softening and removal of the scales or crusts, and the second is to restore the functions of the sebaceous glands to their normal condition. In ordinary cases, where the scales are dry and loose, we may at once resort to remedies which will effect this purpose, and among these the best are resorcin, sulphur, tar, and salicylic acid. Resorcin, if given alone, is best used in the form of a lotion containing alcohol and some bland oil, such as pure castor oil. An excellent prescription is—

Ry. Resorcin.,	ʒiv-ʒij ;
Olei ricin. pur.,	ʒiv ;
Alcohol. fort.,	ʒv ;
Balsam. Peruvian.,	gtt. xij.

This is to be rubbed into the scalp thoroughly once or twice daily by means of an ordinary flat bristle-brush, parting the hair wherever necessary so that the lotion will soak well into the scalp. Frequently the scales will disappear in the course of a few days or a week, although the remedy will have to be applied for some time. Should we desire to give a salve, a combination of resorcin and sulphur will work well :

Ry. Resorcin.,	gr. x-xx ;
Sulphur. præcipitati,	ʒj ;
Unguent. aquæ rosæ, vel unguent. simplic.,	ʒij.

A small piece of this is to be rubbed into the scalp once or twice daily. Instead of resorcin, we may substitute 1 or 2 per cent. of salicylic acid with the same good result.

Another excellent remedy which may be applied both in the form of a lotion or a pomade is *oleum rusci crudum*, the crude birch-tar. The lotion may be made up as follows: *R.* *Olei rusci crud.*, gtt. xv- \bar{z} ijss; *Olei ricin. pur.*, \bar{z} j- \bar{z} ij; *Olei bergamott. et Olei citronell.*, $\bar{a}\bar{a}$. gtt. xv; *Æther. sulphur.*, \bar{z} ij; *Alcohol. fort.*, q. s. ad \bar{z} vij), and is applied once daily with a bristle-brush. Or, *R.* *Acid. salicyl.*, \bar{z} ss; *Olei rusci crudi*, \bar{z} iss- \bar{z} iiiss; *Olei ricin. pur.*, \bar{z} iss; *Alcohol. fort.*, \bar{z} v; *Balsam. Peruvian.*, \bar{z} ss. The pomade is rubbed into the scalp with the finger; its formula is the following: *R.* *Olei rusci crud.*, \bar{z} ivss; *Vaselin. alb.*, \bar{z} vss; *Paraffin.*, \bar{z} j; *Olei bergamott.*, \bar{z} iss; *Olei citronell.*, \bar{z} ij. All these remedies will not only remove the scales, but improve the functions of the glands—so much so that the falling of the hairs, which is almost invariably present, will entirely stop, and a fresh crop of hairs will appear in the course of a few months.

In an obstinate case of *seborrhœa capitis* of long standing, in which there has been considerable *effluvium capillorum*, it is best to commence by using the resorcin lotion for a few weeks, and then change off to one of the other remedies. During this treatment the scalp should not be washed oftener than once in every four or six weeks, and then only with castile soap and water, without using too much friction. Hard rubbings of the scalp, and especially shampoos of any kind, are harmful and should never be allowed.

In cases where the scales are very thick or crusts are present these should at first be softened with olive oil or plain vaseline or lard. It may be necessary to apply the oil frequently and in large quantity by rubbing it well into the crusts; in the course of a few hours or a day the crusts will be soft, and then the above line of treatment can be commenced after the head has been washed either with soap and water or the *spiritus saponatus kalinus* of Hebra, consisting of—

<i>R.</i> <i>Saponis viridis,</i>	\bar{z} iiij;
<i>Alcohol. fort.,</i>	\bar{z} vj;
<i>Olei lavendul.,</i>	
<i>Olei bergamott.,</i>	$\bar{a}\bar{a}$. \bar{z} ij.

This line of treatment will usually suffice even in the severest cases of dandruff, though where stimulation is necessary other remedies, such as a weak corrosive-sublimate solution in water or alcohol, 1:1000, or carbolic acid, tincture of capsicum, or cantharides, may be used. Cutting the hair is absolutely unnecessary, even in the worst cases. In young children a mild treatment with olive oil or vaseline or a weak 1 per cent. salicylic-acid salve with cold cream will usually suffice.

For the non-hairy parts of the body the same line of treatment is indicated, though for *seborrhea* of the face sulphur, either in the form of a salve or a lotion, especially *solutio Vlemingkx*, described in the treatment of *Acne*, or *ichthyol* in 3 to 10 per cent. solutions or salves, is best. Should there be any irritation after the removal of the scales, a plain dusting-powder, such as—

<i>R.</i> <i>Acid. salicyl.,</i>	gr. x;
<i>Zinci oxid.</i> ,	
<i>Amyli oryzæ, vel maydis,</i>	$\bar{a}\bar{a}$. \bar{z} j,

used for a few days, will be indicated.

For seborrhea of the genitals the first indication is absolute cleanliness, washing the parts daily with a mild soap and water. Where excoriations are present the dusting powder just alluded to, used twice daily, over which a piece of absorbent cotton is placed, will work well. Ichthyol is also useful. Where there is considerable discharge the parts should be washed with a corrosive-sublimate solution in water 1:2000, and a piece of lint moistened with the sublimate kept in contact with the parts for a few days, being removed several times daily. For the swelling bathing the parts in warm water is indicated.

ECZEMA SEBORRHOICUM. (LOUIS HEITZMANN, M.D.)

Eczema seborrhoicum, as described by Unna in the year 1887, or, as some dermatologists prefer to call it, dermatitis seborrhoica, is an inflammatory affection of the skin, catarrhal in nature, which almost invariably takes its origin on the hairy scalp and appears in various forms, either scaly, crusty, or moist, with a fatty hypersecretion due to a participation of the fat-producing glands. According to Unna, the sudoriparous glands participate fully as much in the process as the sebaceous; he furthermore stated his belief that the affection was parasitic, caused by micro-organisms.

That in a number of cases an inflammation is associated with the symptoms of seborrhea is undoubted, but it is still a question whether this is not secondary, produced by scratching or some other irritation, or is an accidental combination. The disease is, however, at the present day regarded as a distinct affection by a large number of dermatologists, and may be so described. Kaposi denies the distinctive character of the affection, except in so far that in persons having eczema, syphilis, or other skin-troubles, and who are prone to folliculitis, the disease may especially affect the perifollicular vessels around all places in which the sebaceous glands are abundant, and that in this manner the epidermal products of the sebaceous glands will combine with the inflammatory products, and thus produce characteristic features; furthermore, that annular forms may appear on account of the grouping of the follicles, which will resemble parasitic affections, without bacteria being necessarily present. This form he has described as eczema folliculare or seborrhoicum long before Unna's description appeared.

Symptoms.—With very few exceptions, eczema seborrhoicum commences on the hairy scalp, where it may remain localized or extend over the temporal regions to the ears, and also appear on the forehead, over the eyes, nose, and cheeks. It may extend downward over the sternum, in the axillæ, on the back, abdomen, inguinal regions, and extremities, and, in fact, can appear on any part of the body.

On the *hairy scalp* the affection usually commences as a plain pityriasis capitis, the scalp being covered with a greater or less amount of white or grayish scales, which may accumulate in rather thick masses and give to the hairs a dry appearance: this is the scaly form of the disease, and sooner or later leads to alopecia—the alopecia pityrodes. The scales may increase in numbers and form thick, fatty crusts between the hairs, adhering more or less closely to the skin; they vary in color from white to yellow and brown. The underlying skin is hyperemic, there being either a diffuse redness or larger or smaller, sharply-defined red or yellowish-red patches. These patches may be circinate, and frequently appear at the borders of the hair on the forehead or the temporal regions. On the forehead the sharply-defined, reddened border, covered with yellow oily scales and surrounding the border of hairs,

forming a so-called corona seborrhoica, is very characteristic. The affection not infrequently spreads over the temporal regions to the ears and neck or to the nose and cheeks. These features constitute the crusty form of the disease. In still more pronounced cases the catarrhal symptoms will predominate, the redness will be considerable, and at different places there will be moisture from exudation. This exudation is usually first seen in the temporal regions, and sooner or later attacks the ears and the neck. Not infrequently it extends over the whole hairy scalp, or there may be a simple pityriasis or dandruff on the vertex and occipital region, while the neck and face have the appearance of a moist eczema. The form just described is the moist form.

On the face the lesions may also be either diffuse or circumscribed. In the beard and moustache the scaly form is usually met with, and there may be circumscribed, somewhat reddened, very itchy patches. Falling of hair rarely takes place here. In females the diffuse scaly form is rare, though it is occasionally seen as a fine desquamation and slight yellowish discoloration of the forehead and cheeks; usually circumscribed, scaly, somewhat elevated patches are met with, which frequently escape detection, though there is a decided itching in these places. The skin between the eyebrows is often reddened, greasy, and scaly. At other times there is a more severe inflammation, and larger or smaller papules will develop on the forehead, nose, and cheeks. These reddish papules may either be scaly or free from scales: between them the skin is hyperemic, and there is a continuous burning sensation; gradually a rosacea will develop, and eczema seborrhoicum may be considered as one of the most frequent causes of rosacea in the female, and is not infrequently the cause of the latter disease in males.

The crusty form of the affection is rare on the face, but the moist form occurs quite often, though the nose and mouth always remain free from moisture; vesicles never develop.

The eyelids may be scaly along their margins, or the scales encircle the eyelashes; they are yellow and usually soft. The eyelids may be reddened and swollen. The ears and auditory canal may be the seat of all three varieties. With almost every eczema seborrhoicum of the scalp there may be scaling of the meatus, combined with dryness and itching. The secretion of cerumen is always abundant in these cases.

The chest and back are frequent seats of the affection, the skin over the sternum being a favorite locality, where it is usually found in the crusty form, the scaly and moist forms being rarer. The lesions commence as round or oval spots the size of a finger-nail, single or grouped together, which latter partly coalesce, producing circinate lesions. The borders are red, sharply marked, somewhat elevated, and covered with soft yellow crusts. It is here more often found in fat individuals, in whom there is a considerable amount of hair over the sternum. If the affection becomes more pronounced, the center of the original patches will be found smooth, of a yellowish color, and slightly scaly, while on the periphery fresh, sharply-defined, irregular plaques will develop, having the character of the original lesions; that is, red, somewhat elevated papular patches, covered with white or yellow greasy scales. This latter form is quite frequent on the back and the interscapular region.

In the axillæ scales and crusts are rarely seen, but there are red, sharply-defined, superficial patches of different sizes, which are very itchy, and occasionally exudation will set in, which then rapidly spreads. On the arms it usually attacks the flexor surfaces, in contradistinction to psoriasis, to which it sometimes bears a close resemblance, but the scales and crusts are never as thick as in the latter affection. On the backs of the hands the moist form is

common. On the abdomen the scaly and crusty forms, with the peculiar, sharply-defined red patches, are common. In the inguinal region it resembles an intertrigo, but is apt to spread considerably along the borders. On the lower extremities it takes on the same form as on the arms.

It can thus be easily seen that what is now classed together under the name of eczema seborrhoicum—or, as it is perhaps better to call it, dermatitis seborrhoica, since clinically it does not agree with the pronounced types of eczema—has previously been considered as a number of entirely different affections. It cannot be doubted that a large number of cases which primarily commence as a plain, non-inflammatory seborrhea will sooner or later take on the type of an inflammation, and for such cases the name of dermatitis seborrhoica is very appropriate. Seborrhea itself, however, is a non-inflammatory affection, and should never be classed together with this group, except in so far that it forms the pre-stage of the dermatitis. Unna's scaly type of eczema seborrhoicum capitis is in many cases a plain seborrhea. On the other hand, different types of eczema may be present with a seborrhea, and still be entirely distinct from it: this should always be borne in mind.

Etiology.—The causes of the affection will primarily be those of seborrhea, such as uncleanliness or any debilitating disease, as anemia, chlorosis, gastric and intestinal disorders, tuberculosis, syphilis, and other constitutional disturbances. Irritations or local inflammations undoubtedly predispose to the affection, which may occur at any age from early childhood to extreme old age. Whether the disease is contagious, being caused by combs, brushes, etc., or can be caught from the barber, as is believed, is still an open question, as well as is the parasitic origin. The latter is probably not the case, all bacteria found in the affection being either accidental or secondary.

Pathology.—In describing the pathology of this so-called eczema seborrhoicum of Unna it must not be forgotten that in its milder (the scaly) form the affection is either not inflammatory at all or only slightly so, therefore not deserving of the name eczema, and in its more pronounced forms usually has the character of a dermatitis. Neither the term "eczema" nor the term "dermatitis" is therefore appropriate for the entire group, though both are considerably used.

The mildest (scaly) form is primarily an affection of the fat-producing glands: there is a hypersecretion of fat, with perhaps a slight hyperemia or a commencing inflammation, which may be secondary and produced by microorganisms. Even in the more pronounced form, the crusty, the inflammatory infiltration is slight and very superficial, only occasionally affecting the hair-follicles, there being usually no exudation whatever. In the moist form, however, inflammation is certainly pronounced, and may attack almost the entire cutis. In this form we may get all the pathological features of a more or less severe dermatitis, such as dilatation of the blood-vessels, exudation, and congestion, and increased activity of the protoplasmic elements. The inflammatory corpuscles in the cutis may be present in large numbers. The fibrous connective-tissue bundles of the cutis have become broadened and hyperplastic. The papillary body is enlarged, the papillæ themselves considerably broadened, and consist of coarser bundles than normally. The hair-follicles are usually somewhat dilated.

Unna described the presence of an abundant fatty infiltration in all the layers of the skin as a characteristic feature of the disease; according to him, this is present not only in the epidermis, but also in the cutis. Other observers have not been able to find such an infiltration in the cutis, although it has been found in a moderate degree in the deeper layers of the epidermis.

In his examinations he used hyperosmic acid, and obtained dark granules, which he considered to be fat. These dark granules Ledermann has, however, found in the epidermis in normal skin as early as the fifth month of fetal life and up to old age. Whether they are, in reality, fat-granules is still an open question, but they have undoubtedly no connection whatever with dermatitis seborrhoica.

Diagnosis.—The disease is a chronic affection, lasting for many months or years, usually commencing on the scalp, where it may remain for years with only slight symptoms, and gradually spreading from above downward. It affects all ages, but in its pronounced form is more frequent in adult life. The extension from above downward, from the scalp to the ears, then the face, neck, sternum, interscapular region, arms, and body, together with the sharply-limited red, somewhat scaly contours, will of itself be characteristic for the affection.

The diseases with which the affection may most easily be confounded are psoriasis and eczema. From psoriasis it can frequently be differentiated by the localization, since it usually avoids the places typical for psoriasis, besides spreading in the way just mentioned and often remaining stationary in the middle of the body; furthermore, the greasy and yellowish appearance of the scales in contradistinction to the white, dry, glistening scales of psoriasis, and the peculiar configuration of the single plaques.

These characteristics will also be sufficient to differentiate it from eczematata originating from various causes. Eczema rarely spreads in the same manner, nor do the patches present the same appearances, and papules, vesicles, or pustules, with the formation of exudation crusts, are often present. A little care will at once show the difference between a seborrhoic and a non-seborrhoic affection.

At first sight patches of eczema seborrhoicum on the body may sometimes resemble a syphiloderm; but here the history of the case should alone be sufficient to avoid mistakes.

Prognosis.—The prognosis of the disease is very favorable, since almost all cases, even the most chronic, can be benefited in a comparatively short time. The only thing to be remembered is that relapses are quite frequent and may occur at any time. As regards the alopecia, the prognosis should be somewhat guarded, since in pronounced cases the hairs will not always return. In the larger number, however, a favorable result may be expected if the treatment is carried out faithfully, though it may require many months.

Treatment.—Although constitutional remedies of different kinds, especially tonics, may be given if necessary, the chief treatment must be a local one, and most cases, even of long standing, will be found amenable to comparatively mild treatment. The remedies of greatest benefit are resorcin and sulphur, either in the form of lotions or salves. On the hairy scalp resorcin lotions in 2 to 5 or even 8 per cent. strength, with alcohol or water, will work excellently.

For instance: *R.* Resorcin., ʒss–ʒj; Spirit. vini rectificat. and Aquæ destillat., $\bar{a}\bar{a}$. ʒiiss; or, *R.* Resorcin., ʒiv–ʒij–iij; Olei ricini pur., ʒjss; Alcohol. fort., ʒv; Bals. Peruvian., gtt. xij, applied once or twice daily by means of a brush. The scalp should be washed with warm water and castile soap once or twice a week. On the non-hairy parts or where the inflammation is very pronounced, resorcin salves—*R.* Resorcin., gr. x–ʒss; Unguent. aquæ rosæ, ʒj—applied twice a day, will work well.

Occasionally sulphur, either alone or in combination with resorcin, will be found superior to plain resorcin. The sulphur is best given in the form

of a salve, from 3 to 6 or 10 per cent., and may be combined with 1 to 3 per cent. resorcin: R. Sulphur. præc., gr. xv; Zinci oxidi, ʒss; Unguent. simpl., ʒj; or, Resorcin, gr. v-xv; Sulphur præc., gr. xv-ʒss; Ung. aquæ rosæ, ʒj.

In some cases salicylic or boric acid may be substituted for the resorcin, the former in 1-2, the latter in 3-5, per cent. strength. In those cases which resemble psoriasis, chrysarobin, pyrogallic acid, or anthrarobin may be tried with good result, either in the form of 2-10 per cent. salves or lotions. Anthrarobin has been recommended with tincture of benzoin: R. Anthrarobin., ʒjss; Tinctur. benzoini, ʒj, for the body, to be applied with a brush twice daily. These remedies will be found sufficient in almost all cases. Arsenic, internally, has been recommended, and may of course be given, although it will rarely be beneficial. Should the scales be very thick and there be considerable falling of hair, tar pomade or lotions, as advised for the treatment of seborrhœa sicca, may also be indicated where resorcin and sulphur are not sufficient for a cure.

ASTEATOSIS. (LOUIS HEITZMANN, M. D.)

Asteatosis, the opposite of seborrhea, consists in a more or less pronounced diminution in the amount of sebaceous matter secreted by the skin.

The skin in such cases will be dry, being deprived of its natural fatty secretion, and will soon become thickened, indurated, and fissured. It is usually localized, and is mostly secondary to other chronic skin-diseases, such as psoriasis, lichen ruber, squamous eczema, ichthyosis, or prurigo. Occasionally it may appear in otherwise perfectly healthy persons, being then caused by the application of substances which remove fat, such as strong soaps or solutions containing potash or lime, alcohol, or different chemicals. In the marasmus of old age it is a well-marked feature.

This dry condition of the skin, which is perhaps due more to an abnormal collection of dry epidermal scales on the surface, and not to a deficiency in the activity of the sebaceous glands, is described as frequently affecting the palms of the hands, where there are no sebaceous glands, and is accompanied by a curving of the fingers. It may be found in any part of the body.

The **duration** of the affection depends upon the cause, and the **treatment** consists primarily in the removal of the latter. We know of no internal remedies which have the power of stimulating the sebaceous secretion. The only local treatment which will alleviate the dryness consists in the continuous application of some bland oil or fat, such as olive, linseed, or almond oil, lard, vaseline, lanoline, or cold cream. It must not be forgotten that as soon as the oil becomes rancid it will irritate the skin, and it must therefore be frequently removed, and bathing with warm water and soap be indicated.

COMEDO. (LOUIS HEITZMANN, M. D.)

A comedo is a plug or collection of sebaceous matter and epidermal scales in the excretory duct of a sebaceous gland, which shows itself as a small pinpoint- to pinhead-sized spot of a yellowish or black color on the surface of the skin, for which reason it is commonly called a "black-head."

The yellow or black spot seen on the surface represents the outer end of the plug, which invariably occupies the external orifice of a sebaceous gland, and is rarely elevated above the skin. When it is squeezed out it is found to consist of a white, greasy, dense, oval, thread-like mass of various degrees of thickness and length.

Symptoms.—Comedones are most frequently found on the face, especially the nose, forehead, chin, cheeks, temples, and ears, and on the chest and back, although they may be present on any part of the body. They may occur in small numbers only or be present in extremely large numbers, giving the skin a dirty-looking appearance. Instead of being single, they may occur in twos, forming the double comedo of Ohmann-Dumesnil.

When present in large numbers comedones frequently produce an inflammation, and even suppuration, around the duct, partly on account of the pressure and irritation, and partly through the entrance of bacteria; the result will be an acne. They may occur at any age, though they are most frequent at the time of puberty, from the fourteenth to the twenty-fifth year. Small isolated plugs are, however, not rare in small children, and they may be seen as late as the fortieth or forty-fifth year of life. When the plugs are small and single they may become loose from mechanical irritation or pressure, and empty upon the free surface, leaving the follicular orifice large and open for a short time. If numerous and large, they are extremely disfiguring.

Anatomy.—Comedones consist of an external covering of horny epithelial plates which encloses a mass of fat, cholesterin, and epidermal scales; furthermore, lanugo hairs and occasionally the acarus or demodex folliculorum, a perfectly harmless parasite of the skin. The dark or black color on the surface has been attributed by Unna to a pigment, ultramarine, but is probably nothing but dirt which has collected at the orifice.

Comedones are always found in the orifices of the sebaceous glands, and are perhaps due to an atony of the muscoli arrectores pilorum. These muscles have probably the function to empty the contents of the sebaceous glands into the follicles, and, if they are inactive, the sebum accumulates in the glands, and thus the plugs are produced. According to Biesiadecki, the hair-follicle often forms an obtuse or even right angle with the duct of the gland, and the point of the hair, being thus projected against the wall of the duct, is occasionally curved downward upon itself, exciting thus an irritation at this point and a subsequent multiplication of the epithelium lining the canal. In this manner the epithelial character of the external covering of the plug is explained; furthermore, the frequent occurrence at the time of puberty, when there is an active growth of the hairs, and also the presence of the lanugo hairs in the contents of the comedo.

Etiology.—From what has just been said, the causes of comedones are plain enough. Indirect causes may be found in disorders of digestion, constipation, general systemic disturbances from any cause, or an irregularity of the genital apparatus. Mechanical obstruction in persons working in a dirty atmosphere or uncleanness may also cause the affection.

Diagnosis.—The diagnosis is easy, as with a little care the characters of the affection are easily recognized. From milium, with which comedones might be confounded, they are differentiated by the absence of a black point and a dilated duct, and, furthermore, the inability to squeeze them out.

The **prognosis** is always favorable, although the ducts may fill up for a variable length of time. Sooner or later the treatment will, however, always be followed by a cure.

The **treatment** consists in their removal. They may be squeezed out either with the two cleansed thumb-nails, or with a watch-key, or one of the numerous comedone extractors. An excellent instrument is a small blunt spoon or scoop, the end of which is rounded off, larger and stronger than an ear-spoon (Fig. 270). This scoop is applied a short distance away from the

comedo in an oblique direction, and an even pressure is then exerted downward and forward. With a little practice even the largest comedones can in this manner be easily removed without injuring the skin in the least. If a small drop of blood exudes, the application of an antiseptic lotion, such as a weak corrosive-sublimate or carbolic-acid solution, is indicated. To diminish the secretion of fat and increase the activity of the glands the same rem-



FIG. 270.—Acne-scoop.

edies which are used for the treatment of acne, such as spiritus saponatus kalinus, resorcin, or sulphur, are indicated. When necessary, internal remedies to build up the constitution must also be given.

MILIUM. (LOUIS HEITZMANN, M. D.)

Definition.—Miliun is a small, milletseed- to pinhead-sized white or yellowish-white globular body, either imbedded just within the epidermis or projecting slightly above it.

Symptoms.—It is most commonly found around the eyelids, the temples, cheeks, and borders of the lips, as well as on the genitals—the penis, especially the corona glandis, and the scrotum in the male, and the labia, frequently the inner surfaces of the labia minora, in the female. Milia may be found either singly or in groups, sometimes in large numbers, without increasing in size and never producing any subjective symptoms. They may occur at any time of life, in children as well as in adults.

Anatomy.—Miliun consists of a collection of sebaceous matter in the gland which, on account of an obliteration of the duct, cannot escape to the surface. When it is incised, a small globular mass can easily be extracted, though it may be attached to a small pedicle. It is composed of a capsule of horny epidermal scales, often arranged in concentric layers, in the center of which will be found a mass consisting of scales and fatty matter. This mass represents the contents of one or more acini of a superficially situated sebaceous gland, and is covered by a thin layer of derma with its papillæ.

The **causes** of milia are probably similar to those which give rise to comedones. At times they may be produced mechanically along the edges of cicatrices of any kind whatever.

The **diagnosis** offers no difficulty, as the small, whitish, globular body is quite characteristic.

The **treatment** consists in their removal: the overlying skin should be punctured with a fine-bladed bistoury, when a little pressure will be sufficient to bring out the entire body. Each milium must be opened separately, and some antiseptic lotion applied afterward. At times it may be necessary at first to soften the skin. If they recur, a second removal is indicated.

STEATOMA. (LOUIS HEITZMANN, M. D.)

Definition.—Steatomata, atheromata, sebaceous cysts, or wens are variously sized, globular, or egg-shaped, sharply-limited tumors containing sebaceous matter, situated in the skin or subcutaneous connective tissue.

Symptoms.—These tumors may be found in almost any part of

the body, though the scalp, face, neck, back, and scrotum are their favorite localities. They vary in size from a pea to a walnut or a hen's egg, or they may be even larger, and are usually freely movable. The skin over such a tumor is either normal in color or pale. The consistency of the growth varies considerably, being either firm and hard or doughy and elastic, or even soft. On the surface of some tumors a small opening or duct may be noticed, and by pressure some of the contents may exude; in others there is no trace of any opening. Over the larger tumors, located on the hairy scalp, there is usually an entire loss of hair.

As a rule, these growths are found singly, but they may be seen in groups of two or more. They grow very slowly, and are often present for years without being detected, generally giving no subjective symptoms whatever. Occasionally, when very large, they may break down and ulcerate.

Anatomy.—Steatomata are cysts of the sebaceous glands, and are produced by a retention of sebaceous matter. They consist of a fibrous connective-tissue capsule, in which the contents—epidermal scales, fat, cholesterin, detritus, and perhaps small hairs—are imbedded. These contents will vary in their consistency and may undergo a cheesy degeneration.

The **causes** may be considered the same as for comedones, though many atheromata develop without known causes.

Diagnosis.—Steatomata are easily recognized, but somewhat resemble fatty tumors—lipomata—though the latter are rare on the scalp, where the former are common, are not easily movable, are often multiple, and may grow to very large size. When they have become ulcerated the history of their development and, if necessary, microscopical examination, will prevent an incorrect diagnosis.

The **prognosis** is good, except perhaps in very old and enfeebled persons, in whom they may suppurate or ulcerate and produce serious results. In most cases, however, one single excision, if thoroughly done, will be followed by a rapid and permanent cure.

The **treatment** consists in their removal, which is best done by excision. The cyst should be carefully and thoroughly dissected out, and great care must be taken that the cyst-wall is completely destroyed, as without this the operation will be useless, and the tumor would soon return and become even larger than at first. If the atheroma is soft, some prefer to evacuate the contents and inject the sac with tincture-of-iodine or nitrate-of-silver solutions. Caustics of different kinds have also been used; among these sulphuric acid, nitric acid, chloride-of-zinc paste, and the solid stick of nitrate of silver, all have their adherents, but are not as advisable as excision.

ACNE DISSEMINATA. (LOUIS HEITZMANN, M. D.)

Definition.—Acne disseminata or acne vulgaris is a chronic inflammatory affection of the sebaceous glands and surrounding periglandular connective tissue, and is characterized by the appearance of small reddish pinhead-to-pea-sized or larger papules, nodules, or pustules, or a combination of them.

Symptoms.—The disease, which is one of the most common skin-affections we have to deal with, may occur on any part of the body where there are sebaceous glands, but is most frequently met with on the face, the chest, and the back, where the lesions may be found in large numbers disseminated over a large area, while single papules and pustules are not infrequently met with on the extremities and genitals. The starting-point of the lesion is usually a comedo, around which an inflammation takes place, often

resulting in a papule or pustule: in the center of this the comedo can easily be recognized. Slighter cases, in which only a few comedones and papules are present, are often seen in conjunction with seborrhœa oleosa of the face. In pronounced cases the face, especially the forehead, cheeks, nose, and chin, will be found covered with the lesions in the different stages of their development, in some the comedones predominating, in others the papules, and in still others the pustules. If the nodules are deep-seated, they become more or less indurated, forming an acne indurata.

We may therefore divide an acne disseminata into three broad varieties. In the first or slightest variety the acne is often combined with a seborrhœa; in this form, which is perhaps most frequently seen around the nose, the comedones are usually small and superficial, the papules small and scanty, and the skin has an oily and reddened appearance: this form we may call *acne seborrhoica*. In the second form the comedones are small, but quite long, and papules are very numerous, this being called *acne papulosa*. A few pustules may be present, but to a slight degree only. The difference between this and the former seems to be that the secretion of the sebaceous glands is a more solid one, containing stearine and margarine, whereas in the first it seems to be more of the nature of oleine. In the third form the pustules are very numerous; each pustule is surrounded by a hard infiltration, and the comedones are numerous and deep-seated; this is *acne pustulosa* or *acne indurata*.

The subjective symptoms of acne are, as a rule, very slight, if any are noticed at all; occasionally the lesions are slightly painful or there may be some itching or burning. When a pustule is opened some pus and blood, together with sebaceous matter, will exude, and the comedo, if one is present, will come to the surface; when fully extracted the opening heals in a short time.

The process is an essentially chronic one, though the separate papules and pustules only last for a few days; new lesions will, however, spring up continually, though sooner or later their formation will come to an end. When a number of large, deep-seated pustules had been present, scars or pigment-stains, greatly varying in size and number, will remain; these may be present in small numbers only or be very numerous. In the course of time they will usually smooth out to a great extent, and often disappear entirely after months or years.

Before speaking of the etiology of acne disseminata it may be well to mention a few other varieties of acne which are by no means rare. Of these perhaps the most important are the *iodine acne* and the *bromine acne*, due respectively to the ingestion of iodides, such as iodide of potassium and iodide of sodium, and bromides—bromide of potassium or of sodium. They occur mostly upon the face: the former usually as conical pustules upon a vivid red base, and in the latter there being frequently a deep-seated inflammatory infiltration of the cutis of considerable extent, sometimes with destruction of the glands and follicles, besides the regular papules and pustules; they often leave scars. There are no comedones in these lesions.

Tar acne (*acne picealis*) is due to the application or use of tar or its products, or is seen in persons who work with tar. It consists of reddish-brown papules, in the center of which a black point is seen, a plug of tar occluding the opening of the follicle; pustules and furuncles are also present. It is seen most frequently on the outer surface of the lower extremities.

Acne cachecticorum is sometimes seen on the trunk and extremities of poorly-nourished, broken-down, or marasmic individuals, and consists of

small, flat, livid-red papules or pustules. The lesions are rarely indurated and may leave minute scars.

Etiology.—The causes of acne disseminata are various. It is undoubtedly a disease of puberty, occurring most frequently in persons between the fourteenth and twenty-fifth or thirtieth year, though it may occur in children of eight or ten years or even younger. What influence puberty, the development of the sexual organs, has in producing acne it is impossible to say, and it may be called a reflex neurosis. That disorders of the sexual apparatus—furthermore, masturbation and excesses in venery—will cause acne, can be seen very frequently. In females, uterine disorders may cause it, and outbreaks often occur at the menstrual periods.

Disturbances of the gastro-intestinal tract, such as dyspepsia or constipation, will produce the disease. Certain articles of diet will often favor its outbreak; among these may be mentioned all sorts of cheese, pickles, spices, and aromatics. Alcoholics, especially the stronger ones, are undoubted causes if taken continually and in large quantities, whereas beers or light wines have no influence. Among other causes, mental and physical exhaustion, chlorosis, anemia, and general debility may be mentioned. Local irritation might also produce it.

Pathology.—The commencing lesion in most cases of acne is the comedo, which is perhaps due to an atony of the muscoli arrectores pilorum,



FIG. 271.—Pustular acne—rupture of pus-sac into the derm; mag. 100 diam.: *e*, epithelial lining of sebaceous sac; *p*, *p*, pus-corporuscles and epithelia, the former sprung from the latter; *r*, place of rupture of the abscess; *i*, *i*, intensely inflamed zones of derma; *s*, *s*, slightly inflamed portions of derma; *b*, *b*, blood-vessels engorged with blood-corporuscles.

as explained in the section on Comedo. Any other agent which occludes the follicular orifice and acts as a foreign substance may also cause an inflammation of the surrounding tissue, and papules will be produced; if bacteria, especially the staphylococcus pyogenes aureus, enter in places where there is already a chemical irritation, pustules will be produced.

Whatever the primary cause of the inflammation, its seat is found to be in the sebaceous glands and hair-follicles and the tissue surrounding them.

Frequently the process commences as a perifolliculitis, being an inflammation around the hair-follicles, and invading the follicles themselves soon afterward. The changes in the tissue correspond to the degree of inflammation, being either slight or severe. Primarily there is the engorgement of the blood-vessels, exudation, increased activity of the protoplasmic elements, with a greater or less amount of infiltration with inflammatory corpuscles and broadening of the fibrous connective tissue, and then the formation of a papule. If the inflammation becomes more intense, and pyogenic micro-organisms or their chemical products enter, a pustule will result. Here we find purulent exudation in the excretory duct, and severe inflammatory infiltration in the surrounding tissue, often extending deep down into the cutis. An illustration of a pustular acne in which the pus sac has ruptured into the derma is shown in Fig. 271. The epithelial lining of the sebaceous sac is originally broad, but becomes thinner and thinner, until it finally disappears completely and the abscess has ruptured into the derma. In different places we see a larger or smaller number of epithelia, more or less intermingled with pus-corpuscles, which latter have sprung from the former. The derma is inflamed to a considerable degree, the amount of inflammatory infiltration, however, varying greatly; some zones of the derma are intensely inflamed, others only slightly. The blood-vessels are quite numerous, and are engorged with blood-corpuscles. In large abscesses the hair-follicle is completely destroyed, whereas in smaller pustules it may remain intact.

Diagnosis.—The diagnosis of acne is simple if the symptoms described and the presence of comedones, papules, and pustules in the different stages of development are kept in mind. Single pustules may occasionally resemble a pustular variola, and this may also be the case with a pustular sphyllide; in both cases, however, the history alone will be sufficient to clear up the diagnosis. The grouping of the papules and pustules, together with the course of the individual lesions, is also of importance. From papular eczema acne is at once differentiated by the absence of itching, the irregularity in the grouping, and the lack of scaling.

Prognosis.—The prognosis of acne disseminata is good, since even the severest cases will sooner or later almost always yield to treatment. Recurrences are by no means rare, and fresh papules and pustules may appear for months or years. 3 or 4 per cent. of all cases prove rebellious to treatment, even to the severest measures.

Treatment.—There is probably no skin-disease in which a larger number of remedies has been employed at different times than in acne, yet the treatment is comparatively simple, and will almost invariably be followed by good results. Although the external treatment is of greater importance, constitutional treatment must in many cases also be used. The latter will depend entirely upon the constitutional symptoms. In many cases constipation will be present, and in them it will be of prime importance to improve the digestion, both by regulating the diet, recommending plenty of out-door exercise, fruit, and, if necessary, laxatives of any kind, such as one of the numerous bitter waters, Karlsbad salt, or sulphur internally. Dyspepsia, if present, must also be treated. Certain articles of diet, such as cheese, pickles, and spices, also strong alcoholic beverages, must be forbidden. In females affected with uterine diseases ergot has been recommended, given in the form of the fluid extract in half-teaspoonful doses several times daily. Tonics, especially iron, cod-liver oil, or arsenic, are often indicated, and may be found useful. Of the other internal remedies which have been employed, sulphide of calcium in $\frac{1}{10}$ - to $\frac{1}{4}$ -grain doses, glycerine in one to two teaspoonful doses,

and ichthyol in capsules may be tried, but too much must not be expected of them.

The chief treatment from which good results can be expected is the local, since this alone will cure an existing pronounced acne and will bring about a healthy condition of the glands. As the three different kinds of acne disseminata mentioned will require a somewhat different treatment, it will be best to describe them separately.

The first or mildest form of acne, acne seborrhoica, which is frequently combined with seborrhœa oleosa of the face, will be greatly benefited by the use of sulphur lotions in the form of solutio Vlemingxk. This is prepared by boiling ten parts of calx viva, twenty parts of precipitated sulphur, and two hundred parts of water in a glass dish down to one hundred and twenty parts. It is a reddish-brown solution with a rather disagreeable smell, which, however, disappears as soon as it is applied to the skin. The mode of application is as follows: Take an empty bottle and pour into it one part, either a teaspoonful or a tablespoonful, of the original lotion, being careful not to use a silver spoon, since the sulphur would blacken it, but either wood or glass; to this add ten parts of water to commence with. With the diluted lotion the patient is instructed to wash the face every night before going to bed by means of a flannel for a few minutes, without using too much force, until a slight burning results. This is allowed to dry on the face, and remain on all night, being washed off the next morning with soap and water. Any good ordinary soap, such as plain white castile soap, can be used, though if medicated soaps, such as tar, carbolic, or salicylic soaps, are preferred, they may also be used. Instead of commencing with one to ten, we may use a weaker or a stronger solution at first, according as to whether the skin is more or less sensitive. Every night, or at least twice a week, before applying the solution the comedones must be squeezed out, which in this form is best done by means of the cleaned thumb-nails. Once or even twice a week the mixture is made stronger by taking a half part less water. If we have commenced with 1 : 10, it is next made 1 : 9½, 1 : 9, 1 : 8½, and so forth. As a general rule, cure is accomplished when 1 : 5 is reached, and only in the severer cases will it be necessary to use stronger solutions. After a few months the skin will be so resistant that even the pure lotion may be used without injury, which, were we to use it at the commencement, would severely burn the skin. On the chest and back, where the skin is more resistant than on the face, we may at once begin with 1 : 5 or even 1 : 4. If redness, scaling, and irritation result from rubbing too hard, which may be the case with a sensitive skin, the remedy must be stopped for a few days and a plain, non-irritating fat, such as vaseline or cold cream, applied until the scaling has disappeared. If scales are abundant in the morning, but redness is not present, such a bland fat is used in the morning after washing, and the remedy may again be applied on the following night after washing the skin with soap and water to remove any fat still remaining on the skin.

Instead of solutio Vlemingxk a mixture composed of potassium sulphuratum and zincum sulphuricum may be employed in mild cases: *R.* Potassii sulphurat., Zinci sulphatis, *aa.* ʒj; *Aquæ rosæ,* ʒiv. This is certainly more pleasant than the former, but has no effect in pronounced cases. Sulphur soap, although often advised, is not of much use. Occasionally sulphur salves in 6-10 per cent. strength, either alone or combined with resorcin, 1-2 per cent., may do good.

In the second form, the acne papulosa, the indications to be met with are first to soften the hard comedones by slight irritation, and secondly to cause

the inflammatory infiltration of the skin to disappear by an artificially produced inflammation. In milder cases this can be effected by plain castile soap, the lather of which is rubbed into the skin at night by means of a rough towel, allowed to dry on, and remain on over night, being washed off the next morning. The lather of the soap may be mixed with fine sand in order to also produce a mechanical irritation, or marble- or sand-soap may be used. Ichthyol soap will occasionally do good. In slight cases the comedones, which are superficial, do not even need to be squeezed out, since the mechanical removal of the head of the comedo will give free exit to the sebaceous mass. In more pronounced cases, however, in which the comedones are long, they must always be removed by means of the thumb-nails or one of the comedo-extractors before the application of the remedies.

After removal of the comedones applications of green soap or a solution of it, by means of a coarse piece of flannel, must be used. A good solution is the following: *R.* Sapon. virid., ʒj; Alcohol. fort., ʒij; Aquæ destillat., ʒiij; Spirit, lavandul., ʒss; which is rubbed into the skin thoroughly, and kept on all night, being washed off the next morning with soap and water. This treatment is to be continued until redness and scaling are produced, which may be the case in a few days or not till after a few weeks. An irritation of the skin is desired, because it leads to the softening of the comedones and facilitates their removal, and because the infiltration of the derma can only be lessened by an artificial inflammation. As soon as this stage is reached bland salves, such as plain cold cream, are used to hide the scaling as much as possible. When the inflammation has disappeared we may again use the green-soap solution if necessary, or, if the larger number of comedones has been removed, solutio Vlemingkx may be applied.

An excellent remedy for this variety of acne is a 15-20 per cent. resorcin paste: *R.* Resorcin., ʒj-ʒiiss; Zinc. oxid., amy, Maydis, āā. ʒij; Ung. aquæ rosæ, ʒss; Olei olivarum, q. s. This paste is to be applied every night, and to be left on at first from twenty to thirty minutes, the time being lengthened by five minutes every night until forty-five minutes or one hour is reached, when it can be easily removed with a dry piece of cotton. It will produce considerable redness and scaling, which are treated in the manner above described. In some cases the paste may even be kept on all night. In slighter cases a 10 per cent. salve—*R.* Resorcin., ʒiiss; Ung. aquæ. rosæ, ʒj; which is kept on all night—will also work well.

The severest cases require the strongest remedies. Among these one of the best is the following paste, first used by Lassar: *R.* β-naphthol, ʒijss; Sulphur. præcipit., ʒss; Lanolin. pur. or Unguent. aquæ rosæ and Sapon. viridis, āā. ʒij. With this paste a severe inflammation with desquamation can be obtained in a few days without injury. It is left on the skin for from fifteen to thirty minutes every night, after which it is taken off with a piece of absorbent cotton soaked in olive oil, and then washed with soap and water. As soon as severe irritation sets in, which may be the case after two, three, or four applications, the remedy must be stopped and cold cream or some non-irritating face-powder applied. If necessary this treatment is to be repeated several times.

In the third or pustular and indurated acne the first indication is to remove all abscesses, either with a scoop or, if too large and deep-seated, with Hebra's puncture-needle (see Fig. 272), the cross ledge of which prevents too deep an entrance into the skin. Small sebaceous cysts are opened in the same manner and their contents then squeezed out. The slight hemorrhage which occurs should at once be checked with a piece of cotton dipped

in liquor ferri chloridi, and if a cyst has been opened its wall should be cauterized with a small piece of wood, the point of which is surrounded with a piece of cotton soaked in the liquor ferri. This cauterization is necessary to destroy any micro-organisms which might be present, and to destroy the epithelium lining the inner surface of the cyst. The solution of the sesquichloride of iron should, however, never be employed when solutio Vlemingx is used, since dark spots would then result, which usually disappear in the course of a few days.

After the comedones have been squeezed out it will be well to rub the skin with some cotton soaked with a 5 per cent. carbolic-acid solution; this not only prevents infection, but also causes an intense temporary redness, which hides the redness caused by squeezing out the comedones and hastens



FIG. 272.—Hebra's puncture-needle.

its disappearance. The latter indication may also be fulfilled by bathing the face in hot water.

For the treatment of this form of acne a 1 to 3 per cent. solution of salicylic acid in alcohol is especially indicated; it is applied at night with a piece of flannel. Solutio Vlemingx, spiritus saponatus kalinus, or the resorcin or naphthol paste may all be used in this form.

Even in the severest cases it is never necessary to use the sharp spoon for the removal of the acne-nodes, as its application would certainly leave a scar. Scars, however, cannot always be avoided where the pustules have been deep seated, and will sometimes also remain in ill-nourished individuals. Besides these, pigment-spots may remain. The latter usually disappear after a while, but their disappearance can be hastened by the application every other night of a minute quantity of a salve composed of white precipitate and subnitrate of bismuth, with glycerine ointment: R. Hydrarg. præcipit. albi, ʒj; Bismuth. subnitrat., ʒijss; Unguent. glycerin., ʒx. Scars will gradually improve, but they may be flattened out by long-continued use of solutio Vlemingx or regularly-applied massage of the face. Another method consists in giving the patient 5-gram doses of the purest castor oil several times daily for a long time; when this is done a layer of fat may form in the subcutaneous tissue of the skin, and the scars will gradually improve. Massage is, however, one of the best remedies for this purpose.

ACNE ROSACEA. (LOUIS HEITZMANN, M. D.)

Definition.—Acne rosacea is a chronic hyperemic or inflammatory disease of the skin of the face, more especially the nose, cheeks, and chin, which is characterized by a more or less diffused redness, with dilatation of the blood-vessels, and in more pronounced cases the appearance of larger or smaller papules and nodules, or even a diffused hypertrophy of considerable extent.

Symptoms.—The disease may be either slight or severe—so much so that three grades of the affection are usually distinguished. Its most common seat is the nose and surrounding skin of the face, although it may also be seen on the forehead, cheeks, chin, and the lateral regions of the neck.

In the first or slightest grade a more or less diffused redness and congestion are seen on the nose and surrounding skin, which are unattended by either pain or swelling. The red color will disappear upon pressure, and the skin seems to be somewhat cooler than normal, there being a passive hyperemia, in which the blood circulates slowly through the vessels. At first the congestion is only slightly marked, and may even disappear entirely for a time, but gradually it becomes more pronounced, especially after exposure to sudden changes of temperature or after meals; and then there may be a sensation of burning or heat in the parts. Soon small, newly-formed, dilated blood-vessels will commence to appear. With this the skin frequently has an oily appearance, there being a seborrhœa oleosa connected with it, and the orifices of the follicles will be dilated and contain small yellow plugs of sebaceous matter and comedones, which may easily be squeezed out; also a few small acne-papules. The disease may remain in this stage for months or years, and then either disappear entirely or become worse and develop into the second stage.

In the second stage the erythematous redness is more pronounced, and usually spreads; the dilated blood-vessels become larger and more numerous, assume an irregular tortuous course, running in all directions, and frequently anastomosing with each other. Soon pinhead to pea-sized livid red papules or nodules, which are elastic to the touch, begin to appear, and may be either isolated or be present in large numbers, forming distinct groups upon the affected surface. Frequently the hypertrophied cutaneous vessels will be noticed on their tops. Pustules may also develop. This condition may exist on the nose alone or also on the cheeks, chin, and forehead. Whereas, in the first stage, the affection was more that of a plain rosacea, we now have a pronounced acne rosacea, which, though the subjective symptoms are very slight or entirely absent, may disfigure the face considerably. In most cases the disease will remain stationary, with perhaps occasional slight improvements for months or years, and then either gradually disappear, or it becomes still worse, forming the third and most pronounced stage of the process.

In this third stage large, irregular, soft, elastic growths gradually appear, which may be lobulated, sessile, or pedunculated, and assume the size of a walnut or even be larger, the size of a small fist. They are red or bluish in color, and traversed by a number of greatly dilated blood-vessels, often covered with comedones and pustules. They may be single or multiple. In other cases there is a pronounced symmetrical hypertrophy of the skin of the nose, which may assume large proportions. Such cases are designated by the name *rhinophyma*.

Etiology.—Acne rosacea is a chronic affection, often lasting for many years, which usually appears between the ages of twenty and forty years, although it may be seen much earlier or later in life. It occurs in both sexes in equal degree, the milder forms being more common in females, the severer much more so in males. The causes are various, and may be either gastrointestinal disturbances, such as dyspepsia or constipation, derangement of the sexual organs, or general debilitating conditions. The first stage may occur in females both at the time of puberty and the climacteric period, being caused by irregularities in the menstruation or disorders of the uterus and ovaries. It is frequently associated with anemia, chlorosis, dysmenorrhea, and sterility, and may occur at the time of pregnancy, disappearing after the birth of the child.

A not infrequent cause in both sexes, especially for the mild form, is seborrhœa of the face: if this has lasted for some time, a hyperemia may

sooner or later develop and become more pronounced. An important causative factor is furthermore to be found in alcoholic beverages if taken in excess for a long time—not only whiskey and brandy, but also wines and beers. Exposure to all sorts of weather is an important cause, and it has been known to arise from an excessive use of cold bathing.

Pathology.—In the first stage of acne rosacea there is nothing but a passive hyperemia, and the circulation in the small superficial cutaneous blood-vessels is retarded, so that a paresis of these vessels will soon set in, with a consequent dilatation of them. In the second stage this becomes more pronounced, and new blood-vessels develop, so that the teleangiectasis is well marked. Now the sebaceous glands also become enlarged, and this is more pronounced the severer the process and the more it approaches the third stage. The nodules consist of newly-formed, first gelatinous, then dense fibrous connective tissue, which is infiltrated with a greater or less number of inflammatory corpuscles. Fig. 273 illustrates the pathological changes in

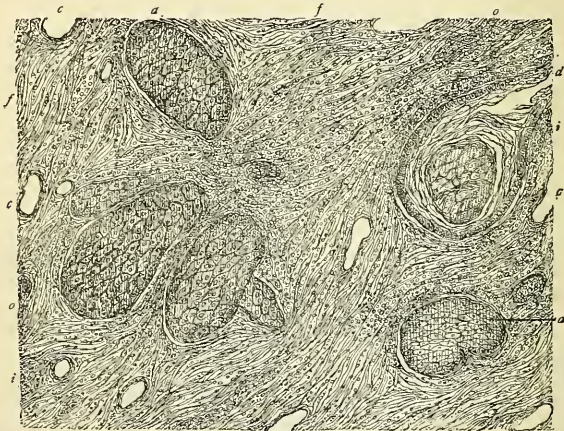


FIG. 273.—Hyperplastic rosacea of the nose; magn. 100 diam.: *a, a*, acini of sebaceous gland pushed asunder by hyperplastic connective tissue; *d*, duct of the sebaceous gland; *f, f*, dense fibrous hyperplastic connective tissue; *i, i*, intense inflammation of the connective tissue; *c, c*, capillary blood-vessels; *o, o*, obliterated capillary blood-vessels.

such an hypertrophic or hyperplastic rosacea of the nose. We see a large number of enlarged sebaceous glands; the acini of these glands are pushed asunder by the hyperplastic connective tissue; the ducts of the glands are also enlarged. The amount of dense fibrous, hyperplastic connective tissue is very great, and this is intensely infiltrated with inflammatory corpuscles. It will be seen that some of the capillary blood-vessels are obliterated.

Diagnosis.—The diagnosis of acne rosacea is not difficult, especially if with the hyperemia and inflammation acne-papules and pustules are present. In doubtful cases the history of the development, first of the hyperemia and then of the enlarged blood-vessels, will aid in making the diagnosis. It might be mistaken for acne vulgaris, lupus vulgaris, lupus erythematosus, or a tubercular syphilide.

In *acne vulgaris* there is no dilatation of the blood-vessels; it is usually more disseminated about the face, and the number of comedones, papules, and pustules is often larger. In *lupus vulgaris* the nodules are not elevated above the skin, and the disease has a tendency to spread at the periphery and to ulcerate; furthermore, there is a tendency to the formation of scars and absence of vascularity, and the history of the disease usually extends back to childhood. *Lupus erythematosus* is characterized by scaling, atrophy, and usually a diffusion over a larger area; there are no pustules, and cicatricial formations always occur. The tubercular syphilide is recognized by its peculiar color, its tendency to ulceration and crusting, and the absence of telangiectases. In pronounced cases of the third stage care must be taken to differentiate the disease from the rare affection rhinoscleroma and malignant tumors.

Prognosis.—In the milder cases the prognosis is always favorable, the affection yielding to treatment in a comparatively short time. In marked telangiectasis, and especially in the third stage of the disease, the prognosis is not favorable, since the process will often persist in spite of the most energetic treatment.

Treatment.—As in *acne vulgaris*, the internal treatment, which is often of great importance, must be directed to the cure of the primary cause, the proper attention being given to dyspepsia, constipation, uterine or ovarian disease, or the general condition of the patient. The diet should be regulated in the same way as for *acne vulgaris*, and alcoholic drinks must either be entirely forbidden or cut down to a minimum. There are no specific internal remedies, although ergot occasionally works well.

The local treatment is of course of the greatest importance, and depends to a great degree on the stage of the disease. In the earlier stages all remedies recommended for *acne*, such as sulphur, resorcin, *sapo viridis*, salicylic acid, ichthyol, or naphthol, will do good, and of these *solutio Vlemingxx* is frequently the best. The hyperemia will usually disappear under this treatment, as well as the smaller papules and pustules. Ichthyol is certainly of greater benefit here than in plain *acne*, and may be used either in the forms of lotions, salves, or pastes; a 5–10 per cent. strength is in most cases all that is required; the lather of ichthyol soap, applied at night, may also be used with benefit. The application of mercurial or salicylic-acid plaster—furthermore, the use of chrysarobin in liquor gutta-perchæ in a 3 per cent. strength—may also be indicated. A solution of iodine and glycerine—*Ry. Iod. pur., Potass. iodidi, āā. ʒj; Glycerin. pur., ʒij*—is sometimes of benefit. This, according to Kaposi, is applied eight to twelve times within three or four days, and immediately covered with gutta-percha paper.

In case where the dilated blood-vessels are pronounced, scarifications can be used. These are best done with a small fine bistoury or Vidal's scarifying needle by making a number of parallel superficial cuts, and immediately applying liquor ferri chloridi; frequently a large number of sittings, once or twice weekly, will be required. Instead of the linear scarifications the blood-vessels may be torn by means of the sharp spoon or a dermal curette. Hebra's puncture-needle, referred to in the Treatment of *Acne Vulgaris*, is also of great use. In other cases the use of electrolysis, first applied by Hardaway, will work excellently. A thin needle is attached to the positive pole of a galvanic battery, while the patient grasps the negative pole, a moistened sponge; the needle is allowed to penetrate the vessel and the current of electricity passed through it for a short time. Although in the treatment of superfluous hairs the negative pole is invariably used, better results are

obtained in acne rosacea with the positive pole. A few cells of the battery only are required, and the pain is trifling. After a few sittings we will often notice a shrinkage of the vessels, which will gradually become obliterated. Scars rarely result from this operation. The thermo-cautery has also been recommended.

In hypertrophic acne rosacea or rhinophyma surgical procedures, such as excision, may become necessary. Moderate degrees of thickening may, however, be relieved by electrolysis, plunging the needle freely into the tissues in various directions. A 10-20 per cent. salicylic-acid plaster—*R*. Acid. salicyl., ፬v-፬x ; *Empl.* diachyl. and *Empl.* sapon., āā. ʒj —will sometimes do good.

ACNE VARIOLIFORMIS. (LOUIS HEITZMANN, M. D.)

Definition.—Acne varioliformis is characterized by flat papules and pustules more or less grouped together without any distinct infiltration and no comedones, accompanied by a destruction of tissue which causes a depressed cicatrix resembling that produced by a pustule of variola.

Symptoms.—The disease must not be confounded with the acne varioliformis of Bazin, which is an entirely different affection and corresponds to what is now called molluscum contagiosum or sebaceum. Its most frequent seat is the forehead near the margin of the hairs, as well as the hairy scalp, although it may occur all over the face, on the neck, and on the chest. It commences with the development of pinhead- to pea-sized flat, reddish-brown papules, in the center of which a pustule forms, which soon dries up, leaving a depressed yellowish adherent crust, beneath which an ulceration with sharply-cut edges and an uneven base is found. When the crust falls off or is removed, a depressed red scar remains. A peculiar variety of this affection has been described by Boeck as acne necrotica.

Etiology.—The disease usually lasts for many years, as fresh eruptions will be continually formed. It occurs in both sexes, mostly in persons of middle age, between the thirtieth and fiftieth years of life. Its cause is entirely unknown, and it is perhaps due to micro-organisms. Intestinal disturbances are present in many cases. Elliot has seen several cases in which the etiological factor appeared to be exposure to heat; these occurred in engineers, who stated that the head and face would become much heated when they were at work, and they were accustomed frequently to douche themselves with cold water.

Pathology.—Very little is known about the pathology of the affection. It is an inflammatory process, probably located either in the sebaceous glands or in and around the hair-follicles, and having a tendency to produce tissue-necrosis. Further studies are necessary before any definite conclusions can be reached.

Diagnosis.—The diagnosis is not always easy, as the disease may greatly resemble a pustular syphilide. In fact, some observers consider it as simply a peculiar variety of syphilis, but it occurs frequently in cases in which there is absolutely no sign whatever of syphilis, so that it may be said to be a distinct affection. A papulo-pustular syphilide will, as a rule, be more generalized, and, especially if it has lasted for a long time, it is apt to spread considerably; other symptoms of syphilis would certainly appear sooner or later.

Prognosis.—The prognosis is quite favorable, although in some cases the disease will continually recur.

Treatment.—The treatment is in most cases extremely simple, as it

will usually yield to the application once or twice daily of a 6-10 per cent. white precipitate salve: *R.* Hydrargyr. præcipit. albi, ʒss-ʒiiss; *Ung.* simplic. or *Ung.* aquæ rosæ, ʒj. A combination of resorcin and boric acid—*R.* Resorcin., acid. boric., *āā.* ʒiiss; *Ung.* aquæ rosæ, ʒij—is also advised; furthermore, sulphur: *R.* Sulphur. præc., sapon. virid., *āā.* ʒiiss; *Ung.* aquæ rosæ, ʒj, may do good. Occasionally new crops will continue to develop in spite of treatment. In such cases mercurial plaster may be tried, or a lotion of corrosive sublimate, 1 : 500 to 1 : 1000, applied several times daily. Internal treatment has no influence on the disease.

C. DISEASES OF THE HAIR-FOLLICLES.

CANITIES. (G. T. JACKSON, M. D.)

Definition.—A blanching of the hair due to loss of pigment.

Canities may be congenital or acquired; it may be partial or complete. Most commonly it is acquired, and when it has begun it is progressive.

Congenital canities is rare. It is hereditary in some families, showing itself in the form of white patches or tufts of hair conspicuous among the normally colored hair. When the whole hair is colorless, then we have to do with albinismus—complete lack of pigment in all the tissues of the body.

Acquired canities may be premature or senile. For convenience we speak of a case as premature when it occurs before the age of thirty-five, as it is exceptional for the hair to turn white before that age. It is uncommon to meet with people of fifty years of age who have not more or less gray hair. As a rule, the first hair to turn gray is that on the temples; later, that on the top of the head and in the beard. The beard may lose its color first. The pubic and axillary hairs turn gray last, and often entirely escape. Occasionally and rarely the hair becomes gray, and after a time regains its normal color. This curious change of color from dark to gray and back again may repeat itself several times. It is not uncommon for the grayness to reach a certain amount, and then to remain stationary for a number of years, though the rule is that when once canities has begun it will steadily progress. There seems to be no doubt that the hair may turn white in a few hours under some strong nervous influence. Apart from the change in color, the hair is usually unchanged and the scalp is unaltered. The color changes first at the root of the hair. Exceptionally we find hairs that show alternate white and normally colored sections, forming what are known as “ringed hairs.” When the hair splits at the ends, the ends will look gray or dusty, on account of the admixture of air with the color of the hair. At first the hair becomes gray, and then white. Often an intermediate green or yellow color will be struck. Brunettes are more prone to turn gray than blondes, and men than women. There is no connection between baldness and grayness, though, as both are senile changes, it is sometimes noted that baldness follows canities after a few years.

Etiology.—Canities is due to some obscure and not understood change taking place in the pigment-forming apparatus of the skin. It is probable that in sudden blanching of the hair the loss of color is due to the entrance of air between the cells of the cortex of the hair. Advancing age, heredity, diseases and injuries to the scalp, some nervous and climatic influences,

prolonged mental strain and worry, and debility of all sorts are the causes of canities.

Treatment.—Nothing can be done for canities, excepting for those cases in which there is some evident and relievable cause. Such being removed, the color may return. Pilocarpine used hypodermically has been followed by a darkening of the hair, and may be tried.

DISCOLORATIONS OF THE HAIR. (G. T. JACKSON, M. D.)

Apart from turning gray, the hair may suffer changes in color. The hair may fall out after a severe illness, and come in of quite a different color. Periodic changes in color have also been reported. Prentiss reports a remarkable case in which the color of the hair became darker under the hypodermic administration of pilocarpine. But most of these color changes are due to external causes and are of the nature of dyes. Thus we have *green hair* in workers in copper. The copper salts can be found on these hairs. The same color has been met with in those who are not copper-workers, and it is not uncommon to see the hair assume a greenish shade when changing from its normal color to gray. *Blue hair* is met with in workers in cobalt-mines and in indigo-works. The color can be readily washed off. *Yellow hair* occurs sometimes in icterus; coal-black hair in those who work in coal.

It must never be forgotten in prescribing remedies for the scalp that they may color the hair. I have found this particularly in gray hair, and have learned that naphthol as well as a combination of corrosive sublimate and resorcin will change such hair to a greenish-yellow. Bicarbonate of soda will discolor dark hair. Chrysarobin stains the hair mahogany red. Peroxide of hydrogen and chlorine gas bleach the hair. Excessive sweating acts in the same way.

HYPERTRICHOSIS. (G. T. JACKSON, M. D.)

Definition.—By hypertrichosis is meant a growth of hair that is abnormally great, either in relation to the age or sex of the individual or to the place in which it grows.

Symptoms.—Hypertrichosis may be universal or partial, congenital or acquired. The *universal cases* are congenital, and are exceedingly rare. Several cases of this sort are on record in which the whole body was covered with hair excepting those localities in which hair never grows—namely, the palms of the hands, the soles of the feet, the backs of the last phalanges of the fingers and toes, the inside of the labia majora, the prepuce, and glans penis. These unfortunate people are known as “*homines pilosi*.” Even in these cases the hair is not the same on all parts, that on the body being softer and more fluffy than that on the head. With the excessive development of the hair there is a deficiency in the growth of the teeth.

Partial congenital hypertrichosis is far more common than the former variety, an excessive growth of hair taking place in a limited region. These cases are related to nevi, differing from them mainly in that there is no change in the color or texture of the skin. Hypertrichosis of the lumbar region is often associated with spina bifida, and at times assumes the appearance of a tail.

Partial acquired hypertrichosis is common, at least in some of its forms. Its least common form is that spoken of as “*hetero-chronic*,” by which is meant the premature appearance of what is known as the sexual hair. Cases

of children of the male sex with beards or of either sex with fully-haired pudenda have been reported. A much more common form is that of excessive length of hair or an excessive amount of hair in places that usually have but little. Again, we may have cases in which hair develops in unusual places, as upon the back of the nose.

The form that most interests us is that known as *hirsuties*—that is, the development of coarse hair upon the face of a woman. This growth takes place at two periods of life. Most cases occur in women who have passed or are nearing the climacteric, and then does not go beyond the growth of a not very large amount of coarse hair upon the chin and upper lip. Some straggling hairs may develop also on the cheeks. These are very manageable cases. The worst cases are those that begin about the age of puberty. In these cases the hair grows on all the face as in a man. Usually the growth is not as rapid as in a man, it remaining longer in the lanugo stage. With the growth of the hair on the face there is coincidentally a development of hair on the arms and legs to an extent greater than usually obtains in women.



FIG. 274.—The Russian "dog-faced man"—an example of excessive hypertrichosis.

Usually the growth is most developed on the chin, neck, and upper lip. Cases of transitory hypertrichosis in women have been reported, a growth appearing during pregnancy, for instance, to disappear after delivery. Hair has also been seen to grow on parts subjected to continuous irritation, to disappear after the irritation has been removed.

Etiology.—We know really nothing about the causes of hypertrichosis excepting that most of the cases of hirsuties are hereditary, some of the female relatives having the same growth. There seems to be some connection between the menstrual functions and the hair-growth. While some of my bearded women have been masculine in their make up, most of them have not been so. We also know that some insane women develop hair on the face.

Treatment.—For universal hypertrichosis we practically can do nothing, because of the great extent of the growth. For all other cases there is but one remedy, and that is electrolysis. Thus far, no depilating powders or fluids are known to physicians that do anything more than temporarily remove the hair. They all eventually increase the growth. Happily, electrolysis is

a perfectly reliable remedy. It has certain drawbacks, which are that it is somewhat painful, very tedious in profuse growths, sometimes in some skins it will leave slight scars, and no one is able to destroy every hair at the first attempt. But the result is sure, and each time the face is gone over the improvement is more and more marked. As in young women there is a tendency for the production of hair for some years, they should be told that we cannot destroy hair that has not appeared, and that they must be prepared for a long struggle with their malady.

The operation for the permanent destruction of hair we owe to Dr. Michel, an ophthalmologist of St. Louis, who introduced it for the destruction of ingrowing eyelashes. It was then taken up by Dr. W. A. Hardaway of the same city, and used for the destruction of hair in hirsuties. The instruments needed for the operation are a good galvanic battery with a current that can be relied on to run evenly; a needle-holder (Fig. 275), a fine needle,



FIG. 275.—Needle-holder.

a sponge electrode, and a pair of epilating forceps with narrow blades and an easy spring. A reclining chair is a convenience, especially if it has an adjustable head-rest. The patient should be seated facing a good steady light, but not in the glare. It is well to wash the part to be operated on and bathe it with an aseptic fluid. The needle, either a No. 5 or 7 steel broach or an irido-platinum needle, should then be passed along the hair in the direction in which it grows and into the follicle for a distance of from one-sixteenth to three-sixteenths of an inch, and the current completed by the patient grasping the sponge electrode. The hair is to be seized with the forceps and put slightly on the stretch until it comes out with the least possible traction. The current should then be broken by the patient taking the hand off the sponge. The needle should be attached to the negative pole of the battery, and a current strength of one to two milliampères should be used. If one has no galvanometer, he may use from six to ten cells of his battery, much depending upon how recently it has been filled. The hairs must not be taken out close to each other at the same sitting for fear of scarring, and the same part should not be gone over more than once in a week. The best means to reduce the hyperemia caused by the operation are bathing with hot water and anointing with cold cream or dabbing on a zinc lotion. The disinfecting of the part to be operated on before the operation and the application of peroxid of hydrogen after the operation will prevent pustulation that sometimes occurs.

When the growth is very fine it is not appropriate for the operation. The patient should be advised to let the hair alone and wait until it has grown coarser. If she will not do this—and many will not—then resort may be had to depilating powders. There is no difficulty in destroying the part of the hair above the skin, and it will do for a temporary expedient, the patient being informed that the growth will be made coarser by so destroying the hair. A powder composed of sulphuret of barium ζ iss, oxide of zinc $5vj$, and carmine $gr. j$ may be used, a little of the powder being mixed with sufficient water to make a paste, applied to the part, and washed off in three minutes; or one composed of sulphide of soda ζij and prepared chalk $5vj$, used in the same way and left on for ten or fifteen minutes or until the skin feels warm. It should

then be washed off and some bland ointment applied. "Rusma" is another preparation said to be used in Eastern harems, where it is the custom to destroy the pubic and axillary hair. It is composed of tersulphuret of arsenic ʒss, chalk ʒss, farina flour ʒij, and hot water to make a paste. This is applied with a wooden spatula in a layer as thick as a table-knife blade, left on for five or ten minutes or until it stings; then it is scraped off, the parts washed with warm water, and dusted with corn starch. All these powders require watching, and in the hands of the inexperienced and clumsy may set up a dermatitis, and possibly leave a superficial scar.

ATROPHIA PILORUM PROPRIA. (G. T. JACKSON, M. D.)

Atrophy of the hair exists under three forms—namely, fragilitas crinium, trichorrhæxis nodosa, and aplasia pilorum propria. These bear a resemblance to one another, but the first is characterized by a simple cleavage of the hair; the second has nodes on the hair and the cleavage occurs through the nodes; while in the third the fracture takes place in the internodular portions.

FRAGILITAS CRINIUM.

Definition.—This may be defined as that condition of the hair in which it is more or less dry and splits either at its extremity or in its continuity.

Symptoms.—The hair is dry and lusterless, and is seen to be split either at its ends or in the continuity of its shafts. In bad cases the hair looks dusty or as if it had been singed. If the cleft is at the end, it will run up the shaft for a variable distance. The filaments of the hair may separate widely or they may hold together. It occurs most often in the head-hair of women. There may be some disease of the scalp, in which case we have to do with *symptomatic fragilitas crinium*, or there may be no other disorder of the scalp, and then it is called *idiopathic fragilitas crinium*.

Etiology.—The symptomatic form is met with in the parasitic diseases of the scalp, in seborrhea, eczema, or other long-continued and dry disease of the scalp. It also occurs in general constitutional diseases attended by lowering of the nutrition of the body, such as phthisis and general nervous depression. All of these diseases interfere with the nutrition of the hair. The causes of idiopathic fragilitas are not so evident, but are without doubt due to malnutrition. Kaposi would explain the splitting of the long hair of women upon the theory that it is due to the distance of the distal end of the hair from the hair-root.

Treatment.—The treatment for the symptomatic form is that appropriate to the underlying cause. In both forms the hair should be cut above the cleft, and the scalp kept clean on general principles. Massage of the scalp may prove useful.

TRICHORRHÆXIS NODOSA.

Definition.—A condition of the hair characterized by nodular swellings along the shaft of the hair, and by fracture of the hair, most commonly through the node, the fractured end fraying out in a brush-like manner.

Symptoms.—This disease most often affects the hair of the beard, but may occur on any of the hairs. There are no subjective symptoms. On inspection there will be found one or more nodular swellings along the shaft of the affected hairs, and some of them will be found to be broken off and presenting frayed-out ends. The disease gives a singed appearance to the beard

or part affected if at all pronounced. Superficially viewed, the hair looks as if infested with nits, but closer inspection will show that the swellings are more oval and more perfectly surround the hair than nits do. There may be from one to five nodes on a hair, and the coarser the hair the larger will be the node. The nodes occur nearer the distal than the proximal end of the hair, usually in the upper third of its length. The hair is brittle, breaking through the nodes on slight traction. At times the fracture is through the internodular portion. If the fracture is incomplete, the fibers of the node will spread out, giving the appearance of two paint-brushes pressed end to end (see Fig. 276). There is no tendency to alopecia.



FIG. 276.—Splitting of the end of a hair: *T.n.*, trichorrhexis nodosa; *S.p.*, scissura pilorum (Michelson).

Etiology.—The cause of the disease is not fully determined. It is usually regarded as a neurosis, but of late the tendency has been to class it among the parasitic diseases.

Treatment.—The treatment is most unsatisfactory. Persistent shaving has at times been followed by a removal of the disease. It will at least remove the unsightly appearance. Antiparasitics may be tried, such as sulphur or pyrogallol.

APLASIA PILORUM PROPRIA.

Definition.—A disease of the hair marked by the appearance along the shafts of a number of nodes and by fractures of the shafts through the internodular portions.

Symptoms.—Like trichorrhexis nodosa, the hairs have upon them one or more nodes, but, unlike that disease, here the normal part of the shaft is the node, while the diseased part is the internodular portion. In consequence of this the fracture takes place through the internodular portion. Another point of difference is that this disease is congenital in nearly all cases, and appears in infancy. It is also hereditary in some cases. Though the child is born with apparently normal hair, after a few weeks the hair breaks off and the scalp shows signs of keratosis pilaris, with many small papules, sometimes reddened, out of which stumps of broken-off hair may or may not protrude. Complete alopecia may result and cicatrices may form.

Etiology.—The disease is congenital and in many cases hereditary, at times descending in the same sex. Further than this we know nothing of the etiology of the disease. Strangely enough, the nodes and the internodular constrictions are arranged alternately, the constricted parts containing neither medulla nor pigment. Why this should be we can form no conception.

Besides these atrophic diseases there are a few abnormalities of the same nature that have been described. Thus we have—

End-atrophy, in which the distal ends of the hair are bulbous and lighter colored than the rest of the hair.

Phagmesis is the name given long ago to a case reported in which the hair had the appearance of feathers.

Noduli laqueati is not an atrophic condition, but an accidental tying of the hair in knots, in which lodge all sorts of foreign matter derived from the atmosphere. It is doubtless due to handling of the hair.

PLICA POLONICA. (G. T. JACKSON, M. D.)

Definition.—Plica is a condition of the hair in which it becomes matted together into thick masses.

Symptoms.—The only proper symptom of this disease is the matting of the hair, usually of the head, into masses of larger or smaller size and various shapes, entangled in which is more or less foreign matter, such as dust, pediculi, etc. Sometimes the plica will assume the shape of a long tail; sometimes that of a coil on top of the head, or any other shape. When the plica is lifted off from the scalp the underlying parts are most commonly found to be eczematous, especially if it lies close to the scalp. If it is at some distance from the head, the scalp may be normal or slightly scaly. In some few cases no scalp disease will be found. The odor from these plica masses is commonly most disgusting.

Etiology.—The great majority of cases of plica are due to filth, lack of care of the hair, and eczema due to pediculi, or other disease of the scalp. There are also undoubted cases of felting of the hair into plica-like masses that are due to nervous influences. This form of plica occurs in hysterical girls. The usual form is met with most often in Poles and Russians.

Treatment.—The treatment of the usual form of plica is to cut the mass off with the shears, and then to treat the underlying disease of the scalp. If the mass is not large, patient soaking and oiling will soften it and enable us to unravel it. In the cases due to nervous influences we should attend both to the hygiene of the scalp and the disease of the nerves.

PIEDRA. (G. T. JACKSON, M. D.)

A description of this disease we owe to Mr. Malcolm Morris of London. It is said to occur only in Cauca, one of the states of the United States of Colombia. It is supposed to be due either to a fungous growth or the use of a mucilaginous oil for a hair-dressing. It consists in the growth along the hair-shaft of a number of small, hard, dark-colored nodes. These nodes are so hard that when the hair-mass is shaken they rattle like little stones. Hence the name of the disease, which in the native language means "stone." Women are by far most often affected. When viewed under the microscope in section the appearance of the node is that of a honeycomb mass consisting of spore-like bodies, deeply pigmented on their surface, the whole originating from one cell by budding. After the mass has attained a certain size its surface-cells become darker and form a pseudo-epidermis.

BEIGEL'S DISEASE. (G. T. JACKSON, M. D.)

This is a parasitic disease, developing in artificial hair, that was first described by Lindemann in 1866, and afterward by Beigel. The parasite forms a number of dirty-brown knots on the hair. As it has no effect on the skin, it may be regarded simply as a scientific curiosity.

TINEA NODOSA. (G. T. JACKSON, M. D.)

This is the name selected by Cheadle and Morris for a disease of the hair in which the hairs look as if encrusted by a granular material around and ex-

ternal to the shaft. The skin is unaffected, and the hairs are firmly fixed in their follicles. The hairs may split. The encrustation increases toward, and reaches its maximum at, the free end of the hair. It is composed of an agglomeration of minute spherical, light-refracting bodies of uniform size, resembling, but larger than, the spores of the trichophyton fungus. If the hairs are split, a few spore-like bodies will be found either clinging to the fibrils or lodging in the spaces between them.

LEPOTHRIX. (G. T. JACKSON, M. D.)

This disease occurs in the axillæ and on the scrotum of those who sweat freely, the hairs in these locations becoming dry and dull, looking as if steamed. They feel rough and uneven. Examination of the hairs will show that they are covered with concretions that may involve the whole shaft or be in the form of nodes. Both forms of incrustation may be present on the same hair. They are firmly adherent. The hairs otherwise are unaffected, and end with fine points. The disease is due to the lodgement and growth of a bacillus in the cortex of the hairs, whose epithelium has been removed by the continuous maceration of the sweat. At first bacilli alone are found, but later there is developed a hard, granular substance which, like a cement, runs in between the bacilli and surrounds the whole damaged part of the hair, forming the node. The bacilli are short, fine rods with rounded ends. They are sometimes joined together, but do not form threads.

Besides this form of disease, induced by excessive sweating, we meet with cases in those who sweat profusely in which grayish, yellowish-red, or brown nodes surround the hairs of the axillæ, chest, genital region, and inside of the thighs. These nodes are of various sizes and completely invest the hair. When taken from the sweating skin the masses appear slimy, but when the hair is dry they are hard. They are composed entirely of micrococci, and their mode of invasion of the hair is the same as in lepothrix.

Treatment.—The treatment of these sweat-engendered diseases is to keep the underlying skin clean and as dry as possible by means of weak antiseptic lotions and dusting-powders after using soap and water.

ALOPECIA. (G. T. JACKSON, M. D.)

Definition.—Alopecia, or baldness, is an abnormal loss of hair, arising from any cause, which occurs most often on the scalp, but may affect all the hairy regions of the body.

Symptoms.—For convenience it is well to regard the disease as having four varieties—namely: 1, Alopecia adnata; 2, Alopecia senilis; 3, Alopecia prematura or presenilis; and 4, Alopecia areata. The last variety differs so materially from the others that it will be described in a separate article.

Alopecia adnata, as its name indicates, is congenital baldness. It may be complete or partial. Many cases of alleged alopecia adnata are only cases of keratosis pilaris, and should be separated from it. In the true cases there is no disease of the scalp evident to the naked eye. Some of these children are born with good heads of hair, but their hair falls out shortly after birth, and fails to grow in again. Sometimes there will be a rim of hair around the head like what is seen in bald old men. Delayed dentition and diseased nails will be found in many of these cases.

Alopecia senilis is the baldness occurring in advancing age. For convenience the age of forty-five is chosen as the dividing-line, and those cases occurring after that age are spoken of as senile. It is common to find men

over forty-five more or less bald. The loss of hair usually first shows itself as a tonsure upon the top of the head, from which the baldness gradually extends into the surrounding hair from behind forward. The mass of hair grows lighter and lighter until the scalp is devoid of hair, and appears smooth, stretched upon the bones, shiny, and, it may be, oily and thinned. A fringe of hair is left all around the head even in the worst cases. In many cases the baldness reaches a certain degree and then stands stationary for years. The baldness is always symmetrical.

Alopecia Presenilis or Prematura.—It is usual to recognize two main varieties of this form of baldness—namely: *Alopecia prematura idiopathica* and *alopecia prematura symptomatica*.

Alopecia prematura idiopathica is that variety of presenile baldness which occurs before the forty-fifth year of age, and arises without any apparent cause either in the scalp or general health of the patient. It is a gradual and progressive loss of hair, the individual hairs falling out, to be replaced with those of lesser diameter, and then the mass of hair becoming thinner and thinner by the failure of the follicles to produce hair at all. Like the senile form, it commonly shows itself first on the vertex, forming the tonsure, or it may begin forward and spread backward. A very common place of beginning is the temples. It is always symmetrical, and the scalp is found to be more or less bound down to the skull, feeling thin. One very frequent variety is the receding temple, which is most often a family trait.

Alopecia prematura symptomatica is that variety of loss of hair in which there is some disease of the scalp or general health to account for it. It is met with most frequently in connection with that scaly disease of the scalp known as seborrhea, dandruff, or seborrheal eczema, syphilis, following fevers, and with localized destructive diseases of the scalp.

Alopecia furfuracea, or *alopecia pityrodes*, is the name applied to those cases that arise from some form of what is generally spoken of as dandruff, and is by far the most common of all varieties of alopecia. Now, dandruff really comprises at least three diseases—namely, pityriasis, where there is only slight scaling of the scalp; seborrhea siccæ, in which there are more or less thick crusts of fatty matter and corneous scales adherent to the scalp; and that inflammatory disease of the scalp where to this fatty crusting of the scalp we have added redness and sometimes other symptoms of inflammation, which has been variously named seborrheal eczema, seborrheal dermatitis, and inflammatory seborrhea. According to the most recent teachings, all of these three diseases are but phases of seborrheal dermatitis. In every case of *alopecia furfuracea* we find one of these forms of disease or a history of there having been dandruff at some time. This form of baldness occurs at all ages, but perhaps it is most common before the thirtieth year. It follows upon the seborrheal condition after it has lasted for a few years. It affects the same regions as the other forms of alopecia, and runs the same gradually atrophic course that the presenile form does. As the hair lessens in quantity there is no let up of the scalp disease, but when baldness is established, then it frequently ceases of its own accord. Both in this form of alopecia and in the previous one it is no uncommon thing to see a tuft or island of hair remain over the middle of the forehead for a long time after the rest of the top of the head is bald.

Alopecia syphilitica is the baldness that comes with syphilis. It has two pretty well-defined periods of appearing—namely, in the early stage of the disease, on account of the interference of general nutrition by the syphilitic poison; and in the later stages of the disease, when it is due to the breaking

down of syphilitic lesions. When it occurs in the early stage of the disease it takes the form of a general thinning of the hair, the hair falling out in tufts here and there, so as to give the head a very ragged look, as if some one had slashed away at it with a dull pair of shears. The scalp may show no evidence of disease, or there may be some dandruff present or some papules or pustules. There will usually be other evidences of syphilis on the body, such as one of the early exanthems. When it occurs as a late symptom there will be broken-down, ulcerated lesions of syphilis on the scalp or cicatrices due to them. Not only is the scalp affected, but the other hairy regions may likewise be affected. The broken arch of the eyebrow is characteristic, and is often seen in women, as well as the loss of hair on the pubis.

Defluvium capillorum is the form of baldness in which the hair falls out rapidly after some acute illness, such as typhoid fever, parturition, and the like, or in the course of some cachexia, such as that arising from the abuse of mercury. It is a general thinning of the hair, and often does not show itself until some weeks or months after convalescence is established, when the patient is surprised by seeing the hair come out rapidly. It is rarely intense enough to produce complete baldness. The early baldness of syphilis is a form of *defluvium capillorum*.

Alopecia follicularis is a loss of hair due to a disease affecting the follicles of the scalp, such as ringworm, impetigo, erysipelas, and the like. The appearances will vary with the disease that produces the loss of hair, and will be described in the sections devoted to those diseases.

Etiology.—Symptomatic premature baldness has many causes. We have already mentioned seborrhea, syphilis, ringworm, impetigo, acute fevers, and erysipelas. Anything that will lower the general nutrition of the body may affect the growth of the hair. Excessive sweating of the head is a cause in some instances. Some people will lose their hair when they live by the seashore. *Defluvium capillorum* is due to interference with the nutrition of the hair during the illness with which it occurs. That it follows so long after the patient is apparently well of his disease is because it takes some time for the hair that has been loosened from its papilla to be pushed out of the follicle by the new hair growing in to take its place. That pustular and deep inflammatory diseases of the hair-follicles should be followed by loss of hair is what is to be expected. *Keratosis follicularis* acts in this way as a cause of baldness. There is a growing opinion that dandruff is due to a parasite and therefore contagious. There are some good grounds for believing this, although the thesis is not yet proven. Sabouraud¹ believes he has found the microbe, and Merrill² has succeeded in obtaining pure cultures of a diplococcus in this disease. Fortunately, every case of dandruff is not followed by baldness. Those who inherit naturally vigorous hair will often escape baldness, though having dandruff for years. On the other hand, those who come of families in which baldness occurs early will be sure to have the fall of their hair hastened by the disease.

Diagnosis.—The diagnosis is easy, as we have both the loss of the hair and the disease of the scalp before us in most of the cases. *Defluvium capillorum* is always suggested by the history of some general exhausting disease preceding the hair-fall and by the sudden and general fall of the hair. It is differentiated from the senile form by the age of the patient, and from the idiopathic form by the presence of some evident cause. From *alopecia areata* it is diagnosed by the absence of circumscribed, round, bald areas. The irregular, ragged look of the baldness of early *syphilis* bears a resem-

¹ *Annal. Derm. et Syph.*, 1897, viii. 257.

² *N. Y. Med. Journ.*, 1895, lxii, 528.

blance to the baldness of favus, but the absence of all history of favus, as well as the fact that there is no change in the texture of the scalp, is enough to establish the diagnosis. In favus there is always cicatrization of the scalp.

Treatment.—It is very important that every disease of the scalp should be taken care of as early as possible, so as to prevent the beginning of destruction of the hair. This is especially the case in those who come of families in which baldness occurs early. These should pay special attention to the hygiene of the scalp. They should avoid frequent wetting of the scalp without the subsequent application of a little oil to supply the natural oil washed off. The hair should be brushed daily and thoroughly for some five or ten minutes with a long-bristled not too stiff brush. The scalp should be washed every two or three weeks with any good soap, the soap washed out by alternate douches of hot and cold water, the hair carefully dried, and then a little vaseline or sweet oil or cold cream rubbed into the scalp.

In idiopathic cases we should try stimulation by means of massage, which seems to me to offer the most rational means for stimulation of the scalp. This should be done for about five minutes daily, the scalp being loosened up from the skull by means of pushing toward each other the ends of the fingers of the two hands placed opposite to each other on the scalp and at a short distance apart. The whole of the top of the head can be readily masséed in this way. The presence in the market of a host of alleged hair-tonics does not speak well for the efficacy of any one of them. The tincture of cantharides is probably the most-used application for stimulating the scalp. It may be used in the strength of $\mathfrak{z}\mathfrak{j}$ – $\mathfrak{z}\mathfrak{i}\mathfrak{i}\mathfrak{j}$ to $\mathfrak{z}\mathfrak{j}$. Acetic acid seems to have some influence on hair-growth, and may be used in Cottle's formula :

R. Acidi acetic,	$\mathfrak{z}\mathfrak{ss}$;
Pulv. boracis,	$\mathfrak{z}\mathfrak{j}$;
Glycerin.,	$\mathfrak{z}\mathfrak{i}\mathfrak{i}\mathfrak{j}$;
Spts. vini rect.,	$\mathfrak{z}\mathfrak{ss}$;
Aq. rosam,	ad $\mathfrak{z}\mathfrak{v}\mathfrak{i}\mathfrak{j}$.—M.

Pilocarpine has caused the hair to grow both more luxuriantly and darker in some cases, and the muriate might be used hypodermically. I have never tried it, as it seems a rather heroic measure. A jaborandi pomade made by boiling down the tincture to half its volume and adding it to cold cream, so as to form a 40 per cent. ointment, does well. Other stimulants to the scalp are carbolic acid, 2 per cent., in alcohol ; tincture of capsicum, $\mathfrak{z}\mathfrak{j}$ – $\mathfrak{z}\mathfrak{i}\mathfrak{i}\mathfrak{j}$ to $\mathfrak{z}\mathfrak{j}$; chloral, $\mathfrak{z}\mathfrak{j}$ to $\mathfrak{z}\mathfrak{j}$; tincture of nux vomica, $\mathfrak{z}\mathfrak{j}$ to $\mathfrak{z}\mathfrak{j}$; corrosive sublimate, 1 to 500 ; aqua ammoniæ fort., pure or diluted.

In symptomatic cases the treatment will vary with the underlying cause. In that form due to pityriasis or seborrhœa sicca I have most confidence in sulphur. This may be used in the strength of $\mathfrak{z}\mathfrak{j}$ to $\mathfrak{z}\mathfrak{j}$. It may be exhibited in cold cream or vaseline or any thin ointment, or suspended in a solution containing oil and alcohol. As the drug does not dissolve to any extent, all mixtures containing it must be shaken up before they are used. It should be applied daily for about ten days, and then the scalp should be washed with soap and water. For the next ten days it is usually sufficient to apply the ointment or oil every other day, and follow with the shampoo, and so the number of applications should be reduced in number, but the applications should be continued at least once or twice in ten days for a number of weeks. As the seborrheal condition is prone to return, the patient should be instructed

to keep his ointment by him for use when occasion calls. Other drugs useful in this form of baldness are resorcin, 2-5 per cent. ; naphthol, 2-5 per cent. ; oil of cade ; and the means useful in the treatment of the seborrhea or seborrheal dermatitis.

Syphilitic alopecia needs no special treatment when it occurs as a general loss of hair. The hair is sure to grow, and we need to give a stimulant only for the moral effect on the patient. If there are any lesions on the scalp, they should be treated like the same syphilides on any other portion of the body. Defluvium capillorum takes care of itself in most cases, and only requires attention to the hygiene of the scalp and preventing the patient from cutting off the hair or shaving the scalp. Alopecia follicularis requires the treatment appropriate to the disease in which it occurs.

ALOPECIA AREATA. (G. T. JACKSON, M. D.)

Synonyms.—This disease has been called by many names, the principal ones being—*area Celsi* ; *porrigo seu tinea decalvans* ; *pelade* (Fr.) ; *Die kreisfleckige Kahlheit* (Ger.).

Definition.—Alopecia areata is a disease of the scalp characterized by the sudden fall of the hair in round circumscribed patches, leaving perfectly bald, smooth areas of scalp, without any secondary symptom. It usually affects the scalp, but may affect any hairy region. It tends to run a chronic course and to recover spontaneously.

Symptoms.—The disease may be sudden in its onset, the patient being told or accidentally discovering that he has a bald spot either on the head or some other hairy part. Or the baldness may appear more gradually, the hair falling more or less rapidly from a circumscribed patch. The bald area may attain its size at once, or, which is the usual course, it gradually grows larger by the hair falling out from the periphery of the original spot. The bald area is always round, unless two or more contiguous patches join at their edges, when the patch may have a scalloped border, though even then it is easy to make out the formation of the patch from a number of round ones. Apart from the baldness, there is no other change in the scalp or underlying part, the skin being smooth, soft, of normal color or perhaps a little pale. It is sometimes slightly depressed on account of the roots of the hairs having fallen out. The sensation of the patch may be normal or somewhat lessened, as shown by the amount of stimulation it will bear without pain to the patient. A few hairs or their roots may remain in the patch for a few days, but these soon fall out. There may be but one patch. Usually there are a number of them scattered over the region affected. Most of the cases occur on the scalp, the next most frequently affected region being the beard. But any part supplied with hair may be affected. In most cases the scalp alone is the part diseased ; sometimes both scalp and beard suffer at the same time, and in very bad cases that are worthy of the name of malignant all the hair is shed from the body. If the disease has attained its full extent, the hairs at the margin of the patch are firmly fixed in their follicles and normal in appearance. If the disease is spreading, the hairs at the margin of the patch come out easily, and they will be dry and brittle.

Exceptionally, the patches, instead of being round or oval, will be linear or band-shaped. This form usually arises from a well-established injury to a nerve, as from a cut or bruise. The size of the patches varies : they may be no larger than a pea or as large as the palm of the hand. At times the whole scalp will be covered with large patches formed by the coalescence of smaller ones. When recovery takes place, it will be heralded by the appearance of

lanugo hairs in the patches. These will fall out, and their places will be taken by stronger hairs, until at last normal hairs will be produced. The disease has a tendency to recur, though such recurrence is not an essential part of the disease.

Etiology.—Our knowledge of the etiology of this disease is by no means perfect. By the more conservative observers it is considered to be a tropho-neurosis. The more advanced and radical students of the subject are of opinion that the disease is parasitic, though the parasite has not been found that is accepted by all as its cause. In support of the neurotic theory we have the presence of antecedent pain or well-established nerve-injury in some cases; the sudden onset; and the results of Joseph's experiments in producing the disease by cutting out the second cervical ganglion in cats. It has also been seen to follow operations for the removal of enlarged glands and tumors in the neck.

The parasitic theory of causation finds support in the occurrence of epidemics of the disease, showing a contagious element in the production of some cases. Only one epidemic has been reported in this country, and that was by Putnam, whose observations were confirmed by Drs. White and Bowen of Boston.¹ This was in an asylum for girls. There was absolutely no trace of ringworm in these cases: 60 out of 65 girls in the institution were attacked by the disease, which consisted in loss of hair in areas, just as occurs in alopecia areata. A number of epidemics of alopecia areata have been reported by competent observers in France. On the other hand, the vast majority of cases do not seem to possess contagious qualities. Some of the English observers believe that the disease is the result of ringworm in an earlier period of life. It is certainly worthy of notice that in those countries in which ringworm is most common alopecia areata is most common.

The following have been noted as predisposing causes: disturbances of the general health, menstrual disorders, arsenic.

Pathology.—Hairs from the edges of spreading patches show atrophic changes of their roots, but these are not characteristic of the disease, but such as may be found in any case of loss of hair. Giovannini² teaches that the disease begins as a perivascular infiltration by leukocytes about the lower part of the hair-follicle, from which point the hair-root is invaded, causing degeneration of the cells of the matrix, hair-, neck, and internal root-sheath, which may be followed by destruction of the hair-bulb. The follicle atrophies, but usually escapes destruction, a new hair forming after a time. Robinson³ also shows that the disease from the earliest period is inflammatory, affecting especially the corium, and is not primarily a disease of the follicles. These are affected secondarily. The longer the disease lasts, the plainer are the signs of inflammation. The same author⁴ has also found cocci deep down in the follicles as the cause of the disease. They were in the lymphatic vessels and in the walls of a few blood-vessels, and are small round, dark bodies of equal size and grouped in zoöglea masses. The more chronic the case the fewer the cocci. Various parasites have been reported upon by various observers, but as there is no unanimity in their findings, we must hold that the question of the parasitic nature of the disease is still unsettled. Sabouraud⁵ believes that the hair-fall is due to a bacillus which he describes.

Diagnosis.—If the characteristics of alopecia areata are held in mind, there can be no difficulty in recognizing a case, as there is no other disease in

¹ *Archiv. Pediat.*, 1892, ix. 595.

² *Monatshft. f. prakt. Dermat.*, 1888, vii. 28.

³ *Morrow's System of Gen.-urin. Diseases, etc.*, 1894.

⁴ *Monatshft. f. prakt. Dermat.*, 1888, vii. 476.

⁵ *Annal. Derm. et Syph.*, 1896, vii. 253.

which we have round or oval perfectly bald patches without other changes in the skin. In ringworm we have round or oval patches, but they are not perfectly bald, as they have broken-off hairs in them. Moreover, they are scaly and have a rather grayish color. In some old cases of ringworm the patches may become bald, but even then we will have a well-marked history of the gradual formation of the patches, and not of their sudden occurrence. In favus we have perfectly bald patches, but they are irregular in shape and evidently cicatricial in character. In syphilis we have the sudden formation of bald patches, but they are of irregular shape and not sharply defined, but rather a general thinning of the hair. No absolutely bald round areas can be made out in syphilis of the early stages, while in the later baldness of syphilis, the bald spots being caused by destructive processes, there is evident cicatrization.

Prognosis.—The hair tends to grow in due time. The younger the patient the more certain will be the return of the hair. The chances of recovery lessen as the patient passes middle life. Malignant cases, when all the hair is lost, are of doubtful prognosis, and often remain permanently bald. It should not cause over-anxiety even if two years pass without hair-growth, but if the baldness continues longer than that, it renders the prognosis grave, though the hair does return in some cases after it has been absent more than four years.

Treatment.—In a disease like alopecia areata, that tends toward recovery even without treatment, it is hard to say how much we really accomplish with our remedies. Stimulation is what we want in the treatment of the disease, and of the stimulants one of the best is the liquor ammoniæ fortior, applied once or twice daily to the bald areas. Under this I have seen a number of cases recover. Bichloride of mercury, 2 or 3 grains to the ounce, has done well in some cases. The same drug has been used hypodermically by Moty in a solution of 4 per cent. strength in water, 2 per cent. of cocaine being added. Of this four to six drops are injected into a small patch, and four or five injections of the same amount are made about the periphery of a large patch. These injections are to be repeated every four or five days. Good results are reported. By others chrysarobin is preferred in the form of an ointment of 3 to 12 per cent. strength, care being used to avoid getting the drug into the eyes. Pure carbolic acid is another powerful remedy, of which Bulkley¹ speaks highly. It is to be painted on to small patches at a time. Croton oil, used with care as a blistering fluid, has been followed by growth of hair. Cantharidal collodion is used for the same purpose. Iodine repeatedly painted on the patches has been followed by growth of hair. I have seen good recovery take place after other plans had failed by using the method of Raymond,² as follows: The surface of the patch is to be washed with carbolic soap and its periphery shaved twice a week. Every morning a wash of—

Ry. Hydrarg. bichlor.,	gr. vijss ;
Tinct. cantharidis,	ʒvj ;
Balsam Fioraventi,	ʒjss ;
Aquæ cologniensis,	ʒv.—M.,

is to be rubbed into the patches with a paint-brush for one or two minutes. At night the following solution is to be used in the same way :

Ry. Acidi salicylici,	ʒss ;
Naphthol.,	ʒijss ;
Acidi acetici crystal.,	ʒss ;
Ol. ricini,	ʒijss.—M.

¹ *Journ. Cutan. and Gen.-urin. Dis.*, 1892, x. 47.

² *Annal. derm. e syph.*, 1892, iii. 794.

In one of my cases the hair returned in sixty days, which is the time in which Raymond promises a return of the hair. Both galvanic and static electricity may do good. Many other combinations and drugs have been recommended, but the ones given are as reliable as any.

FOLLICULITIS DECALVANS. (G. T. JACKSON, M. D.)

Definition.—As its name indicates, this is an inflammatory disease of the hair-follicles followed by destruction of the hair.

Symptoms.—At present our knowledge of this disease is not complete, and we are in some doubt as to what the disease really is. It has been recently described by French authors under various names. Lupoid sycosis, alopecie cicatricielle innominée, acne pilaire cicatricielle dépilante, folliculite épilante, acne decalvante, ulerythema sycosiforme, and sycosis chronique are some of these names. The disease is marked by a follicular and perifollicular inflammation; by a complete destruction of the hair-follicles, causing baldness and cicatricial tissue about the follicle-mouths; and by the tendency of the lesions to group. It may show itself in the beard, on the scalp, or on any part of the body supplied with hair.



FIG. 277.—Folliculitis decalvans.

Folliculitis decalvans of the bearded portion of the face affects by preference the cheeks, whence it may invade the scalp. It begins as a folliculitis by redness of the part and the appearance of vesico-pustules at the follicle-mouths in groups. When the acuteness of the disease is over, it will be found, as the crusts fall off, that the skin underneath is cicatricial and the hair has been permanently destroyed. The patches may be single or multiple, symmetrical or non-symmetrical. They tend to spread slowly, serpigiously, and at their peripheries. The disease is chronic in its course, and may exist for years, gradually sowing the beard and temporal regions of the scalp with small bald patches, which are cicatricial, depressed, and perhaps keloidal. This is the lupoid sycosis or sycosis chronique or ulerythema of some authors. The last term is that of Unna, who says that the pustular element at times met with is not part of the disease, but is accidental.

Folliculitis of the scalp has two forms—the alopecie innominée of Besnier and the folliculite epilante of Quinquaud. In the first form, the alopecie innominée, we find on the scalp one or a number of irregular bald patches, which are cicatricial, thinned, slightly depressed, smooth, or sieved over with the open follicular mouths. There may be no evidence of dermatitis, or there may be slight signs of inflammation about the mouths of the follicles. Sometimes there may be redness with fine scaling, or even some small and superficial pustules. These are soon transformed into depressions in the epidermis, out of which the hair falls. With the fall of the hair there is a subsidence of the inflammation. The hair is permanently destroyed. The disease often is noticed by accident, and examination shows the destroyed scalp and the loss of hair. Around the patches there are tufts of hair or the cicatricial patch runs out in irregular shape into the sound hair.

The folliculite epilante usually affects the scalp, but it may occur on the beard, pubis, and axillæ. It corresponds with the preceding form, but has a more marked dermatitis preceding it. The patches are about the size of a silver quarter of a dollar, pale, and show a few red points in them. About the patches are various evidences of folliculitis, such as purulent points and small abscesses with hair in the middle of them, or there may be only red papules. In either case the hair is permanently destroyed.

Etiology and Pathology.—We are ignorant of the cause of the disease. A micrococcus has been described by Quinquaud as the cause of his form. It occurs as a monococcus, diplococcus, and in series of four in the blood and in the inflamed skin. The fluid from the cultures rubbed into the skin of animals and man produces a similar disease. In all forms of the disease there is atrophy of the hair-follicles and sebaceous glands.

Diagnosis.—Folliculitis decalvans of the beard differs from sycosis in causing permanent destruction of the hair with cicatrization of the skin. It is a more sluggish process, with less pronounced symptoms of inflammation. Sycosis does not permanently destroy the hair, and is distinguished by pustules about the hair-follicles and a good deal of crusting in chronic cases. It is more disseminated through the hair, and not so patchy. The diagnosis of folliculitis decalvans of the scalp is by no means easy, specially from the remains of favus. In fact, without seeing favic crusts or having a history of their occurrence it would be very difficult to make a diagnosis. The patches differ from those of alopecia areata in being irregular in shape and in the signs of inflammation that they will show at some time or place. Alopecia areata is in round or oval patches and absolutely non-inflammatory.

The **prognosis** is bad, as the disease is progressive.

The **treatment** thus far has been most unsatisfactory. Perhaps the best things to do are to use an antiseptic solution and to keep the scalp clean.

DERMATITIS PAPILLARIS CAPILLITII. (G. T. JACKSON, M. D.)

This is a rare disease of the scalp that has received several names. The one here given is the one proposed by Kaposi, who first described the disease. It has been assumed by some to be one variety of folliculitis decalvans. It has been called frambesia, aene keloid, and pian ruboide.

Symptoms.—The disease is located in most cases upon the back of the neck just at the lower part of the hair, whence it may spread up the back of the head to reach the vertex. It begins as an eruption of large and small papules that are markedly firm and of a congested red color, as if they were full of blood. They are discrete at first, but afterward run together to

form well-marked elevated, uneven, lobulated tumors. At times pustules form on top of the lesions, but are superficial. The hair is partly lost from over the tumors and partly gathered into bunches—a characteristic of the disease. When the mass attains a large size it sometimes exudes a foul-smelling secretion, bleeds easily, and is covered with crusts. In course of time the growth flattens down into a keloidal mass. Pain may be complained of, but often there are no subjective symptoms.

Etiology and Pathology.—The cause of the disease is not determined. From its most frequent location it has been suggested that it is caused by the rubbing of the shirt-collar or the pressure of the collar-button. It occurs at any age and in either sex. Kaposi describes the disease as a chronic inflammation of the corium, attended by a great increase in the number of the blood-vessels and in the size of the papillæ. This is followed by the formation of new connective tissue, which by pressure destroys the sweat- and sebaceous glands, and at last the hair-follicles and hairs.

Diagnosis.—Its location upon the back of the neck and the firmness of its papules are peculiar to this disease. It differs from syecosis in the absence of pustules pierced by hairs. Warts or papillomas are much softer, and do not run the same course. Syphilis may be suggested in some cases, but a little watching of the same will soon decide, as the syphilide would either soften and ulcerate or be absorbed.

The **treatment**, thus far, has not been successful. The growths may be cut out or otherwise destroyed, but are very liable to return.

CONGLOMERATE SUPPURATIVE PERIFOLLICULITIS. (G. T. JACKSON, M. D.)

This is a rare disease, first described by Leloir.¹ Other authors, mostly French, have since then reported cases.

Symptoms.—As described by Leloir, the disease seems to commence as a diffused red patch upon which small pustules develop, or as small red more or less conglomerate papules that form patches. Both forms are itchy. A fully-formed patch is round or oval, sharply defined, elevated, flattened, and of red, vinous, violaceous, or blue color. The patches vary in size from that of a five-cent piece to that of a silver dollar. They are often crusted, but when the crust is removed their surface is smooth or mammillated, never papillomatous, riddled by a number of orifices, pinpoint to pinhead in size, the mouths of the glands. These are often obstructed by a greenish plug of dried pus. There are also a large number of yellowish points that are ready to become pustules. At a more advanced stage these pustules may become small ulcers. Lateral compression of the patches forces out on the surface a certain amount of pus or a serous fluid or vermicelli-like masses. If the disease is still more active, the patch may be greatly swollen and elevated, and closely resemble a kerion. Indeed, it is questionable if the disease is not simply a kerion developing away from its usual site, the scalp.

The part affected is most often the back of the hand or the wrist. It may occur also on the foot, thigh, or elsewhere. The hair is usually absent from the patches. There are no constitutional symptoms, nor is itching a prominent symptom. The course of the disease is acute, reaching its height in about eight days, and under proper treatment subsiding in about two or three weeks. The hairs come in again after the subsidence of the disease, and no permanent damage is done to the skin.

Etiology and Pathology.—The cause of the disease is not yet deter-

¹ *Annal. de Derm. et Syph.*, 1884, v. 437.

mined. By some it is regarded as simply a manifestation of trichophytosis. Leloir describes it as a perifolliculitis of the hair and sebaceous follicles, and regards it as due to micrococci, which occurred both single, double, and in zoöglea masses.

Diagnosis.—It differs from carbuncle in the absence of systemic reaction, the mildness of its symptoms, and the rapidity of its progress to recovery; moreover, it is lacking in that brawny induration so characteristic of carbuncle. It differs from eczema in not itching, and in having so many points from which pus is exuding or to be squeezed easily, and in being sharply defined and running a definite course.

Treatment.—The best treatment seems to be to squeeze out the pus once a day, bathe the part then with warm carbolized water or boric acid for half an hour, and cover with an antiseptic dressing. Obstinate cases may have to be curetted.

SYCOSIS. (G. T. JACKSON, M. D.)

This disease has been called by many names: its most common synonyms are folliculitis barbæ, folliculitis pilorum, acne sycosis, sycosis non-parasitica, mentagra, and, erroneously, barber's itch.

Definition.—An inflammatory disease of the hair-follicles, marked by the eruption of isolated papules or pustules pierced by hairs, which chiefly affects the hairy portion of the face and runs a chronic course marked by relapses.

Symptoms.—The disease begins by the eruption of a few or a great number of small red papules about the hairs, which are isolated and have sound skin between them. If the beard is the affected part, a small portion only may be affected, or the papules may be scattered through the whole beard. Usually the cheeks are more affected than the chin, but the upper lip is the part most frequently attacked. Sometimes the disease may stop at the papular stage and recovery take place. More commonly the papules are seen to change into pustules, new pustules form, and the disease progresses. At first and for some time the lesions are isolated, but in pronounced cases it will be seen that the pustules come out so near to each other as to crowd together and form patches. If the pustular process is intense, we will have crusted patches that are swollen and raised. After a time the intensity of the inflammation lessens under appropriate treatment or spontaneously, and the patient congratulates himself that he is getting well, when suddenly, without apparent cause, a relapse takes place and he is as bad as ever.

There is rather a sense of burning, tension, and discomfort than of itching in sycosis. While the disease most often attacks the bearded portion of the face, involving it either wholly or in part, it may occur on any hairy region of the body, and is seen upon the eyebrows, scalp, pubes, axillæ, and limbs. It never encroaches on the non-hairy parts contiguous to the parts attacked. The hairs are at first very sensitive to the touch, but when pustules form they are loosened in their follicles, so that they can be readily removed. First attempts at epilation are always painful, but subsequent ones are not. As a rule, the hair is not destroyed in sycosis, but when the inflammation has been intense or long continued, permanent destruction of the hair may take place. What has been described as lupoid sycosis, chronic sycosis, and ulerythema sycosiforme, in which destruction of hair always occurs, is described under the heading of Folliculitis Decalvans, and to this the reader is referred.

Etiology.—We are still ignorant of the cause of sycosis, though the parasitic theory is gaining ground in regard to this as it is in regard to other dermatoses. The disease is one of the less common diseases of the skin. It affects men almost exclusively, as we might expect on account of its favorite site being the bearded portion of the face. All classes and occupations are subject to this disease. An eczema predisposes to it, and a nasal catarrh is the most frequent cause of it, as it occurs on the upper lip. Shaving in an unskilful manner, the application of irritants to the skin, such as poultices, and exposure to high winds or dust-laden air, will act as excitants to the disease. It is not usually regarded as contagious, but if the microbic origin of many of the cases is allowed, the contagious nature of the malady must also be granted. Moreover, it is certainly contracted in barber-shops. Unless the individual is in the proper condition to form a good growing-ground for the micro-organisms of sycosis, he will not have sycosis. All causes that decrease his resistance increase his chances of infection.

Pathology.—The disease is a perifollicular inflammation of the hair-follicles primarily. The follicles themselves are secondarily affected, their sheaths becoming softened and pus entering the follicles. The sebaceous glands may be affected and may be destroyed, while the sweat-glands escape, as a rule.

Diagnosis.—Sycosis is most often mistaken for eczema; indeed, by some authors the two diseases are considered identical, or, rather, they deny that there is such a disease as sycosis. There is little difficulty in distinguishing one from the other in typical cases. Eczema is a disease of the skin primarily, the hair being involved only secondarily; so, instead of finding isolated lesions pierced by hairs, we find a diffused patch of redness with more or less hair in it, or else papules or pustules without any reference to hairs. Pustular eczema is far more crusted than is sycosis. Eczema generally encroaches upon the non-hairy neighboring skin, and is itchy to a far higher degree than sycosis ever is. When the case presents as a crusted disease of the bearded part of the face which does not go over upon the non-hairy skin, it will be hard to make a diagnosis until after the case has been watched for a time. If it is sycosis, the isolated lesions pierced by the hairs will surely show themselves. As sycosis is sometimes left over from an eczema, there is often difficulty in knowing whether we are dealing with a declining eczema or a beginning sycosis. Happily, the treatment appropriate to the one is appropriate to the other, so that an exact diagnosis is not of much consequence to the patient.

A certain amount of confusion exists in the mind of some between sycosis and trichophytosis barbae. The two diseases are very different. Sycosis affects most often the upper lip and the face above a line drawn from the angle of the jaw to the corner of the mouth; ringworm affects by preference the chin and the neck below the line of the jaw. Sycosis begins as isolated papules or pustules; ringworm begins as a superficial scaly ring or a number of deep nodules arranged roughly in a circle. In sycosis the hairs are affected late or not at all, while in ringworm they are broken and split early in the disease. Ringworm often encroaches upon the sound skin, and very often typical ringworms are to be found away from the lesion of the beard. Then the finding of the trichophyton fungus is decisive as to ringworm.

Syphilis, if of pustular form and an early eruption, will be on other parts of the body at the same time; if it occur late in the disease, it will be on one side of the face, and there will be other evidence of the disease to be found.

Acne is a general disease of the face, and not confined to the bearded part, nor are its pustules pierced by hairs.

Prognosis.—Although sycosis is a very chronic and often a most obstinate disease, still it does get well. We should always remember the tendency to relapse that the disease shows, and be cautious in promising a speedy cure. Left to itself, it shows little tendency to recovery, and even under the most skilful treatment it may require months to cure the disease.

Treatment.—The first thing to be done is to find out, if possible, what the cause of the disease is, and what the general condition of the patient is. The patient's diet, exercise in the outer air, and general hygiene must receive attention, so as to improve his general condition. As a rule, all alcoholics must be stopped. If the disease is just appearing, a sharp saline cathartic may be given, and often has a good effect in reducing the inflammation. Chronic cases often need tonic treatment, and cod-liver oil and iron are often most to be relied upon.

The local treatment must vary with the stage of the disease. In acute cases, when the papules are just appearing, we may succeed in aborting the disease by the application of the ointment of the ammoniate of mercury diluted with one-third of vaseline. If there is a good deal of inflammation and swelling, then remedies such as lead-and-opium wash or simple soda and water should be used until the swelling is reduced. During the night, when it would be inconvenient to continue the wash and the skin would therefore become dry, it is well to use a 2 per cent. solution of salicylic acid in oil. If the case comes with a good deal of crusting, the first thing to do is to soak the crusts in the just-mentioned salicylated oil for twelve or twenty-four hours, and then wash the part with soap and water to remove the crusts. Shaving is useful in allowing the remedies to reach the skin with ease, but at times seems to rather assist in spreading the disease. The hair should be kept cut short and pulled from all the diseased follicles, especially from the pustular ones. It is a painful operation to many. If the hair is not very thick and the patient presents himself with a great number of pustules, the face may be curetted, and this will be followed by improvement.

The disease is essentially a chronic one, and we must be prepared to change our local applications from time to time as the skin becomes accustomed to the different remedies. In the early stages of the disease oxide-of-zinc ointment is often the best remedy. If there is a good deal of pustulation, then we can use Lassar's paste with salicylic acid. Tannic-acid and boric-acid ointments are also useful. In less acute cases the diachylon ointment of Hebra is excellent. All ointments should be kept as much as possible bound down to the parts spread on cloths. As the disease becomes more chronic and the inflammation less marked, then we can use stimulation by adding oil of cade to our zinc or diachylon ointment in the strength of a half dram to a dram to the ounce. Sulphur is also very useful at this time in about the same strength as the tar. In several cases I have had remarkable success by using tumenol, 10 per cent. in olive oil. Ichthyol is highly spoken of. An ointment of the red sulphide of mercury 1 part, sublimed sulphur 24 parts, and lard 75 parts is excellent in some cases. Many other combinations of remedies are given, but these are enough for guidance in treatment. After a cure is apparently effected the patient should be kept under observation for some time, and should bathe the face daily with hot water and apply some simple protective ointment.

It should be always borne in mind that sycosis of the upper lip is usually due to a catarrhal condition of the nose, and that it will be impossible to

cure it without attention to the nose. The treatment of sycosis as it occurs on other locations than the face is along the same lines as that of the face.

D. DISEASES OF THE NAILS.

ONYCHAUXIS. (H. N. LYON, M. D.)

Definition.—The term onychauxis is employed to denote any increased growth or hypertrophy of the substance of the nail, whether this consists in a simple thickening of the corneous layers, or, as more generally happens, a general enlargement of the whole substance of the nail, with associated changes in the shape, color, and texture.

Symptoms.—In the first variety the nails become extremely hard and heavy, misshapen, opaque, grayish-white in color, glossy on the surface, and often considerably curved, so that they turn downward over the edges or over the end of the finger. In the second variety the hypertrophy may be chiefly lateral, and the common condition known as ingrowing nail, met with most frequently on the toes, is produced. At other times the hypertrophy manifests itself longitudinally, and the distortion known as curved nail or onychogryphosis is met with. Sometimes the nails become so twisted and curled upon themselves that they resemble a ram's horn, and present a color varying from a grayish or dirty yellow to a brown, are glossy, and are marked by longitudinal and transverse ridges or striæ. The under surface is of a dark-brown color, and marked by depressions and ridges, and frequently a collection of softened and foul-smelling epithelium is to be found.

In addition to the deformity, there is usually loss of tactile sensation to a greater or lesser degree. When the toe-nails are affected there is more or less difficulty in walking, and locomotion may indeed be altogether impossible.

Etiology.—Onychauxis may be either congenital or acquired. In the former case it is found in combination with congenital hypertrophy of the fingers or associated with ichthyosis, papillary enlargement, or congenital syphilis. The acquired form is more frequent, and is produced by injury, uncleanliness, or parasitic fungi. In certain races—the Chinese—it occurs simply from unrestrained growth. It is seen in the bedridden, the paralytic, and in elderly people, and when the nail and matrix are involved in any chronic inflammatory processes, such as elephantiasis Arabum, chronic eczema, lichen ruber, psoriasis, etc. It may occur from disturbances of circulation produced by tight boots, or symptomatically as a sequel of degenerative or irritative neuropathic affections, such as chronic myelitis, neuralgia, trauma of mixed nerves, or with ankylosis, disease of the bones, or chronic rheumatism.

The **diagnosis** of the disease can present no great difficulty.

Prognosis.—The prognosis varies according to the cause of each individual case. When it is dependent upon neglect, uncleanliness, and chronic inflammatory skin-affections, the removal of these conditions will produce amelioration or cure in the nails. If lepra, elephantiasis, or severe traumatism, nothing but removal will end the condition.

Treatment.—The primary indication is the removal of the cause, whatever that may be. The knife, cutting pliers, or even saw, should then be employed to remove as much of the hypertrophied tissue as possible. Existing inflammations must be subjected to appropriate treatment. If ingrowing

nails have resulted from lateral extension, this condition may sometimes be remedied by wearing a broader-toed shoe and immersing the offending toe in hot water until the nail has become softened, and then scraping the center until quite thin, so as to bring about retraction of the nail. The granulations should be touched with some suitable cauterizant. In the majority of cases operative measures must be resorted to. When psoriasis, eczema, or syphilis is the cause, treatment directed to these conditions will effect a cure.

ATROPHIA UNGUIUM. (H. N. LYON, M. D.)

Definition.—This term is employed to denote those congenital or acquired conditions of aplasia met with in the nails. In the congenital forms there are usually coexisting defects of development in the phalanges of the toes and fingers, and associated absence of hair. The condition is more frequently acquired, due to local or systemic causes. Among the local causes traumatism plays no small part. A direct blow or contusion of the nail interferes with nail-formation. Ill-fitting shoes, by pressing the nail-bed upward, interfere with its activity and produce thin nail-plates. Complete suspension of nail-growth may be induced if antero-posterior pressure is exerted at the same time. Extreme degrees of cold, freezing of the fingers and toes, may be followed by complete cessation in the nail-growth. The continued use of strong acids, alkalies, coloring matter, etc. will affect the nails deleteriously. Inflammatory processes about the nail, with pus-formation, will cause arrest of nail-development. Chronic systemic diseases, as scurvy, malign neoplasms, serofulosis, syphilis, caries, and necrosis of bones, etc., may induce atrophic changes in the nails. Fevers also cause it.

Treatment.—The nails should be frequently trimmed when so twisted, deformed, and exfoliated as to interfere with the daily occupation of the individual. They should further be protected from injury by coating with wax. The cause of the atrophic changes should be removed, if possible. External traumatic, thermic, and chemic influences must be carefully avoided. Quinine, iron, and other tonics should be employed when impaired nourishment and deficient blood-supply exist. Dyscrasias, nervous affections, inflammations, and ulcerative processes must be properly treated. Where deficient nail-growth is the result of febrile affections, the affection will improve with the increasing strength of the patient without special therapeutical measures. Unna has suggested the application of strips of adhesive plaster, so as to exert even pressure on the nail. He believes this facilitates the growth and gives a correct shape to the nail.

ONYCHIA. (H. N. LYON, M. D.)

Definition.—The word “onychia” is used to designate an inflammation of the matrix of the nail, either acute or chronic.

Such an inflammation may arise from trauma, leprosy, tuberculosis, eczema, psoriasis, ringworm, and syphilis. It is at times met with when it is malignant in nature. Of all these, the onychia syphilitica and onychia maligna are of greatest import. As all the forms but the latter have been fully treated of in other sections of this book, there remains the onychia maligna to be treated of here.

This is an inflammation of the matrix having for its exciting cause some slight trauma. It is usually confined to one nail, and is most commonly seen in unhealthy children, in whom other evidences of the strumous diathesis are usually found. It commences with all the customary signs of inflam-

mation, swelling, redness, and tenderness, but rapidly presents that complex which we term "a phlegmonous inflammation." The pain is throbbing in character and often intense. A fetid sero-sanguinolent fluid collects under the nail, separating the latter from its bed and exuding from its separated edges. The extremity of the affected finger becomes livid and bulbous. The nail itself becomes greatly thickened, and is opaque and discolored; its edges may curl up, and often it may become completely separated, leaving a gangrenous, readily-bleeding surface, from which a foul, sanious matter escapes. This surface may slowly heal and become covered by an imperfectly formed nail. Not infrequently, however, the inflammation extends to the adjacent tissues, and a fully-formed paronychia is developed, with caries of the terminal phalanx.

Treatment.—The treatment must be directed to the improvement of the general system. Vigorous, supporting treatment is often indicated—quinine in full doses, with stimulants, a generous diet, and, if possible, a change of regimen and scene.

As to local measures, in very mild cases an antiseptic cold-water dressing suffices. In severer cases the tension must be relieved by free incisions or by removal of the entire nail. The surface thus exposed may need curettement, and always thorough cleansing, when applications of iodoform, aristol, or some mercurial should be made, and a moist borie-lint dressing applied.

ONYCHOMYCOSIS. (W. T. CORLETT, M. D.)

Derivation.—Gr. *ὄνυξ*, the nail, and *μύκηξ*, a fungus.

Definition.—Onychomycosis is a disease of the nail caused by a vegetable parasite.

Symptoms.—There are two vegetable organisms that are known to attack the nail, the achorion and the trichophyton; the symptoms will therefore vary somewhat according to the fungus present.

Onychomycosis favosa is a very infrequent disease, and usually accompanies and is inoculated from the affection on other parts of the body. The cases in which the disease is limited to the nails are extremely rare in medical literature, and Vidal's observation, subsequently referred to, offers quite an exception to the rule. The reader will find favus of the nail further treated of under *Tinea Favosa*.

More commonly the trichophyton attacks the nail, although it is likewise usually inoculated by scratching other parts of the body already affected. The nails of the fingers are, as a consequence, the most frequently involved. Fournier¹ reports an epidemic of *tinea trichophytina* in a family, contracted from a servant with onychomycosis trichophytina. It is very seldom that more than one or two nails are affected, and the disease is well established before it becomes apparent.

In the cases that have been under the author's observation the free end of the nail has first presented a dark color, becoming brittle, and finally fissured, with ridges also of dark, lusterless color, extending backward under the body of the nail.

Pellizari,² who reports the remarkable frequency of 20 cases in 150 of all varieties of *tinea trichophytina*, gives the main features of the disease as follows: The first apparent change is in the color of the nail, which becomes spotted or striated with whitish, lusterless areas which are sometimes split or

¹ Fournier: *Journ. des Malad. cut. et syph.*, 1889, t. i. p. 3.

² Pellizari: *Ricerche s. Trichoph. tonsur.*, Milano, 1888, iv. p. 17.

ridged. Sometimes the whitish discoloration is limited to one side of the nail, in which case the border involved is liable to curl upward. After several years the nail becomes of a yellow color, thick and irregular. The superficial part of the nail is the last to become involved.

Pathology and Anatomy.—This has also been studied by Pellizari, who found the trichophyton in the nail-bed, and especially as the free border was approached (Fig. 278). In the neighborhood of the matrix of the nail

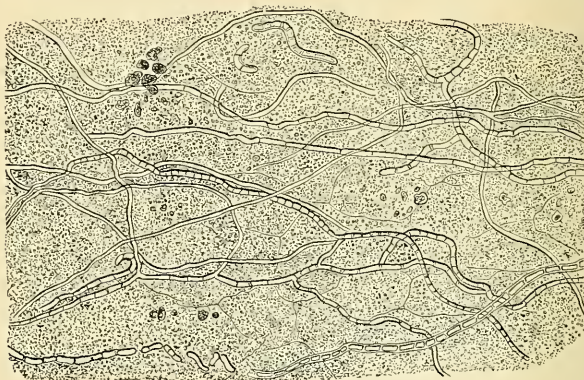


FIG. 278.—Onychomycosis trichophytina.

the epidermic cells contained eleidine in place of onychogene; this retrogression is due to the inflammation present, which further gives rise to thickening of the nail and loss of its natural pinkish color. Numerous cavities were also found between the lamellæ containing the trichophyton, which gives rise to the whitish spots and lines previously referred to. It was also found that the trichophyton penetrated into the subjacent derma.

Diagnosis.—The disease must be differentiated from both eczema and psoriasis; lichen ruber also affects the nails. The main point of distinction lies in the more general distribution of these diseases when affecting the nails; whereas onychomycosis is generally limited to one or two nails, and then only one part of the nail may be involved. Again, the various affections mentioned are usually distributed over other parts, where their true nature may be more readily determined. In the majority of cases a diagnosis may be made by subjecting scrapings from the diseased nail to microscopical examination. From onychomycosis favosa, ringworm of the nail may be recognized by the presence of the yellow spots in favus and the more deep penetration of the fungus in onychomycosis trichophytina.

Treatment.—Avulsion of the nail, either the whole or the part diseased, is the first procedure. Scraping, so often sufficient in favus, is seldom sufficient in ringworm. After the nail-bed is exposed some of the many parasiticides previously mentioned may be used.

Besnier¹ recommends macerating the nail in potash soap covered with a rubber finger-tip until it becomes soft, then with a local anesthetic the horny

¹ *Loc. cit.*

covering is scraped or filed away. Iodoform, mercury, or Vigo plaster may then be applied.

According to Crocker,¹ the following plan, suggested by Harrison of Bristol, has been most efficient: Two solutions are prepared. No. 1 consists of liquor potassæ and aquæ destillatæ, of each ℥ss; potass. iodidi, ʒss. No. 2 consists of hydrarg. perchlor., gr. iv; spir. vini rect., aq. dest., *aa.* ʒss. The nail should first be scraped as thin as possible, and No. 1 applied on lint covered with oiled silk for fifteen minutes. This is immediately followed by No. 2, which is applied in the same way and allowed to remain twenty-four hours. At the end of this time the procedure is repeated. When the skin begins to peel and the subungual parts become tender, this treatment should be suspended and the hyposulphite of soda (ʒj-ij to ʒj) applied until all tenderness disappears. It must be remembered that this is a severe mode of treatment, and should be recommended only when under the care of a physician.

Sabouraud² recommends the following:

Iodine,	gr. xv;
Iodide of potassium,	ʒgr. xxx;
Distilled water,	ʒxxxij.

This is to be applied by means of lint held in position with rubber fingertips.

LEUKOPATHIA UNGUIUM. (H. N. LYON, M. D.)

White spots are quite common on the nails, especially in young people. These were called by the ancients mendacia (lies), and are to-day vulgarly known as "gift-spots" or lies. This condition occurs in spots, bands, and very exceptionally the whole of the nail may be of a white color. They are thought to be due to injury of the nail and the presence of air in the nail-substance. Interference with the complete cornification of the nail-cells, brought about by mechanical means, is also thought to produce the spots. Picking back of the nail-fold is a common cause. In some instances these spots are particularly dependent upon trophic changes.

Scleronychia.—A condition of the nails bearing a certain superficial resemblance to eczema of the nails, but allied to leukonychia, is described by Unna under this term. Instead of the nails being abnormally soft, as in leukonychia, they appear to be of normal or even abnormal hardness. The nails are thickened, inelastic, hard, rough, opaque, and have a yellowish-gray color. Longitudinal furrows often occur, while in other cases the whole surface is covered with protuberances and depressions, and the anterior border is rough and irregular. The lunula is no longer well marked. There seems to be an increase in the normal air-bubbles. The condition is possibly only a manifestation of a general anomaly of cornification of the body, which has reached such a degree on the nails as to be evident, and for that reason is only recognized there. There may, however, be some unknown specific change in the nail-cells or some affection of the nail-matrix.

Spoon-nail is a condition sometimes observed in wasting diseases, but more frequently of unknown etiology, in which the nail becomes thinned and of a concave form from side to side. The edges are everted, and occasionally an antero-posterior curvature is associated with it. The trouble is met with

¹ *Loc. cit.*

² Sabouraud: *Ann. de Dermat. et de Syph.*, Jan., 1896.

in the nails of the fingers; the toes appear to be exempt. It begins in the nail of one finger and gradually involves the others.

Reedy nail is a term applied to that condition in which the normal longitudinal striæ become much more prominent, apparently the result of an atrophy or wasting of the intermediate substance. The disease is very common in aged people. Fothergill regards this condition of the nail as symptomatic of gout, but a great many cases present it in which no other manifestations of gout are to be found. It is more probable that it is one of the associated changes of senility. There is no therapeutic indication for either of the above conditions.

Pterygium is the word applied to the downward growth over the nail of the fold of skin normally present at the proximal extremity. The lunula may come to be hidden by this prolongation.

The treatment consists in loosening the skin and pushing it back or clipping it off.

CLASS VIII. PARASITIC DISEASES.

A. VEGETABLE.

VEGETABLE PARASITIC DISEASES. (W. T. CORLETT, M. D.)

DISEASES of this group are due to vegetable parasites which belong to the fungus family; further, the exact botanical position of these micro-organisms has not yet been definitely determined. They are assigned to the sub-group Hyphomycetes, or by some more appropriately called *fungi imperfecti*.

The fungus belongs to the cryptogamic plants, and occupies an intermediate position between the algæ and bacteria or schizomycetes (σχιζέειν, cleave, split, and μύκητες, fungi, mushrooms). The absence of chlorophyll distinguishes it from the former, while the line of demarkation between the schizomycetes and certain fungi found in erythrasma and mycetoma is not as yet clearly drawn. The hyphomycetes (ύφης, a web) are further characterized by naked spores or conidia on conspicuous threads, with branched or unbranched mycelia and hyphæ, hence sometimes spoken of as filamentous fungi. They are unable to assimilate inorganic substances, as do the algæ, nor are they like bacteria so often found in the deep pathogenic processes of the human subject, but are more prone to attack the superficial epithelial structures, such as the epidermis, hairs, nails, etc. The shape and other characteristic features of the various fungi which attack the skin are not visible to the naked eye, but under a low power, from 300 to 600 diameters, they may be clearly seen. The method of preparing a specimen for examination is simple. Hairs, crusts, or scrapings from the part affected are first washed with a few drops of ether to remove the oil, then placed on a slide; a drop or two of liquor potassæ are added and the cover-glass applied. This is allowed to remain a few minutes, care being taken that the specimen be thinly spread out, and, if hairs are examined, they should be firmly pressed with a sliding motion of the cover-glass, thus rendering them transparent,

when a one-fourth to one-sixth inch objective will reveal the growth underneath. In examining the dry crusts of favus a 7 per cent. solution of caustic potash is all that is necessary. When it is desired to mount the specimen permanently, the fungus may be stained with an alcoholic solution of eosine and mounted in Canada balsam. For this Crocker¹ regards Payne's modification of Bizzozero's method the best. The preparation is first soaked in ether for fifteen minutes, then a few drops of 50 per cent. acetic acid is added and allowed to evaporate. The specimen is then stained by Gram's method,² and mounted in chloroform or xylol solution of Canada balsam. Adamson³ recommends, when examining for the trichophyton tonsurans, that the hair be not pressed between the slide and cover-glass, lest it disturb the arrangement of the fungus elements, and that a weak solution of potash be used (potassium hydrate 5 to 10 per cent.), the specimen to be examined during disintegration, when the relative position of the fungus to the hair can with greater accuracy be determined.

Our knowledge of fungi as etiological factors in diseases, as well as of bacteria, the smallest of micro-organisms, marks two distinct epochs in medical science which have taken place within the memory of men still living. The impetus which gave birth to such wonderful results may be traced to the discovery of a fungus by Bassi and Balsamo in muscardine,⁴ a contagious disease attacking silkworms.

According to the nomenclature adopted by the Royal College of Physicians of London, diseases due to the vegetable fungi are called tinea; this generic prefix will therefore be used in speaking of the different diseases of this class.

TINEA FAVOSA. (W. T. CORLETT, M. D.)

Synonyms.—Favus; Tinea vera; Tinea lupinosa; Honeycomb ring-worm; Porrigo lupinosa; Porrigo favosa; Teigne faveuse (*Fr.*); Erbgrind (*Ger.*).

The term favus has been used since the time of Celsus to designate various eruptions, usually on the scalp, having a honeycomb appearance. Alibert's plates, which appeared in 1815,⁵ contain the first true illustration of the affection, which he called *teigne faveuse*. He believed the disease was often hereditary. Willan and Bateman,⁶ writing at the same time in England, described the disease under the name *porrigo lupinosa*. Mahon⁷ the younger was the first to recognize that the crusts of favus were not due to dried pustules, as had heretofore been supposed; he also wrote of its contagious nature. Yet it remained for Schönlein⁸ of Zurich, later of Berlin, to demonstrate the real nature of favus and to mark a new era in cutaneous pathology in the discovery of a fungus which he called *oïdium*. From this date (1849) the history of the cutaneous parasitic diseases of vegetable origin really begins.

¹ Crocker: *Diseases of the Skin*, London and Philadelphia, 1893.

² Gram's method: To fresh aniline-water (aniline oil, shaken well with water and filtered through moistened filter-paper), a concentrated alcoholic solution of gentian-violet is added, drop by drop, until the liquid loses its transparency. The specimen is allowed to remain in this solution from five to thirty minutes, then washed in absolute alcohol, and placed for five minutes in a solution of iodine 1 part, iodide of potassium 2 parts, distilled water 300 parts, when it is again washed in alcohol until no color can be extracted, and mounted in water, chloroform, or Canada balsam.

³ Adamson: *Brit. Journ. of Derm.*, July, 1895.

⁴ Balsamo: *Gazette de Milan*, 1835, cited by Kaposi in *Hebra on Skin Dis.*, 1880.

⁵ Alibert: *Description des Maladies de la Peau*, Paris, 1815.

⁶ Bateman: *A Practical Synopsis of Cutaneous Diseases*, London, 1814.

⁷ Mahon, Jr.: *Recherches sur le Siège et la Nature des Teignes*, Paris, 1829.

⁸ Schönlein: "Zur Pathogenie der Impetigines," *Müller's Archiv*, 1849.

Definition.—Favus is a disease of the skin characterized by the formation of dry, yellow, sulphur-colored, saucer-shaped crusts, varying in size from a pinhead to a dime, and when rubbed between the thumb and finger are readily reduced to a powder. These crusts or cups are called scutula (*scutum*, a shield). The eruption gives rise to a mousy odor, which may be likened to decomposing cat's urine or to mouldy straw. The disease usually attacks the scalp, although no part of the cutaneous surface is exempt, and it has been observed to extend to the mucous membranes. It is more liable to attack the young, although it often remains to middle life. It is mildly contagious, and is due to a vegetable parasite, called by Remak,¹ in honor of its discoverer, achorion Schönleinii. In this country favus is usually met with among immigrants.

Symptoms.—The parasite finds a nidus most favorable to its development in the funnel-shaped opening of the hair-follicles. It is on the scalp, therefore, that the disease is usually met with. It first appears as variously sized, erythematous patches sparsely covered with dry, branny scales, which give it the appearance of dry eczema or pityriasis. In the course of a fortnight to three weeks there appear pinhead- to lentil-sized, sulphur-colored bodies imbedded in the epidermis. Upon close inspection each of these yellow bodies will be found to be pierced by a hair-shaft. If examined a week later, it will be seen that they have increased in size and have extended at the periphery, which has become especially prominent, while the center immediately surrounding the hair is depressed. In this way the cup-shaped crusts or scutula are formed, which is the most characteristic feature of the disease (*favus urceolaris*). As the affection progresses the scutula enlarge at the periphery until they attain the size of a split pea to a half-dime. Sometimes the cuticular covering ruptures at the margin, allowing the sulphur-like substance to escape. Again, as the scutula spread out at the periphery they often coalesce with their neighbors, forming large ringed or honeycombed crusts which may extend over the entire scalp (*favus scutiformis*). Usually, however, the part of the scalp protected by the cap suffers most. Another prominent symptom of favus is the odor, which is usually distinctive.

The itching in favus, although present, is not, as a rule, severe. As the disease develops the nutrition of the hair begins to fail; it becomes lusterless, dry, often split in its long axis, and covered with a fine dust. Upon slight traction it may be removed from the follicle. The favus parasite in time exhausts the soil necessary for its sustenance, so that the mature scutulum loses its yellow color, becomes pale or dirty-white, is more friable, and finally, from scratching or some other mechanical disturbance, it is loosened from its bed and falls. A permanently bald cicatrix remains, which is at first reddish and covered with slight moisture or pus if inflammation has supervened; it soon, however, becomes white. This goes on for months and years, until the scalp is mapped out with irregular bald cicatrices or the entire crown is involved, leaving a hirsute fringe about the margin of the scalp (see Plate 24).

It is during this late stage that the eruption presents the atypical appearance sometimes spoken of as *favus sans favi*, or favus without the characteristic cup-shaped scutula.

Favus is not infrequently complicated by other diseases, such as eczema, pediculosis capitis, etc. When eczema is present the crusts may become mixed with pus and other products of inflammation, so that the original disease is often completely masked. In pediculosis the scratching may obliterate

¹ Remak: *Med. Vereinszeitung*, 1840.

PLATE 24.



Tinea favosa of scalp and side of the face, of long standing.

rate the form of the scutula; there is also in pediculosis and eczema enlargement of the post-cervical lymphatic glands.

Favus is sometimes encountered on the so-called hairless parts of the body.¹ The symptoms do not, however, differ materially from those already detailed. On account of its exposed position the eruption is sooner detected and a better opportunity is given to observe the erythematous stage. The ringed, erythematous plaques are more pronounced than on the scalp, and at their periphery minute vesicles are often found. At this stage the disease is readily mistaken for ringworm. Soon (from ten to fifteen days) at the opening of the rudimentary hair-follicles the yellow, sulphur-like grains appear, which develop into true favic cups, merge together, and form concentric rings and craggy crusts. As on the scalp, the eruption here may be limited to a few scutula or it may involve extensive surfaces. Numerous instances are recorded in which the eruption has been limited to the smooth parts,² others in which the scalp has become secondarily involved. The reverse of this, however, is the rule. There is no part of the skin, including the glans penis,³ where favus has not been seen. Kaposi⁴ and others have reported cases in which the autopsy revealed an extension of the favic processes to the mucous membrane of the esophagus, stomach, and intestines. Favus of the hairless parts runs a more acute course and yields more readily to treatment than on the scalp.

Favus of the nail is a very rare affection (favus unguium, onychomycosis favosa). In the few cases reported it has generally been traced to inoculation from some other part of the body. We would expect, therefore, to find the disease most frequently in the nails of the hand; this is the rule, although Vidal⁵ has seen favus occurring primarily in the nail of the great toe without other parts of the body becoming affected, and Zeisler⁶ mentions a case primarily attacking the nails of the toes.

The nails of the index finger and thumb are most liable to the disease. It generally begins as a small, yellow, grain-like body between the nail-bed and the horny substance of the nail proper. Usually the side, where the skin folds over the nail, is affected; again, it may be the free border or the lunula. It usually remains limited to one part, yet the whole nail may present a dry, blackish appearance, with clefts or split into laminae, which can be differentiated from onychomycosis from other causes only by means of the microscope or cultural tests.

Etiology.—Since Remak⁷ first demonstrated that favus could be inoculated from one person to another (1842), and especially since a host of more recent investigators have shown that the active agent in this communication is the achorion Schönleini, the etiology of favus is regarded as settled by most dermatologists. True, there have not been wanting conservative men who have questioned the rôle fungi play in disease. Thus so careful an observer as Sir Erasmus Wilson,⁸ as late as 1880, believed that the micro-organisms found in favus, ringworm, etc. were processes of degeneration, and in no sense to be regarded as causes of disease. No one to-day, however, doubts that favus is due to a micro-organism.

Undoubtedly, climatal conditions influence the growth of favus. Thus it

¹ For résumé of literature on this subject the reader is referred to Cantrell's paper in *Journ. Cutan. and Genito-urin. Dis.*, Sept. and Oct., 1894.

² Lustgarten: *Journ. Cutan. and Genito-urin. Dis.*, May, 1895.

³ White: "Discussion on Favus," *Trans. Am. Dermat. Assoc.*, 1894.

⁴ Kaposi: *Diseases of the Skin*, p. 633, 1895.

⁵ H. Leloir et E. Vidal: *Traité descriptif des Mal. de la Peau*, 4me, liv., Paris, 1893.

⁶ Zeisler: "Discussion on Favus," *Trans. Am. Dermat. Assoc.*, 1894.

⁷ Remak: *Loc. cit.* ⁸ Wilson; Personal conversation with the writer.

is common in certain localities, as in Russian Poland, France,¹ Scotland,² and Italy, less common in Spain, Morocco, and Mexico, while it is rare in Germany, England,³ and in the United States.⁴ The growth of hair favors the lodgement of the fungus, while want of cleanliness and the infrequent changing of the clothing are also conducive to its growth and development. It is said there exists in certain individuals a certain predisposition or susceptibility to favus, but of this we know nothing positive. On general principles we might suppose any systemic or local lowering of the vitality would predispose to its development.

Favus is usually communicated directly from person to person, less frequently from one of the domestic animals, as the cat, dog, mouse, rat, or fowl. In 50 cases Bodin⁵ found more than one-half attributed it to others affected with the same disease; of these 29 were in schools, asylums, and hospitals; 10 were exposed to animals having the disease (mice, dogs, especially the rat-terriers, cats, and more rarely fowls); in 10 cases it was impossible to trace the origin. It is said by Bodin to be a rural disease, occurring most frequently in the country, and in cities largely confined to the suburbs.

Pathology and Anatomy.—The achorion Schönleinii consists of spores and mycelia. The spores are isolated or in chains; the latter are often found at the extremity of a filament of mycelium. They are round, angular, or slightly elongated, with a granular nucleus surrounded by a homogeneous,

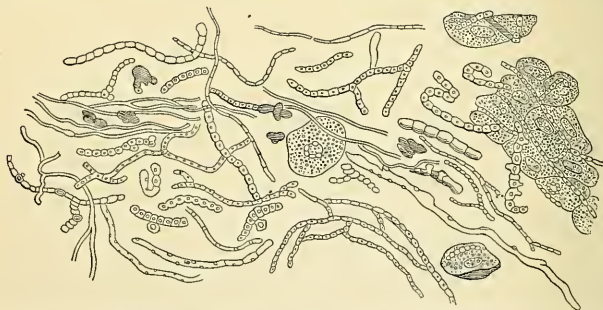


FIG. 279.—Achorion Schönleinii from under surface of favic scutulum, showing various forms of mycelia and spores (Kaposi).

transparent, resisting membrane. In size they vary from 3 to 11 μ . The mycelia largely predominate. They are composed of irregular tubes or sections, which may be straight, bent, or broken, ramifying in different direc-

¹ France—H. Feulard (*Ann. de Derm. et de Syph.*, 1892, p. 1118) gives statistics from the report of the Minister of War, as follows: Between 1876 and 1880, of all recruits at the age of twenty, there were rejected on account of favus 1541, or 3.01 to 1000. Between 1881 and 1885, of all recruits at the age of twenty, there were rejected on account of favus 1399. Between 1887 and 1891, of all recruits at the age of twenty, there were rejected on account of favus 964, or 0.10 to 1000.

² Scotland—Anderson: 156 in 10,000 consecutive cases of skin-disease: *Lancet*, Nov. 11, 1871.

³ England—Crocker: *Loc. cit.*, 1 in 2000.

⁴ The report of the Am. Derm. Association shows 2.86 in 1000 cases of skin-disease. My own notes show 5.25 to 1000. They were all seen in hospital and dispensary work, principally among Polish Jews, although immigrants from France, England, and Germany have been seen.

⁵ Bodin: *Annal. de Derm. et de Syph.*, Nov., 1894.

tions. Sometimes sporules are seen within the mycelium; the more common form of germination, however, appears to be by the formation of terminal conidial chains.

Of late there has been an effort made to ascribe favus to a variety of fungi, and some have claimed that the disease presents certain variations according to the special form of micro-organism found therein. Quineke¹ found three varieties of favic fungi, while Unna² describes nine. J. Sabrazés³ also claims to have demonstrated three varieties, which may be distinguished by the appearance of the cultures; in the structure of the mycelium and by its coloration; and by the character of the lesions following their inoculation in both man and animals, as well as the different degrees of severity in the disease itself. The first variety is, according to this observer, peculiar to man, the second to the dog, and the third to the fowl; each variety may be inoculated, however, from man to animals and *vice versa*.

Busquet⁴ draws an analogy with other forms of plant-life to prove that the fungus of favus shows certain modifications according to the soil in which it is implanted. Thus, according to this observer, rats and mice are the original sources of the favus fungus (achorion arloini of Quineke). Thence it is inoculated on to the cat, the dog, the calf, horse, and fowl, where it assumes the form epidermophyton gallinæ (Megnin), and so on to man, where it is known as achorion Schönleini. On the contrary, Elsenberg⁵ selected specimens from twenty-seven individuals, and, although he found two varieties invariably present, yet their differences were so slight that he regarded them as belonging to the same fungus.

Danielssen⁶ conducted a number of experiments in which he demonstrated that there is but one variety of the disease.

Mibelli⁷ also conducted a series of observations in seven cases of favus, in which he demonstrated that the so-called forms of the disease—viz. herpetic, erythematous, papulo-squamous, and scutular—were one and the same affection, and, further, that they were due to but one fungus.

Bodin⁸ in a careful study of fifty cases occurring in Besnier's clinic found five varieties of fungi, which by repeated cultures always maintained their special characteristics; in other words, they bred true. He is inclined to believe, however, that their presence is largely accessory, for by repeated inoculations he was unable to distinguish them clinically.

There can be no doubt that minor differences exist in the fungus of favus, but thus far it has not been shown that they have any appreciable effect on the disease; therefore we must for the present regard them as various elements of the achorion of Schönlein.

At first the tissues offer no resistance to the invasion of the parasite, which becomes manifest by a slight dilatation of the superficial capillaries of the pars papillaris. There next appear numerous spores and a few mycelia in the stratum lucidum and stratum Malpighii, with a complete disappearance of the stratum granulosum.⁹ These changes take place about the hair-follicle, which also finally becomes involved. Long before the hair suffers the proliferation of the achorion in the epidermis gives rise to characteristic

¹ Quineke: *Monatshft für prakt. Dermat.*, 1887, Nos. 2 and 22.

² Unna: *Ibid.*, 1 and 2 Jan., 1893. ³ Sabrazés: *Annal. de Derm. et Syph.*, Nov., 1893.

⁴ Busquet: *Ann. de Derm. et de Syph.*, 1892, p. 916.

⁵ Elsenberg: *Viertelj. für Dermat. und Syphil.*, 1889, p. 179.

⁶ Danielssen: *Atlas of Vegetable Parasitic Diseases*, Bergen, 1892.

⁷ Mibelli: "Sul Favo," *Giornale Ital. delle mal. ven. et della pelle*, 1892, ii.

⁸ Bodin: *Loc. cit.*

⁹ Leloir et Vidal: *Mal. de la Peau Symptom. et Anat. path.*, liv. v., Paris, 1893.

scutula, the formation of which is described by Kaposi¹ as follows: At the mouth of the hair-follicle there exists a funnel-shaped space due to the separation of the epidermic cells, the outer border of which is formed by the superficial cells of the horny layer, which pursue a horizontal direction and are firmly attached to the cuticula of the emerging hair-shaft, while the lower boundary is formed by cells which incline to the bottom of the follicle. In this space fungi which have been implanted or have extended from the depths

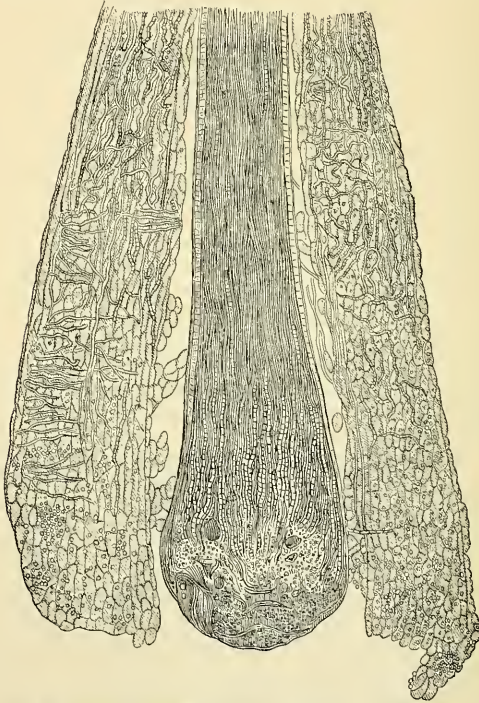


FIG. 280.—Achorion invading root-sheaths and bulb of the hair (Kaposi).

of the follicle proliferate into compact bodies. As the achorion develops the superficial epidermic cells which are firmly adherent to the hair are held down while the fungus spreads out at the periphery, where resistance is not encountered. Here, according to Robinson,² the epidermis finally ruptures, thus allowing the sulphur-yellow contents to form the rim of the cup. The lower surface of the scutulum is convex, causing at first flattening, and finally atrophy of the papillæ from pressure or from inflammation. In this way the

¹ Kaposi: *Pathology and Treatment of Diseases of the Skin*, 1895, p. 631.

² Robinson: *Manual of Dermatology*, New York, 1885, p. 605.

hair-papilla is obliterated. The fungus sometimes invades the derma to a slight extent, as observed by Malassez,¹ when inflammation and the formation of scar-tissue result.

As soon as the hairs become affected migratory cells are found invading the inner root-sheath, and finally the cortical substance of the hair is involved; there is a slight edema, and, as the disease progresses, the hair-bulb is likewise invaded by the achorion. Kaposi² says the fungus proliferates between the root-sheaths as far as the base of the follicle, thence into the bulb and upward to the shaft of the hair (Fig. 280).

Unna³ found the hair-bulb, external root-sheath, and prickle-cell layer of the rete free from the fungus, while in the hair, at its point of exit from the follicle, the fungus developed only in the corneous cell-layer, penetrated the cuticle, extending downward, involved the inner root-sheath, and destroyed the medulla and cortex of the hair. This was most marked in the upper third of the follicle. Finally, the prickle-cell layer became flattened and the granular layer almost completely obliterated, due to the pressure of the scutulum. Changes were also noted in the subpapillary part of the derma where the vessels were dilated and surrounded with a firm connective tissue, densely infiltrated with cells. Below this the derma remained normal. In these secondary changes the greatest cell-infiltration was found in the funnel-shaped opening of the hair-follicle and the mouth of the sweat-ducts, with atrophy of the sebaceous glands. Cystic degeneration of the follicle was also found, with from four to six rudimentary hairs.

In the nail the same cellular structures underneath the horny plate are involved, and, like the hair, they are the last to be invaded, and often retain the fungus after the disease has disappeared from the epidermis.

Diagnosis.—When the yellow cup-shaped crusts are present favus stands alone, and is not easily mistaken for any other affection. When accompanied by suppuration or pediculosis, however, its characteristic features may be completely masked and its presence overlooked. Again, before the scutula have formed or late in the course of the disease, when they are broken into a crumbling mass or have completely disappeared, its diagnosis may present some difficulty unless one is familiar with the disease. It is sometimes confounded with eczema, tinea tonsurans, lupus erythematosus, or psoriasis.

Eczema.—This being essentially a moist eruption, it is only when favus is accompanied by a dermatitis that a mistake in diagnosis is liable to occur. It should be borne in mind that eczema has no special predilection for the scalp, and, although it may be limited to this region, yet it shows a strong tendency to extend to the face and other parts of the body, while the opposite obtains in favus. Again, this tendency to diffuseness shows itself at the margin of the eruption, which gradually merges into the healthy skin, while the well-defined, bold margin of favus is a conspicuous feature. Even when the scutula coalesce, forming irregular plaques, this sharp line of demarkation is retained. The odor of eczema when present is ill defined, of a sickening nature, suggesting decomposing sebaceous material, and is especially noticeable on the scalp; while the odor of favus is usually characteristic and is easily recognized. Finally, favus is a very chronic disease, lasting years, leaving bald patches, and exceedingly rebellious to treatment; while eczema is more prone to disappear, does not usually affect the growth of hair, and does not contain the achorion of Schönlein.

¹ Malassez, cited by Cornil et Ranvier: *Man. d'Histol. path.*, 2e ed., Paris, tome ii. p. 873.

² Kaposi: *Loc. cit.*

³ *Path. Anat.*, von J. Orth; *Hautkrankheiten bearbeitet* von P. G. Unna, Berlin, 1894, p. 385.

Tinea Tonsurans.—When favus occurs on the smooth parts and during its erythematous stage it looks very much like ringworm, but the appearance of the yellow cups soon puts aside all doubt. It must be remembered, too, that the hairs resist the invasion of the achorion, and are the last to become affected, while in ringworm the hairs suffer early in the disease. In the former the hairs when affected are easily pulled out of the follicle, while in ringworm they break off a short distance from the scalp.

Unfortunately, even the practised eye cannot always distinguish between the fungus of favus and that of ringworm; but this will be further considered under the latter disease.

Lupus Erythematosus.—Favus is a disease of childhood which sometimes lasts to middle life, but lupus erythematosus usually appears for the first time in adults. Its favorite location is the face, sometimes extending to the scalp, while the reverse of this is seen in favus. In my experience lupus erythematosus is an unstable, somewhat evanescent disease, changing its position, returning in sites previously occupied, while favus shows no evanescent tendency, and remains until the soil becomes exhausted. The baldness of favus is recognized by its peculiar whitish, irregular, scar-like appearance, while in lupus erythematosus there is a smooth, atrophied, parchment-like condition of the scalp. The microscope may again be brought into requisition in examining the hairs about the plaque.

Psoriasis.—It is when the favic scutula have coalesced, or later when they have begun to crumble into irregular mortar-like masses, that psoriasis is liable to be mistaken for favus. But the hair remains unaffected in psoriasis, and the white, silvery scales may usually be detected, although sometimes only at the margin of the eruption. Again, the microscope will readily clear up any remaining doubt.

Prognosis.—As to life the prognosis is favorable, for the disease seldom affects the general health,¹ although it is one of the most obstinate of cutaneous affections, lasting for months and years under the most careful treatment.

It often leaves more or less extensive permanent bald patches. In the majority of cases, however, the ultimate prognosis is good, for by careful and persistent treatment the disease will disappear.

Treatment.—Favus being a local disease and seldom extending beyond the reach of direct medication, its eradication would seem to be easily attained. Experience, however, teaches that the most systematic and thorough measures are necessary to control it.

First: All crusts must be removed; second: loose hairs are to be epilated; third: one of the numerous parasitocides to be mentioned should be applied. On the manner and thoroughness of these three procedures depends the success of the treatment. To remove the crusts the scalp should be soaked with carbolic acid 1 dram, glycerin 4 ounces. To ensure complete saturation strips of flannel may be first dipped in the glycerin and bound on by wearing a close-fitting cotton hood. Olive oil or any of the bland oils may be used instead; coal-oil is the most potent of all for this purpose, besides being a parasiticide. It is disagreeable to use because it irritates the normal skin; it is also extremely difficult to prevent soiling the cap or pillows and to limit its action to the parts affected. After the scalp has been treated in this way for twenty-four hours the crusts may readily be removed with a dull knife or

¹ In Oct., 1884, Kaposi and Kundrat showed a case of universal favus to the Society of Physicians of Vienna which pursued a very rapid course, followed in a few weeks by vomiting and diarrhea. On the 28th of November the patient died of exhaustion. The autopsy revealed favus foci in the esophagus and stomach.

the handle of a teaspoon, when the scalp should be washed with warm water and strong potash soap. The removal of all loosened hairs in the affected area should then be undertaken. Kaposi's method of grasping the hairs between the thumb and a blunt tongue-spatula or the handle of a spoon is the most rapid and painless, because the loosened hairs only are removed.

Numerous substances have been recommended as local applications, such as the oil of birch, acid salicylic (3-5 per cent.), acid carbolie (gtt. xv- $\bar{5}$ j to $\bar{5}$ j of olive oil), naphthol oil (1 per cent.), ichthyol, sodium hyposulphite ($\bar{3}$ j to $\bar{5}$ j), corrosive sublimate (5 per cent., with alcohol), and various other forms of mercury.

Besnier recommends the tincture of iodine, freely applied. Crocker cured a case of twelve years' standing with resorcin, $\bar{5}$ j to $\bar{5}$ j of lanoline and oil. Mibelli speaks highly of oleate of copper (20 per cent.), and washing with soft soap and alcohol every second day. In my own experience chrysarobin, varying in strength from ten to twenty grains to the ounce of lanoline, is the most efficient drug we possess. Whatever parasiticide is selected, it must be thoroughly rubbed and kneaded into the skin twice daily. In using the stronger drugs, such as chrysarobin, care must be taken not to apply them near the eyes, lest a conjunctivitis be set up. To guard against this and to ensure the constant application of the parasiticide a linen cap or hood may be worn. The epilation should be repeated daily, and if the crusts return, they are to be removed as previously described. With the removal of crusts, daily epilation, and the thorough application of some efficient parasiticide twice a day until all traces of the eruption have disappeared, the disease in mild cases may be considered cured when after six to eight weeks' discontinuance of all treatment neither scalliness nor scutula appear. The necessary time, therefore, for treatment and subsequent observation is at least many months.

The treatment of the nail does not differ materially from that of the skin, except that the horny covering must be cut or scraped away, together with the scutulum. If the whole nail is dark, brittle, or fissured, it is best that it be removed entire and the parasiticide applied to the nail-bed.¹

TINEA TRICHOPHYTINA. (W. T. CORLETT, M. D.)

Derivation.—Lat. *tinea*, a worm, and Gr. *θριξ*, hair, and *φυτόν*, a plant.

Synonyms.—Trichophytosis; Dermatomycosis trichophytina; Ring-worm; Porrigo (of old authors).

Tinea trichophytina is a term used to express a class of parasitic diseases affecting different parts of the body, and differing in appearance and severity according as it attacks the free epidermis, the hairy scalp, or the beard. As evidenced by the various names that have been applied to it from the time of Celsus to the present, tinea trichophytina has been *la bête noire* of dermatology, and continues to be a subject of controversy to the present day. In Willan's plates (1817) we find the first illustration of the disease, and Bateman² gives an unmistakable description under the name porrigo, although he confounds it with eczema, favus, and other affections. Plumbe (1821) first removed the disease from the confusing entanglement in which he found it, and described porrigo as a single affection attacking both the hairy and smooth parts, "the apparent difference of character being solely the result of the mischievous influence of the hair of the scalp."³ Little was known of its etiology

¹ For further treatment of the nail see Onychomycosis.

² Bateman: *A Practical Synopsis of Cutaneous Diseases*, London, 1814.

³ Plumbe: *On the Diseases of the Skin*, London, 1837, p. 142.

in 1840, when Cazenave¹ more minutely observed its clinical features in an epidemic in a school in which sixteen boys were attacked. He called it herpes tonsurans (ἕρπεις, to creep), which name is still retained on the continent of Europe. At this time, working widely separated and independently, Gruby of Paris and Malmsten of Stockholm were about to give out the result of their labors. In 1842-44, Gruby² announced to the Royal Academy of Sciences of Paris the discovery of a micro-organism in the teigne tondante of Mahon and the herpes tonsurant of Cazenave, which he called rhizophyto-alopecia. Malmsten's³ discovery was published the following year as the trichophyton tonsurans, which name it still bears. Following this, Bazin's⁴ description of the three stages of development finally succeeded in uniting in a single disease a whole group which had long been known to be closely allied.

Again, most observers not only recognize clinical varieties of the disease, but regard the trichophyton as a collective term comprising several varieties of fungi.

For convenience of description, and because tinea trichophytina presents certain clinical differences according as the fungus attacks the free epidermis, the hairy scalp, the beard, and the nails, the subject will be considered under *Tinea Circinata*, or ringworm of the body; *Tinea Tonsurans*, ringworm of the scalp; *Tinea Barbæ* when involving the hairy parts of the face; and *Onychomycosis* when attacking the nails.

TINEA CIRCINATA. (W. T. CORLETT, M. D.)

Synonyms.—Ringworm of the body; Herpes circinatus; Fr. Herpès circiné, Trichophytie circinée.

Definition.—*Tinea circinata* is a contagious disease attacking the general surface of the body, and sometimes occurring with *tinea tonsurans* and *tinea barbæ*, to which it is allied. It is characterized by the formation of one or more circumscribed, pale reddish, slightly scaly patches, which vary in shape and size according to the stage of development.

Symptoms.—When the disease is seen at an early stage it is usual to find a half-dime-sized patch of a slightly pink or pale-red color, which varies in different individuals according to the amount of accompanying inflammation, and which is covered with a few branny scales. It soon becomes well defined, is sometimes slightly raised above the general surface of the skin, and in severe cases the periphery is marked by small pinhead-sized vesicles, which soon rupture or degenerate into pustules. The lesion extends at the periphery in common with other affections of this group, and tends to spontaneous resolution in the center. The disease may be limited to one patch, or several may appear on different parts of the body; ordinarily two or three are met with at the same time. These may be widely separated or near together, in which latter case the rings often coalesce, forming irregular or serpiginous lines. At other times, though rarely, the lesion extends in the form of radiating waves, so that several concentric rings, one within another, usually from two to four, may be seen at the same time. Crocker reports a case in which these concentric circles and gyrations extended nearly over the entire trunk. Although rare in Europe, this form is common in hot

¹ Cazenave: *Leçons sur les Maladies de la Peau*, Paris, 1845, p. 46.

² Gruby: *Comptes rendus de l'Académie des Sciences*, Paris, 1842, t. xv. p. 512; 1843, t. xvii. p. 301; 1844, t. xviii. p. 583.

³ Malmsten: *Trichophyton tonsurans*, *Harskärande Mågel, Bidrag till utredande af de sjukdomar, som Vallahartes affel*, Stockholm, 1845.

⁴ Bazin: *Recherches sur la Nature et le Traitement des Teignes*, Paris, 1853.

countries, where it is known as India ringworm, Burmese ringworm, Chinese ringworm, etc. In tropical countries ringworm is far more active than in the temperate zone; hence some doubt may arise as to the nature of the disease when met with in warm, humid climates; and, while the appearance differs, there is no real clinical or pathological difference in the disease.

There is a limit to the growth of the plaques: as a rule, they are quarter- or half-dollar-sized, although palm-sized lesions are occasionally met with. They then remain stationary for months or years, become broken up into small, finger-nail-sized, irregular, slightly scaly spots, which finally disappear.

The symptoms vary according to the region of the body invaded. Thus, in dry or northern climates when the disease occurs on exposed parts, such as the face, neck, or hands, it is usually limited to one or two dime- to quarter-dollar-sized lesions, which, excepting in infants or delicate-skinned children, are of a dull pink or slightly reddish color, and covered by closely adherent, branny scales, while under the clothing, where the bodily heat and moisture are retained, the trichophyton flourishes more luxuriantly. Here the lesions are more pronounced in color, attain a greater size, and the periphery is more frequently studded with papules or small, pinhead-sized vesicles. In moist countries, such as England, and especially within the tropics, this distinction is less pronounced.

Besnier and Doyon¹ describe a form of ringworm on the backs of the hands frequently met with in butchers, cow-boys, and poultry-dealers, which is more severe and pursues a more rapid course. It is characterized by well-marked vesiculation at the periphery, which extends rapidly, while the center of the patch may be excoriated, scaly, or return to its normal condition. This bears out the rule, to which allusion has elsewhere been made, common to all vegetable parasitic growths which exhibit unwonted luxuriance when transplanted from one of the lower animals to man. According to Sabouraud's investigations, this form is always of animal origin and due to a special fungus. Again, on parts that are habitually kept warm and bathed in perspiration the disease manifests its greatest activity. Thus, the axillæ, the inner surface of the thighs, the groin, and between the nates are frequently the seat of the disease; and in these positions the affection is most difficult to get rid of. When it occurs in the axillæ it is known as *tinea circinata axillaris*; more frequently, however, the disease attacks the crural region, when it is designated *tinea circinata cruris*. The disease not unfrequently involves both axillary and crural regions, *tinea cruris seu axillaris*. It is also known as *eczema marginatum* (Hebra). When it attacks these parts it often extends over wide areas, and not infrequently becomes complicated with eczema, which may supersede the original disease. As involution proceeds a serpiginous wall composed of enlarged papillæ covered with epidermic scales may extend upward as far as the umbilicus and halfway down the thigh, enclosing a smooth bluish or darkly-pigmented surface. This variety of *tinea circinata* is encountered most frequently in adults.

Tinea circinata is also seen, though rarely, on the palm of the hand and sole of the foot, where it is liable to be mistaken for other affections. Djéla-leddin-Moukhtar² of Constantinople has collected the literature bearing on twenty-five reported cases. The mucous surfaces are also sometimes invaded. Thus, Alessandro reports a case of trichophytosis affecting the mucous mem-

¹ Besnier and Doyon: *Maladies de la Peau*, Paris, 1891.

² D. Moukhtar: *Annal. de Derm. et de Syph.*, t. iii. p. 885.

brane of the mouth, while Robinson has observed it extending from the face on to the lips.¹

Etiology.—Much uncertainty existed in regard to the cause of tinea circinata until Bazin² discovered the parasite, which proved to be the trichophyton previously discovered, and therefore etiologically related to tinea tonsurans and tinea barbæ, to be spoken of later.

On the free or hairless parts the fungus is readily transmitted from one individual to another, either by contact or by the exchange of clothing. In bathing establishments, where the promiscuous exchange of imperfectly dried clothing is common, the disease is frequently transmitted. I have known the damp seats of water-closets to serve as a vehicle for transmitting the disease from one person to another.

All individuals are not equally susceptible to tinea circinata: it is more common in childhood than in adult life, although no age is entirely exempt. Uncleanliness predisposes very strongly to its spread, while heat and moisture are conducive to its development. It therefore does not occur with equal frequency in all countries. In North America it occurs in the proportion of 5.57 to 1000 of all cases of skin-disease.³ In England, Crocker⁴ gives a statistical frequency of 20 to 1000, while in Scotland, Anderson⁵ encountered it 5.4 times in 1000 consecutive cases of all forms of skin-disease in dispensary practice. It may be contracted from cows, horses, fowls, etc.

Pathology and Anatomy.—The trichophyton in tinea circinata presents its lowest form of development. It is made up principally of mycelia, which are remarkable for the length of their individual segments, and under the microscope look not unlike a loose, irregular net. There are few conidia present, and, as Robinson has pointed out, they are found most readily at the periphery of the patch. Excepting in hot, moist climates it is unusual for the fungus to penetrate deeply into the skin, but is found in the superficial layers of the epidermis, the under surface of the stratum corneum, and in the stratum lucidum. Another remarkable feature of the fungus is that it shows little or no tendency to penetrate into the rudimentary hair-follicles, as is the case in sycosis and ringworm of the scalp, but spreads out in a horizontal plane. As in other varieties of vegetable parasitic diseases, there is in tinea circinata a marked proclivity to soil-exhaustion, so that, as the fungus proliferates at the margin, it dies out in the center, forming the circles and rings so characteristic of this affection. This subject will receive further consideration under the head of Tinea Tonsurans, to which disease the reader is referred.

Diagnosis.—Ordinarily, the clinical features of tinea circinata are distinctive and render it easy of recognition; if, however, there is doubt as to its nature, the microscope will usually remove it. To one unskilled in examining a specimen under the microscope it should be borne in mind that fine lanugo hairs, wool-fibers, and epithelial scales are liable to be mistaken for mycelia. Especially is this so when epidermic scales overlap each other, giving the appearance of short segments of the mycelium. By slightly changing the focus the contour of these bodies may be seen, which differs from the clear-cut, well-defined outline of the mycelium. Occasionally the fungus is difficult to find; this is especially so when the disease is of long duration or becomes complicated with eczema, as occurs so often about the genitalia.

¹ Abstract in *Brit. Journ. Derm.*, Feb., 1896, p. 59.

² Bazin: *Leçons théoriques et cliniques sur les Affections cutanées parasitaires*, Paris, 1854.

³ *Report of the Committee on Statistics of the American Derm. Assoc.*, 1894.

⁴ Crocker: *Loc. cit.*

⁵ Anderson: *Lancet*, Nov. 11, 1871.

Eczema, therefore, is liable to be mistaken for the disease under consideration. In eczema the sharply-defined, bold border of the tinea is absent, and the lesions show no tendency to heal in the center. There is usually a history of moisture, with the formation of vesicles, pustules, and crusts, accompanied by severe itching; which contrasts with the slight vesicular margin sometimes present in tinea, together with its slightly scaly, mildly pruriginous lesions. More difficulty may be experienced in differentiating between ringworm of the hands and forearms of animal origin and dermatitis hiemalis,¹ or winter eczema, which occurs on the backs of the hands in certain localities during cold weather. The resemblance is often very striking, but in the latter disease its association with cold and its spontaneous disappearance or marked amelioration during the summer, together with the tendency to recur each succeeding winter, are sufficient to put one on guard, when scrapings should be examined with the microscope. In winter eczema only epidermic scales and other ordinary products of inflammation have been found, whereas in ringworm the trichophyton may be seen in abundance.

Seborrhea of the chest and back bears a close resemblance to tinea circinata. But in the former disease the scales are loosely attached, have an oily, unctuous feel when rubbed between the thumb and finger, and there will be evidence of glandular derangement on the parts adjacent as well as on the shoulders, face, and scalp.

Psoriasis, occurring in an atypical form, with but few scales and when generally disseminated over the body, bears some resemblance to tinea circinata. The lesions of psoriasis, however, are usually more widely distributed, they have a special predilection to appear on the extensor rather than on the soft flexor surfaces, and are seldom absent from the points of the elbows and knees. The histories of the two affections are quite dissimilar, and the microscope should be used if doubt exists.

Pityriasis maculata et circinata is probably more frequently than any other disease mistaken for tinea circinata. In Germany and Austria, where the latter affection is rare, they are often treated of as varieties of the same disease (*herpes tonsurans maculosus universalis*). Although they have many features in common, yet in origin, course, and termination they are quite distinct.

Pityriasis rosea, as it is often called, appears to come spontaneously, while tinea is usually present in other members of the family or in associates, from whom it is contracted; pityriasis rosea avoids the face and neck, while they are favorite positions for ringworm; pityriasis rosea begins on the upper part of the trunk and rapidly travels downward, usually involving the lower extremities, which presents a striking contrast to tinea circinata. The general distribution of the former and the limited number of lesions in ringworm should enable one to readily distinguish between them.

Finally, pityriasis is a self-limited affection, running its course in from eight to twelve weeks, while tinea goes on for months and years.

Syphilis.—In the rare instances in which tinea occurs on the palms and soles it might possibly be confounded with syphilis. But in syphilis other lesions are usually present on remote parts or on the mucous membranes, which are more easily recognized. The histories of the two diseases, so entirely dissimilar, might aid in eliminating either one or the other affection.

Prognosis.—From its superficial position tinea circinata is the most

¹ Corlett: "Cold as an Etiological Factor in Diseases of the Skin," with report of cases, *Journ. Cut. and Genito-urin. Dis.*, Nov., 1894. Also, by the same author, "Weitere Untersuchungen über Dermatitis hiemalis," *Monatsshefte für Prakt. Dermat.*, xxiii. Band, 1896.

easy of all affections of the trichophyton group to eradicate. Yet in certain cases, and especially when occurring in the crural region in adults, it is often rebellious, and on account of its liability to become lodged in the clothing it is prone to recur long after the treatment has been discontinued.

Treatment.—Local means are usually sufficient to control the disease. When occurring in delicate children or when the skin is moist and flabby internal medication may afford some aid. No definite rules can be given, but in general such drugs as cod-liver oil, the preparations of iron, vegetable bitters, and sulphuric acid are indicated. Again, atropine or strychnine may be used to advantage. Bathing with warm water and soap should be attended to daily, and the tincture of green soap with warm water should be applied over the patches in obstinate cases, using a cotton cloth to rub the soap thoroughly into the skin.

In selecting a parasiticide the age of the patient, as well as the extent and severity of the disease, should be considered. In infants or when the disease is of moderate severity some of the milder applications, such as resorcin (gr. xv–xx to ʒj), either with alcohol or vaseline, or sulphur ointment (ʒj to ʒij), should be used. Ichthyol (gr. x–xxx to ʒj), and the alcoholic preparation of tar known as liquor carbonis detergens (ʒj to ʒij), are also valuable. In severe cases the tincture of iodine painted over the patch once or twice a day is one of the most efficient remedies at our command. Chrysarobin (gr. x–xxx to ʒj), suspended in flexible collodion or traumaticine (a solution of gutta-percha in chloroform), is also an admirable application. Care must be taken not to use it on infants or delicate-skinned persons, especially on the face.

To prevent a relapse and the disease from spreading to others the clothing should be thoroughly boiled or baked.

TINEA TONSURANS. (W. T. CORLETT, M. D.)

Derivation.—Lat. *tinea*, a worm, and *tondere*, *tonsum*, to shear, shave.

Synonyms.—Ringworm of the scalp; Trichophytosis capitis; Herpes tonsurans; Herpes tonsurans capillitii; Tinea tonsdens; Fr. Herpés tonsurant, Teigne tondante; Ger. Scheerende Flechte.

Definition.—A contagious, parasitic disease of the scalp met with in childhood, characterized by circumscribed, slightly scaly, slate-colored patches which contain short, broken hairs, giving them the appearance of the skin of a plucked fowl.

Symptoms.—Unlike the achorion, the ringworm fungus requires no abrasion or follicular opening to find a soil suited to its growth, for it thrives best on that part of the epidermis which has undergone keratization. It is, therefore, in the stratum corneum and hairs the disease first shows itself. Its period of incubation has been demonstrated to be about three days. Although the first stage of the affection is often overlooked by the patient, yet as the process extends and new islets of the disease appear the physician finds ample opportunity to study the eruption at its onset. At first there may be noticed a slightly reddish spot, about the size of a split pea or larger, covered with a few adherent scales and accompanied with slight itching. Sometimes a few small vesicles appear, especially at the margin, which soon rupture, and their contents, mingling with the branny scurf, form an encrusted outline. The spot gradually enlarges at the periphery, retaining its round or oval shape, until it often attains the size of a silver dollar or larger. New foci appear, either in the neighborhood of the original plaque or on other parts of the scalp, which, enlarging, may coalesce, forming irregular or serpiginous areas.

Very soon after the invasion of the disease—and this is generally the first symptom seen—the hairs in the affected area lose their normal flexibility, assume a dull, lusterless, faded color, and break off a short distance from the scalp, leaving an irregular, brush-like area which is the most characteristic feature of the affection. The extent of the hair-fall and the length of the stump varies in different cases: sometimes it is complete, the shaft breaking off just within the mouth of the follicle, leaving a smooth, billiard-ball surface, not unlike alopecia areata, and which has been called bald tinea tonsurans. Again, the hair becomes thin, faded, bent, and broken over large areas, presenting a patchy look; this has been designated as disseminated ringworm. This variety is usually encountered late in the course of the disease or in neglected cases where involution is taking place spontaneously. Between these two extremes various conditions and degrees are encountered. Thus the lesions are usually coin-sized—that is, they range from a dime to a silver dollar—are multiple, covered with brownish or slate-colored scales which are interwoven with bent and broken hairs, reminding one of what is known in forestry as a “wind-fall.” Some hairs in an affected area may remain normal, while the stump varies in different cases from a half inch in length to a mere speck at the mouth of the follicle. (See Plate 25, Fig. 2.) All these variations present themselves—in fact, they make up the great majority of cases. In debilitated subjects or where the patches have been subjected to very irritating applications the condition known as *kerion*¹ may be met with. It is comparatively of recent date that Tilbury Fox² first identified *kerion* as a form of ringworm. Usually, however, but one plaque takes on this form of the disease, in which case the skin becomes red, swollen, and edematous. Sometimes smarting, at other times pain, is complained of, and soon the skin becomes boggy and dotted with numerous suppurating openings or foramina which correspond to the site of the hair-follicles. On pressure a glairy mucus escapes from the follicles which later may become purulent and is often mixed with blood. There is slight fluctuation, although the formation of an abscess is uncommon. The suppurating foramina extend deeply into the mass. Enlargement of the post-cervical glands is not uncommon. In severe cases permanent destruction of the hair takes place.

Etiology.—As previously stated, tinea tonsurans is due to the implantation and subsequent growth of a vegetable micro-organism. In common with other forms of plant-life, it requires a suitable soil and thrives best with warmth and in a moist atmosphere. Light is not essential to its growth. I have observed in Cuba and in the lowlands of Mexico, where heat and moisture tend to the greatest vegetative luxuriance, that tinea trichophytina is very severe and strikingly abundant.

In Morocco the custom of constantly wearing a covering to the head, together with the climatal conditions, render it a common disease. So it is in England, where perennial verdure obtains, and in damp, unwholesome dwellings. I am in accord with Robinson³ and others as to the susceptibility and immunity of certain skins. Yet the disease is seen in the well-nourished and cleanly. The scalp is rarely attacked in the adult. In France it is said to be far more frequent in cities, while it is usually endemic in asylums, homes, etc. where large numbers of children are con-

¹ This word was first used by Celsus, hence sometimes called *kerion Celsi*. It is of Greek derivation, meaning honeycomb (*κρητιον*), while the Italian word for the disease signifies hornet's nest.

² Tilbury Fox: “The Kerion of Celsus; a phase of Tinea Tonsurans,” *Lancet*, 1886, i. p. 156.

³ Robinson: *Loc. cit.*

gregated. It is highly contagious, and often goes through institutions with but few escaping. It is readily communicated from one individual to another by the exchange of hats, pillows, etc. As the disease exists also in domestic animals, such as the horse, dog, cat, calf, and fowl, it may be contracted from them. When thus transplanted on to a new soil it is said to be more active and the fungus exhibits a more vigorous growth (Robinson).

The frequency of *tinea tonsurans* in America, according to the returns of the American Dermatological Association, is 5.45 to 1000 of all diseases of the skin. In England, Crocker¹ reports it much more frequent, being 100 to 1000. According to McCall Anderson, it is less common in Scotland—7 to 1000.

Pathology and Anatomy.—Like the *achorion* in favus, the fungus in ringworm of the scalp consists of mycelia and spores. The former appear under the microscope as long, slender, colorless, usually well-defined threads, which are straight or tortuous, sometimes, though seldom, branched, and vary both in length and width. Sometimes septa are seen, between which one or more pale nuclei are visible. The conidia also vary in shape and size; they are usually round or flattened, highly refractive, and contain a nucleus. They may be single or arranged in rows, and in *tinea tonsurans* are far more abundant than the mycelium.

The marked microscopical and cultural variations in the fungus, as well as the distinct differences in appearance of some of the lesions produced, have given rise to some diversity of opinion as to the unicity or plurality of the fungus. Gruby² from the first described two varieties of fungus—the one large (*rhizophyto-alopecia*), which corresponds to the *trichophyton*; the other composed of small cells, which he called *microsporon Audouini*, and which has become associated with *alopecia areata*, although Gruby's description clearly refers to ringworm. Later, Bazin³ confirmed Gruby's observations, and described minutely not only the appearance of the large- and small-spored fungi, but also the position in the epidermic scales and the hair in which the *microsporon Audouini* was found. Furthmann and Neebe⁴ were the first to revive the study of the ringworm fungi, and described four varieties of *trichophyton* fungus. Sabouraud,⁵ who is engaged in investigating this subject, has already given us many valuable contributions based on a series of experiments in 100 cases. According to Sabouraud, *tinea trichophytina* comprises three or more distinct affections, differing in the microscopic appearance of the parasites, in the situation of the diseases, as well as in their course and termination. The parasites are divided into two main varieties: the first is a true *trichophyton*, composed of large cells, 5 to 7 micro-millimeters, the second of small cells, 2 to 3 micro-millimeters, which is not a true *trichophyton*, but the *microsporon Audouini* of Gruby. The large-celled *trichophytions* are further divided into—first, *trichophyton megalosporon endothrix*, which is the ordinary mild form of ringworm met with in all ages and on various parts of the body; second, *trichophyton megalosporon ectothrix*, which is always of animal origin. Two clinical forms of this latter variety are recognized: first, that contracted from the horse, which is highly pyogenic, giving rise to perifollicular purulent dermatitis, and the

¹ *Loc. cit.*

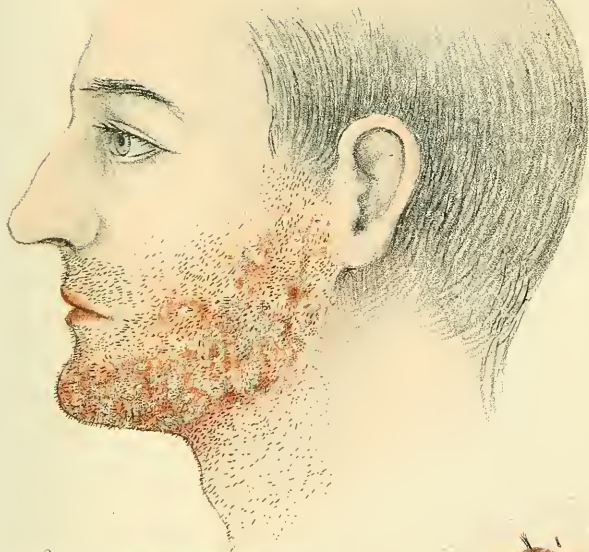
² Gruby: *Comptes rendus des Séances de l'Acad. Royal des Sciences de Paris*, t. 17, p. 301, 1843.

³ Bazin: *Loc. cit.*

⁴ Furthmann and Neebe: *Monatsch. f. prak. Derm.*, vol. iii., Nov., 1891.

⁵ Sabouraud: *Annal. de Derm. et de Syph.*, 1892, t. iii. p. 1061; also *Les Trichophyties humaines*, Paris, 1895.

1



2



a

FIG. 1.—*Tinea barbae*, showing nodule with broken hair (a).
FIG. 2.—*Tinea tonsurans*.

cause of tinea barbæ and kerion; the second is taken from the cat, dog, etc., and recognized by its more superficial position and its vesicular lesions.

The microsporon Audouini, or small-celled variety, is the cause of the most common form of ringworm in children, and is highly contagious and rebellious to treatment. It attacks only the superficial parts of the epidermis and hair, and does not produce permanent baldness.

I.

Trichophyton.

(θριξ, hair, and φυτόν, a plant.)

Spores large, size of red blood-cell; mycelium abundant, often in chains.

Megalosporon Endothrix.

(μέγαλ-, large, and ἔδον, within.)

Fungus grows inside the hair; attacks both epidermis and hair; found in all ages, most common in children; easily cured; not epidemic; ringworm of all parts; never causes permanent bald spots; hairs large, broken off short.

Megalosporon Ectothrix.

(ἐκτός, outside.)

Fungus grows outside the hair; of animal origin; invades follicle and produces suppuration; causes kerion in children, sycosis in men; may cause permanent bald patches.

II.

Microsporon.

(μικρός, small, and σπόρος, seed.)

Spores small, half size of red blood-cell; little or no mycelium; fungus outside the hair; hair fine, broken off long; very contagious; rebellious to treatment; attacks the hair, does not thrive on epidermis; seen in early childhood; occurs in epidemics.

Quite recently Mibelli¹ has verified the observations as to the plurality of the fungus in tinea trichophytina; he does not, however, accept in full the claims of Sabouraud. In England the subject has attracted wide attention, and Alder Smith,² Adamson,³ and others have expressed views harmonizing in main with those of Sabouraud. Adamson in a series of 178 consecutive cases of ringworm found the small-celled variety (microsporon Audouini) largely predominating, 24 to 1; while Sabouraud found in Paris 12 of the small to 8 of the large-celled variety. More recently Colcott Fox and Blaxall⁴ have conducted a series of investigations in 432 cases of ringworm, in which they found between 80 and 90 per cent. were of the small-spored variety. In Boston, Dr. C. J. White⁵ found 95 per cent. of all cases examined were due to the small-spored fungus.

There can be no doubt of the manifold forms of the fungus found in tinea trichophytina, neither can the close observer fail to detect certain clinical differences in the disease in different subjects, even on the same region of the body. Still, many believe with Leslie Roberts⁶ that these variations are due more to the quality of the soil than to inherent differences in type. The consensus of opinion is, however, in favor of the plurality of the ringworm fungus.

The microsporon flourishes best in epithelial structures, and especially those that have undergone keratization. Only rarely is it found in the derma.⁷ It readily attacks the hair, passes through the cuticle, and sometimes forms a spore-sheath surrounding the shaft. Again, the fungus is seen between the hair and inner root-sheath; later, tubes of mycelia are found permeating the bulb, especially at its upper part. In severe forms the inner root-sheath is involved, and in kerion (megalosporon ectothrix) the process involves the sebaceous glands (Robinson) and extends deeply into the follicles and derma. Pellizari⁸ has also found the fungus in the derma under the nail.

¹ Mibelli: *Annal. de Dermat. et de Syph.*, Sept., 1895, p. 733 et seq.

² Alder Smith: *Brit. Journ. of Dermatology*, April, 1895.

³ Adamson: *Loc. cit.*

⁴ Colcott Fox and Blaxall: *Brit. Journ. Derm.*, July, Aug., Sept., and Oct., 1896.

⁵ C. J. White, *Journ. Boston Society Med. Sciences*, May, 1897.

⁶ Roberts: *Brit. Med. Journ.*, Sept. 29, 1894.

⁷ Campana, R.: *Arch. f. Derm. u. Syph.*, 1889, p. 51.

⁸ Pellizari: *Récherches sur le Trich. tons.*, Milano, 1888.

According to Roberts,¹ the fungus may retain its infective property several years. When suppurative folliculitis takes place, permanent baldness may ensue in the areas involved; usually the hairs regain their normal growth.

Diagnosis.—In the majority of cases *tinea tonsurans* may be readily recognized. For, as Daniel Turner² expressed it more than a century and a half ago, “the hair falls off, not altogether from the root, but by piecemeal.” The scurfy, partially bald patches, having irregular, short, stumpy hairs, are highly characteristic, and when doubt exists we have recourse to the microscope. But there are times when the eruption, closely simulating other affections, may be mistaken for them or the actual disease not thought of. This is most liable to occur either at an early stage, before the hairs break off or when the disease has existed a long time. The diseases with which it may be confounded are—*tinea favosa*, *seborrhœa sicca*, *eczema squamosum*, *psoriasis*, and *alopecia areata*.

Tinea favosa may be mistaken for ringworm at an early stage, but soon the yellow, powdery dots appear in favus, and the stumps interposed with brittle hairs in ringworm. For it must be remembered that the ringworm fungus thrives on the hair-structure, and attacks it as readily as it does the epidermis, while in favus the hair is only secondarily and to a less extent involved, the

FIG. 281.—Hair in *tinea tonsurans*, showing upper part of root and broken end of shaft just above follicular opening: *a*, spore-sheath.

fungus finding its habitat in the soft, pulpy cells of the internal root-sheath. For this reason the hairs in ringworm break off when slight traction is made, while they may be pulled out entire in favus. Greater difficulty is experienced after the disease has existed a long time, and the scalp presents the patchy aspect as if the hair has been unskilfully cut. Nor will the microscope always clear up the diagnosis between these two affections, for in detached specimens, where the relative position of the fungus is deranged, there is nothing distinctive in the appearance of the fungi themselves. But in the arrangement and position of the parasites there are certain points that should be noted. Thus the trichophyton and microsporon never form accumulations, such as the favic scutula. In ringworm the spores are found in abundance, either permeating the cuticle of the hair, extending high up, or forming the so-called spore-sheath around the shaft, while in favus the mycelia are more numerous and the spores are confined to the lower part of the shaft, extending downward into the follicle. The history may fur-

¹ *Loc. cit.*

² Turner: *A Treatise on Diseases of the Skin*, London, 1736.

nish a clue, for tinea trichophytina yields more readily to treatment, is decidedly contagious, and is endemic in the United States, while favus is an imported affection.

Seborrhœa sicca also presents scaly surfaces, with the nutrition of the hair impaired, but it is usually seen after puberty, while ringworm is, for the most part, a disease of childhood. Again, seborrhea is more widely distributed and rarely confined to circumscribed patches; the scales are often oily; the hair, though often dull, has not the broken, bent, and washed-out look of ringworm. In all cases of doubt the microscope should be used.

Eczema Squamosum.—When much inflammation of the patches exists, either from a peculiarly susceptible skin or from too strong applications, ringworm may be mistaken for eczema. In the latter disease the roundish, well-defined plaques are rare, and the hair does not suffer as in ringworm. Eczema is not contagious, and several parts of the body are generally implicated at the same time. There is severe itching in eczema, while in ringworm it is less troublesome.

Psoriasis when pronounced could scarcely be mistaken for ringworm, because the heaping up of the silvery scales, with the hair intact, is quite unlike the latter disease. But in atypical forms, with but few scales, and especially when psoriasis is limited to the scalp, as it sometimes is for a time, some care may be required to differentiate between them. It must be remembered that psoriasis does not affect the hair, and it is usually seen on the elbows and the knees. Again, psoriasis comes later in life, and is for the most part a disease of adults, while a great majority of the cases of tinea tonsurans occur before puberty.

Alopecia Areata.—In certain cases the hair-fall is complete in the patches of ringworm, but it falls gradually, while in alopecia it comes out *en masse* before the patient is aware of any trouble with the scalp. At the margin the hairs in alopecia are normal or may be pulled out by the roots, while broken or rotten hairs will be found in ringworm. By close inspection even in the so-called bald ringworm the short stumps of hair may be seen within the follicle.

Prognosis.—In recent cases the disease is easily cured, and in all the prognosis is ultimately favorable, but when the fungus extends deeply into the hair-follicle, months are required to eradicate it. In my experience the disease has proven more rebellious in asylums and homes where a large number of children are congregated than when occurring sporadically. Even without treatment the disease dies out, and is seldom seen after puberty. Many years are necessary, however, for this spontaneous involution or soil-exhaustion to take place. It is only rarely, and then to a limited extent, that the hair is permanently destroyed. It does not seem to affect the general health. As in favus, relapses are liable to occur after treatment is suspended.

Treatment.—Our first duty is to limit the extent of the disease by keeping it within the areas involved and from disseminating among other children. For this either segregation of the child or protecting the scalp by wearing an impermeable dressing is imperative. Segregation is not always practicable, as when one or two are affected in a family containing other children; in public homes and asylums it is also extremely difficult to carry out, in which case an impervious covering, to be spoken of later, should be worn. A skull-cap or hood answers a good purpose if it be lined with white cotton cloth or fine paper, which must be renewed daily and the soiled lining burned. In addition to this, either olive oil or castor oil, containing carbolic acid (gr. 20–30 to ʒj) or salicylated oil (gr. 10–15 to ʒj), should be applied daily over

the whole scalp. Care must also be taken not to spread the disease by combing or brushing the hair over the affected parts. Some difference of opinion exists in regard to washing the scalp with water, a few authors maintaining that by the application of water we supply the elements, heat and moisture, necessary to the growth of the fungus.

Most writers recommend, however, the use of soap and water. It will be found necessary from time to time during the course of treatment to cleanse the diseased areas of an accumulated débris made up of epithelial scales, broken hairs, and the medicament employed. For this purpose some strong potash soap should be selected, such as the German green soap, soft soap, or the tincture of green soap; after which the parts may be thoroughly dried by applying alcohol or ether. As the fungus retains its vitality several years, caps, mufflers, and jackets worn by children having ringworm should be burned.

Unaffected children who are brought in contact with ringworm should likewise take some prophylactic measures against the disease. Thus the most scrupulous cleanliness should be enjoined, and the physician should see that any shortcoming in the general hygienic surroundings, especially as relates to damp, ill-ventilated apartments, be corrected. Such children should on no account be allowed to sleep with those having the disease, nor should they use the same comb, brush, towel, or cap.

It is further advisable to have the hair shortly cut, which facilitates daily inspection of the scalp, and some recommend the application of an antiseptic dressing, such as a saturated solution of borax, carbolized or salicylated oil, etc. An efficient and more agreeable lotion may be made of corrosive sublimate (gr. ij-v, resorcin ʒij, glycerin ʒij, and alcohol ʒvj). In using all preparations containing mercury extreme care must be exercised, especially in infants or in delicate-skinned children, lest constitutional symptoms of the drug be induced. The best prophylactic, however, is in keeping children unaffected away from the source of contagion.

In beginning treatment for ringworm the hair over the entire scalp should be closely clipped and the affected areas shaved, extending fully half an inch beyond the margin. This should be repeated weekly or oftener. When several spots are present or in the disseminated variety shaving the whole scalp is to be recommended.

When tolerated, epilation (which is a modification of the "pitch-cap" and the "calotte") is to be recommended in chronic ringworm, because each affected hair removed eliminates a large quantity of infective material from the fundus of the follicle. As the obstinacy of the disease depends upon these deep-seated foci, which are so difficult to reach, the value of epilation is at once apparent. But, unfortunately, the pain is considerable and the task tedious, so that comparatively few can be treated in this way. On theoretical grounds local anesthesia would commend itself, yet practically it is difficult to lessen the pain by applying either cocaine or the ether spray. Crocker¹ recommends in children over six years of age a 10 per cent. solution of cocaine in lanoline, or carbolic acid in glycerin (1 to 20), to be applied until sensibility is deadened or the hairs loosened. Then a square quarter of an inch or more is to be removed each day. Bazin lessens the pain of epilation by painting the patch with oil of cade. The operation may be performed by using forceps with narrow blades, removing one hair at a time, or by broad duck-billed forceps, when several hairs are extracted at once. Duckworth of London has devised a broad epilation-forceps which expedites the process

¹ *Loc. cit.*, p. 867.

by grasping several hairs at the same time. Early in the course of the disease this process is unnecessary.

Having taken all possible precaution against invasion of new territory, and having cleared the way to the seat of the disease, we proceed immediately with topical remedies, the so-called parasiticides. Some have a deleterious effect on the fungus itself, while others prove inimical to its growth by altering or destroying the soil from which it derives its nourishment.

It matters less which one of the numerous drugs that come so highly recommended is selected than it does upon the thoroughness and persistency with which it is used. For we know of no sovereign remedy equally applicable to all cases, nor one if carelessly or improperly employed that will eradicate the disease.

When seen before the fungus has penetrated deeply or in infants, one of the milder applications, such as used in tinea circinata, should be selected. When ointments are employed the vehicle is of importance, because it is necessary, after the disease has become established, to penetrate as deeply as possible into the follicles of the skin. Vaseline is preferred by some because it does not readily decompose, but, excepting in very acute attacks, it does not meet the requirements to which allusion has just been made.

The introduction of lanoline as a vehicle for ointments has facilitated the penetration of various drugs into the deeper parts. It is of too firm consistency to be used alone, but mixed with some of the fixed oils, such as oil of sweet almonds ($\mathfrak{z}\text{ij}-\text{ij}$ to $\mathfrak{z}\text{j}$), it answers the purpose admirably. Crocker employs lanoline, \mathfrak{v} ; paroleine (a heavy paraffine oil), $\mathfrak{z}\text{ij}$. Abraham¹ of London has devised an apparatus by which parasiticial applications can be forced under atmospheric pressure deeply into the follicles of the skin. Reynolds² proposed to reach the deeper layers of the skin by means of the cataphoretic action of the galvanic current of electricity. Reports from most authors who have tried this method, however, have been disappointing.

Usually, when the case comes under observation the disease has sufficiently progressed to call for the most active agents, such as the different preparations of tar or of mercury, which have long been used and still find their enthusiastic advocates. Tilbury Fox recommended the oil of cade $\mathfrak{z}\text{ij}$, sulphur $\mathfrak{z}\text{ij}$, and lard $\mathfrak{z}\text{j}$, to be applied twice daily. For very young children or on delicate skins the liquor carbonis detergens $\mathfrak{z}\text{j}-\text{ij}$, ammoniated mercury gr. x, to an ounce of the compound lanoline *cum oleo*, is a very efficient and agreeable application. Lallier employed at the Hôpital St. Louis in Paris a solution of corrosive sublimate, 1:300 to 1:1000, with excellent results. Care should be taken when this remedy is used over extensive surfaces. Carbolic acid is said also to be one of the most efficient applications. It should be used with glycerin, $\mathfrak{z}\text{j}-\text{ij}$ to $\mathfrak{z}\text{j}$, or, as suggested by Alder Smith—

R. Acid. carbol. cryst.,
 Ung. hydrarg. nitrat.,
 Ung. sulphuris, $\bar{a}\bar{a}$. $\mathfrak{z}\text{ss}$.—M.

Salicylic acid ($\mathfrak{z}\text{j}$ to $\mathfrak{z}\text{j}$), or Coster's paint, which is composed of iodine $\mathfrak{z}\text{ij}$ and light oil of wood-tar \mathfrak{v} , are powerful remedies recommended by Crocker. Before using the bottle must be shaken, and the fluid vigorously applied with a stiff brush. In about two days a dark crust forms, which should be removed with a pair of forceps, the parts washed with soft soap

¹ Abraham: *Lancet*, Oct. 13, 1894, p. 859.

² Reynolds: *Trans. Am. Med. Assoc.*, 1888.

well rubbed in with flannel, and the paint reapplied. It is claimed that the disease will yield after a few applications.

Blistering is also highly spoken of: for this Squibb's cantharidal collodion may be used. Alder Smith recommends for the same purpose four grains of corrosive sublimate to the ounce of glacial acetic acid. The crusts which form should be removed in a few days and the surface dressed with some milder application, such as the liquor carbonis detergens ointment already referred to. These applications are too strong for infants or children under six years of age, neither should they be used, except with caution, in delicate or strumous subjects.

The oleate of copper is also highly spoken of by various authors, and from personal experience may be highly recommended: it is used in the strength of $\frac{3j}{\text{ounce}}$ of the pure oleate to an ounce of the lanoline mixture; this may be increased to $\frac{3iv}{\text{ounce}}$ to $\frac{3j}{\text{ounce}}$. Oleate of mercury may also be used ($\frac{5j}{\text{ounce}}$ of the 20 per cent. to $\frac{3j}{\text{ounce}}$). This must likewise be used with caution, lest salivation follow its continuous employment over a large area. Alder Smith speaks highly of the pure oleate of mercury prepared with paroleine, instead of dissolving it in oleic acid. He takes ten parts of oleate of mercury to ninety parts of heavy petroleum oil. According to this writer, it produces but slight irritation, and may be used in very young children properly diluted with ordinary petroleum (hydrarg. oleat. $\frac{3j}{\text{ounce}}$, petrol. $\frac{3j-ij}{\text{ounce}}$). The oleates possess great osmotic power and penetrate deeply into the skin.

Crocker, whose wide experience in treating ringworm has enabled him to give a fair trial to the various methods in vogue, prefers the following: The affected region is shaved in the usual way at least three-quarters of an inch beyond the margin of the patch; then an impermeable dressing, composed of salicylic acid gr. x; collodion $\frac{3j}{\text{ounce}}$, is painted on the shaved area, extending beyond the diseased skin, and repeated daily for a week. At the end of this time the crust formed by the collodion is removed by inserting the blade of a forceps underneath the margin and gradually lifting it from its attachments. The salicylic varnish is again applied for another week, and so on until the disease yields. The advantages of the method are that in removing the crusts of collodion many hairs and flakes of the corneous layer of the epidermis are detached, carrying with them large quantities of the fungus, and, as shown by Vidal, the trichophyton is aerobic, the varnish excludes the air, thus interfering with the vitality of the parasite. It also prevents spores from gaining access to other parts or from being disseminated by currents of air.

Dubring, after an extensive experience with various parasiticides, found sulphur and chrysarobin to be the most efficient. The sulphur ointment ($\frac{3j-ij}{\text{ounce}}$ to $\frac{3j}{\text{ounce}}$), according to this author, is used with especial advantage to clear up the scurfy condition of the scalp late in the course of the disease, also after the stronger applications of chrysarobin have been employed, as well as in infants and delicate-skinned persons. Chrysarobin is likewise used in the form of an ointment (gr. xv- $\frac{3ij}{\text{ounce}}$ to $\frac{3j}{\text{ounce}}$, the average being $\frac{3j}{\text{ounce}}$ to $\frac{3j}{\text{ounce}}$). It should be used only under the direct supervision of the physician, care being taken that it does not extend to the face nor produce a too active dermatitis. At first the applications should be sparingly made and the strength gradually increased: a bit of cloth or a rubber finger-tip should be used to rub the ointment thoroughly into the skin. It may be necessary to discontinue it from time to time, when the sulphur ointment should be used. Croton oil also has its advocates, but it is a powerful remedy and should be employed with caution.

In the service of Dr. Besnier at the Hôpital St. Louis the following is the treatment carried out at the present time: 1. The hair over the entire scalp is closely clipped, and kept so during the course of treatment. The scalp is not shaved, fearing auto-inoculation. 2. A circle six to eight millimeters broad is carefully epilated around the patches; especially should this be done around the initial plaque. 3. The débris of broken hairs, etc. is removed, and as soon as the irritation has subsided the parts are washed with a pledget of sterilized cotton saturated with a liquid containing one hundred grammes of alcohol (90 per cent.), one gramme of boric acid, and five grammes of chloroform. The patches are again curetted, this time causing slight hemorrhage. 4. All the accessible fungus being as completely as possible eliminated, the plaque with its surrounding zone is again subjected to a thorough cleansing with the antiseptic lotion, and a pledget of cotton saturated with Van Swieten's liquor one hundred grammes and crystallized acetic acid one gramme is applied. Finally, the affected parts are covered with Vigo ointment one hundred grammes, acetic acid one gramme. 5. Cleanliness of the scalp is easily maintained, provided the hair is kept closely cut and is washed daily with warm water and some medicated soap, such as the borated, sulphur, or tar soap.

Uma recommends the following, which he claims eradicates the disease in about four weeks: 1. The hair is closely cut over the whole scalp. 2. A protective zone is made with zinc paste around the margin of the scalp, extending for a short distance on to the smooth surface. 3. Then a chrysarobin ointment (chrysarobin 5-10 per cent., salicylic acid 2 per cent., ichthyol 5 per cent.) is applied over the entire scalp. 4. This is covered with some impermeable substance, such as aërated cotton cloth, gutta-percha, or rubber, which extends to the protective zone and is sealed at the margin with the zinc paste; a close-fitting flannel cap or a rubber bandage is then applied. 5. Every twenty-four hours the cap or bandage is removed and the dressing loosened at one side, when it may be turned over, and after drying the scalp the ointment is reapplied and the covering sealed as before. 6. On the fourth day the chrysarobin ointment is removed with pledgets of cotton or soft cloth, and ichthyol ointment (5:100) is applied daily for three days. At the end of the first week all dressings are removed, together with the zinc paste, and the scalp thoroughly cleaned with oil and soap. The whole process is repeated for another week, and so on until the cure is complete.

Eddowes¹ also speaks highly of this method, but warns against producing too active inflammatory disturbances. He advises suspending the chrysarobin from time to time and thoroughly cleansing the parts with hot water and soap.

The treatment of kerion is usually more simple, because the trichophyton which gives rise to it is said not to thrive in the presence of suppuration. Epilation and the application of some soothing lotion or ointment containing carbolic acid, boric acid, hyposulphite of sodium, or sulphur is all that the majority of cases require. Brocq prefers the tincture of iodine as a local application after epilation. When much inflamed and painful the evaporating lotion of Hutchinson² or cocaine may be applied. Many authors caution against incisions even when fluctuation is present. It is seldom called for, because the numerous follicular openings allow a free escape of pus, but should subcutaneous abscesses form an incision should be made.

¹ Eddowes: *Trans. XI. Internat. Med. Congress*, Section Derm. and Syph., Rome, 1894.

² R. Spts. rectificati,	1.00;
Liq. plumbi,	0.10;
Aquam,	ad 3.00.

When can ringworm be considered cured? This is an important question the medical attendant is often called upon to decide. Time alone will enable one to give a positive opinion on this point. To ascertain the progress made, all treatment should be suspended. If, as is often the case, a scaly condition of the skin persists, the treatment should be resumed, for a careful search will usually reveal the fungus. If, on the contrary, the skin assumes its natural appearance, and the hairs are found to grow without becoming brittle, of a natural color, and no stumps are found at the end of a month or longer, the disease may be considered practically at an end. It is advisable, however, to continue some mild parasiticide for at least two months, such as the sulphur ointment or the liquor carbonis detergens ointment, once or twice a week.

TINEA BARBÆ. (W. T. CORLETT, M. D.)

Synonyms.—Sycosis parasitica; Tinea sycosis; Parasitic sycosis; Tinea; Trichophytina barbæ; Herpes tonsurans barbæ; Mentagra parasitica; Ringworm of the beard; Barber's itch; Fr. Sycosis parasitaire, Trichophyite sycosique; Ger. Parasitäre Bartfinne.

Definition.—Tinea barbæ is a highly contagious disease due to the trichophyton attacking the face and neck in the adult male, and leading to suppurative inflammation of the hair-follicles and subcutaneous tissue.

Symptoms.—Ringworm of the beard presents two distinct sets of symptoms according as the disease is seen early in its course or after it has invaded the follicles of the hair and the subcutaneous structures. It may be found that this difference depends upon the special fungus rather than on the stage of the disease. Starting from a slight cut or abrasion or without any visible injury, there appears at first a pale-reddish, hyperemic patch, which spreads out at the periphery and clears in the center, forming a well-defined, slightly scaly ring, which sometimes is studded with pinhead-sized vesicles. Other patches and rings soon appear in the neighborhood, which, as a rule, do not attain a large size, and if subjected to treatment disappear. This, it will be observed, differs in no way from ringworm on other parts of the body. The course of this disease, or premonitory stage, is about three weeks, and terminates in recovery, as previously stated, or leads to invasion of the hair-root and its follicle, which constitutes sycosis proper. Naturally, from its conspicuous position and in cleanly persons, this latter is a very rare disease.

Ringworm of the beard manifests itself by the formation of small, pea-sized nodular swellings or tubercles about the roots of the hair, of a dark-red or purplish color, and, aside from slight tingling and itching, gives rise to no marked subjective symptoms. The lesions are frequently grouped, and sometimes form circles or segments of circles. The free shaft of the hair at this time usually shows no evidence of the disease, but if slight traction is made, it will be found loosened from the follicle, and may be withdrawn without pain. As we have repeatedly observed, the root is peg-shaped or bears a striking resemblance to an exclamation point, is devoid of its root-sheath, and under the microscope the lower part of the root and the bulb are found to be disintegrated by the trichophyton.

As the disease progresses the nodules increase in size, involve the perifollicular structure, become prominent above the surface, and discharge a thick, glairy mucus, mixed with pus and slightly tinged with blood. Crusts form from the dried exudate intermingled with epidermic scales, etc., which when removed expose the open, suppurating follicles, presenting an appear-

ance which the Greeks likened to the pulp of a fig; hence the name sycosis (*σύχος*, a fig). These deep-seated indurations with open-mouthed suppurating follicles are the most distinguishing feature of the disease. The hairs are not implicated so readily as in ringworm of the scalp, and the lower part of the root becomes involved first; later the free shaft may present the appearance described in tinea tonsurans, and becomes stumpy and lusterless. The process bears a close resemblance to kerion, with which it is pathologically identical.

The disease usually first makes its appearance on the chin, extending backward under the symphysis, and outward and upward over the rami of the jaw and sides of the face, giving rise to large hickory-nut-sized lesions; in rare instances it attacks the nape of the neck and eyebrows, while the upper lip usually escapes. (See Plate 25, Fig. 1.) Mibelli¹ reports two cases in which the disease invaded the eyebrows, one in a child six years old, in which the eruption extended from the face. Other members of the family were also affected with ringworm, including a male servant and the father, who had typical sycosis barbæ trichophytina. The disease was contracted from a cow. Mibelli's second case occurred in an army officer, the eruption extending from the beard and neck. The source of the disease was unknown. This author has been able to collect but two other reported cases.

Ætiology.—As in other varieties of ringworm, tinea barbæ is due to the trichophyton. This was first pointed out by Gruby² in 1842, and confirmed by Bazin³ in 1855. It may be the result of extension from other parts of the body; more frequently it is contracted from another individual having some form of ringworm, not necessarily on the face, or it may be contracted from one of the domestic animals. Hyde⁴ mentions an epidemic caused by shearing sheep having diseased pelts. It is well known that hostlers and cowherds are especially prone to the disease.

The manner of contagion likewise varies; it may occur by immediate or direct contact with the diseased surface or by mediate contact; that is, the fungus is carried from one person to another by means of towels, sponges, brushes, combs, clothing, etc. A frequent source of communication, especially the milder form, is from the utensils used by the barber; hence the common term "barber's itch."

The state of the general health does not seem to have any influence whatever on tinea barbæ. Uncleanliness, however, offers a strong inducement to its development, and slight cuts and abrasions often prove avenues through which the fungus gains access to the stratum lucidum. The disease is most common in young manhood or between twenty-five and forty years of age.

Like other dermatoses of parasitic origin, it varies in frequency in different countries. The report of the American Dermatological Association shows a frequency of 2.95 to 1000 of all cases of skin-disease. In Scotland, Anderson saw it 18 times in 10,000 cases. The disease is more common in England, Germany, and France, while it is extremely rare in Austria.

Pathology and Anatomy.—The process does not differ essentially from what has already been observed in Ringworm of the Scalp and of the Glabrous Skin, to which the reader is referred for a more detailed account. Thus, at the onset, four or more days after inoculation, there may be seen a

¹ Mibelli: *Loc. cit.*

³ Bazin: *Leçons de Séméiologique cutanée*, Paris, 1885.

⁴ Hyde: *Diseases of the Skin*, Philadelphia, 1895.

² *Loc. cit.*

slight hyperemia caused by the development of the fungus in the upper strata of the cuticle, which corresponds to ringworm of hairless surfaces.¹

In the second stage or more severe form of the disease, which, as previously stated, is rare, the morbid anatomy corresponds to the condition met with in kerion; in other words, there is a suppurative inflammation of the hair-follicles, caused by the trichophyton fungus.

A peculiarity of the fungus when it attacks the beard is that it penetrates deeply into the follicle, involving the bulb often before the free shaft shows any impairment, although Besnier² speaks of a case in which the shaft alone was diseased, showing the usual characters of *tinea tonsurans*, without preceding epidermic symptoms and without subsequent folliculitis.

As observed by Robinson and others, the fungus penetrates deeply into the follicle, attacking the root-sheaths, the bulb, and the lower part of the shaft. The mycelia are abundant, while the conidia are sparsely found. Jamieson believes this accounts for the severe inflammation in sycosis, as the mycelia are known to be more irritating to the tissues than are the spores (Fig. 282), while Lang³ looks upon the sebaceous glands, which

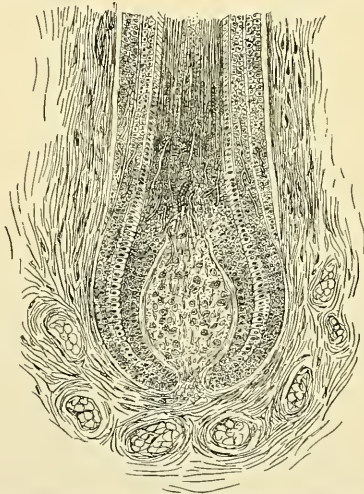


FIG. 282.—Root of hair in *tinea barbæ*, showing early invasion of trichophyton in root-sheaths and upper part of bulb.

in the bearded part of the face are abundantly supplied with blood and which lie in loose connective tissue, as the cause of the severity of the disease. The sebaceous glands are always implicated in sycosis, and the hairs are broken off shorter than in *tinea tonsurans*, often within the follicle.

¹ Sabouraud (*loc. cit.*) regards this a variety of the disease caused by large spores, trichophyton megalosporon endothrix, which never give rise to folliculitis nor do they invade the hair. This form, according to this writer, comprises the great majority of all cases of *tinea barbæ*.

² *Loc. cit.*

³ Lang; *Vierteljahr. f. Derm. u. Syph.*, 1878, v. 393 *et seq.*

Pus has a deleterious effect on the fungus, and in sycosis, as in kerion, the trichophyton may be difficult to find. We must regard sycosis, therefore, as a condition pathologically identical with kerion and due to a special fungus.

Diagnosis.—There need be little difficulty in making a differential diagnosis in typical cases, but when the eruption is modified by treatment or other extraneous influences, it may bear at first sight a resemblance to certain other affections.

The microscope, however, will enable the physician in the great majority of cases to arrive at a correct conclusion. Yet it must be borne in mind that suppuration and the presence of pus destroy the trichophyton, so that repeated trials may be necessary to find the fungus. The disease most frequently confounded with tinea barbæ is *sycosis non-parasitica*. But this is not a contagious affection; therefore it is never contracted from another nor from animals, as is the case in tinea.

Again, ordinary sycosis is an active inflammation, and appears in the form of small pustules at the opening of the follicles, which are usually pierced by a hair, without a previous condition of rings and with more itching and burning than is experienced in ringworm. The dark-red, purplish color and lumpy induration of tinea are not present in ordinary sycosis, nor is the affection so rapid in its development, and generally it attacks the upper lip, where ringworm does not appear.

The hairs are not affected in sycosis vulgaris, and only in severe cases with extensive suppuration do they become loosened as in ringworm. Again, in sycosis there is a general tendency to pus-formation, while tinea is limited to certain parts, and the microscope will reveal the trichophyton.

Syphilis occurring on the bearded part of the face sometimes bears a close resemblance to tinea barbæ, especially when it is tubercular and grouped in circles. Syphilis, however, tends to ulcerate, the hairs are not involved, and there are other evidences of the affection which will render the diagnosis easy. The principal danger arises from the fact that patients are loth to expose the body for examination, and the physician is liable to content himself with a too cursory examination.

Eczema also bears a certain resemblance to sycosis parasitica when the latter has been subjected to strong applications, causing a more or less active dermatitis. But the subjective symptoms are more severe in eczema and the disease is more rapid in its course; there is also an absence of the lumpy condition met with in tinea sycosis, the hairs are not broken or disintegrated, and the disease is not contagious.

Acne when indurated resembles the nodules of sycosis, but acne is not limited to the bearded part of the face. Occurring on the nape of the neck, the resemblance between the two diseases is more striking; but seldom is either affection limited to this part, and, if so, the broken, stumpy hairs in tinea and the sebaceous contents of the nodules in acne are usually sufficiently distinctive to form a correct diagnosis.

Prognosis.—Few diseases are easier to get rid of than a recent attack of tinea barbæ, and I believe some cases terminate in a short time with hygienic measures alone. When the hair-roots have become implicated, however, the disease is hard to eradicate, and months of systematic treatment are sometimes required before the disease completely disappears. It is less difficult to cure than tinea tonsurans. If properly treated, the hairs regain their healthy growth, but if neglected, especially when the disease is severe, permanent loss of the beard in the parts affected is not uncommon. With the obliteration of the hair-follicle the disease may finally disappear.

Treatment.—This must be regulated according to the length of time the disease has existed, and will depend upon the condition present—whether it be superficial or deep-seated, involving the follicles, and also the amount of inflammation accompanying it.

It is highly important that the process be eradicated before the follicles are invaded; this may best be accomplished as follows: The beard on the affected part, including a half inch surrounding it, should not be shaved, lest the disease be disseminated, but clipped with a pair of fine curved scissors; if scales or crusts exist, they should be removed by washing with warm water and potash soap, thoroughly scrubbed into the parts, after which an alcoholic solution of boric acid (ʒj to ʒiv), thymol dissolved in the oil of sweet almonds (ʒj to ʒj), corrosive sublimate (1 to 400–500), or carbolic acid (ʒj to ʒiv) should be used over the hairy part of the face. After drying a strong parasiticide should be applied.

When there are only one or two lesions, chrysarobin, suspended in either collodion or traumaticine (gr. xx–xxx to ʒj), will be found the most efficient. The coating formed should be removed daily, the hair clipped, and the varnish reapplied. When several lesions are present or in very irritable skins the patches should be painted with tincture of iodine, and repeated as often as the irritability of the skin will allow. Or a more agreeable application consists of bichloride of mercury gr. iv, glycerin ʒij, alcohol ʒvj, applied twice daily. Usually a few days will be found sufficient to employ this treatment, although the antiseptic lotion should be continued until it is evident that it is no longer needed.

Milder though less efficient measures may be taken, for which the reader is referred to the Treatment of Tinea Circinata.

When the hair-follicles are involved a different procedure must be followed. Here the pathogenic changes are deep seated, and we have the same problem to confront as presented in kerion. The removal of crusts, by first soaking the parts with oil and afterward washing in warm water and potash soap, epilation, and daily shaving are now required, or epilation and shaving may be performed on alternate days. Immediately after this some penetrating parasiticide should be applied. I have had good results from an ointment containing sulphur gr. xxx, oleate of mercury (20 per cent.) gr. xxx, lanoline ʒvj, with oil of sweet almonds ʒij, to be thoroughly rubbed into the skin three times a day. The oleate of copper (ʒss–j to ʒj) is also highly spoken of by Van Harlingen; ichthyol (ʒss–j to ʒj) is also serviceable. When the parts are much inflamed, Besnier recommends scarification and the application of lint compresses saturated with a boric-acid solution. Poultices should not be applied, as moist heat favors the growth of the trichophyton.

The treatment previously recommended in kerion will also be found to meet the requirements in tinea barbæ. Likewise the parasiticides used in tinea tonsurans when well diluted may sometimes be indicated in the present disease.

TINEA IMBRICATA. (W. T. CORLETT, M. D.)

Synonyms.—Tokelau ringworm; Le pita; Lafa tokelau; Bowditch Island ringworm; Herpes desquamans; Tinea circinata tropica; Buckwar; Southwest guné; Cascadee; Fr. Herpes tonsurans desquamatif, Gune.

From the variety of names given to this affection one would infer the disease has been recognized by various observers who were little acquainted with its nature, and less with the meager literature bearing on the subject. Thus as early as 1729, Dampier in his *Voyage Around the World* gave a fair

description of the disease in the Philippines; Marsden in 1811 probably referred to it as common among the inhabitants of Polo Mas and the west coast of Sumatra. Yet the first accurate description of the affection was furnished by Fox, a medical officer attached to the United States Exploring Expedition in 1841.¹ He called it *gune* (native word for skin).

Of the various descriptions which have since been given nothing very definite was known until quite recently Königler,² Roux,³ and Manson⁴ have each contributed largely to our knowledge of the subject. From the peculiar position of the scales, resembling tiles on the roof of a house, Manson called the disease *tinea imbricata*.

Definition.—*Tinea imbricata* is a contagious, parasitic disease of the skin indigenous to the Malay Peninsula, Philippine, Caroline, and other groups of islands of the South-west Pacific, and characterized by the formation of concentric circles composed of large epidermic scales which are attached to the subjacent skin at their distal border. The eruption is very extensive in its distribution, involving at times the trunk, one of the extremities, or even the whole body surface.

Symptoms.—According to Manson, who inoculated several students with the disease, there appears on the tenth day at the point of inoculation a minute, slightly elevated, brown spot which increases in size until on the seventeenth day it has attained a diameter of three-eighths of an inch. At this time the epidermis splits in the center, becomes detached from the rete, and curls up, while it remains continuous with the normal skin at the mar-

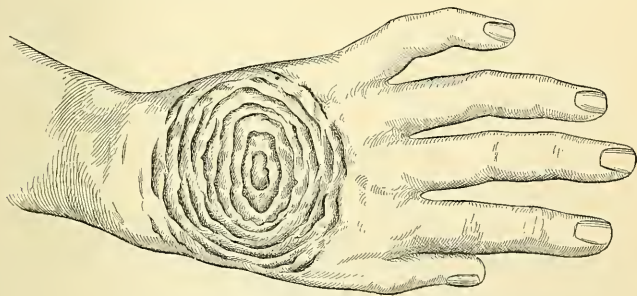


FIG. 283.—*Tinea imbricata* attacking the back of the hand.

gin. Around and beyond the margin there appears a brownish zone slightly elevated, about one-sixteenth of an inch wide, which Manson says is the fungus proliferating between the corneous layer and the rete, and which is followed, as it extends at the periphery, by a curling up of the epidermis, as before described. It travels about a quarter of an inch a week. As soon as the epidermis has re-formed in the center it again takes on the brown color, gives way, and forms a second scaly or pie-crust ring as before. In this manner the crescentic waves of the disease spread out and new ones form in the center, and, as in Manson's observations, five rings may form in a single

¹ *Narrative of the U. S. Exploring Expedition, 1844, vol. v. p. 401.*

² Königler: in *Virchow's Archiv.*, 1878, Ed. 72, p. 413.

³ Roux: *Traité prat. des Maladies des Pays chauds*, t. iii., 1888, p. 231.

⁴ Manson: *British Journal of Dermatology*, Jan., 1892, p. 5.

month. Numerous other foci go through the same evolution, until the merging of various concentric systems destroys the regularity of the lines and covers the part or the whole body with a coat of mail. The eruption has been likened to "watered silk," to "clay" drying on the skin, and to "shaving the upper layer of stiff cardboard in such a way as to make it curl up in circles"¹ (Fig. 283).

If the scales be removed by washing with warm water and strong potash soap, the brownish rings alternating with whitish intervening zones are quite distinctive.

Königer describes the onset of the disease as consisting of small papules arranged in concentric circles, which are very itchy, and which later become covered with large epidermic scales. The lanugo hairs are destroyed, although the disease does not attack the large hair-follicles of the scalp or beard.

Etiology.—The disease is caused by a vegetable parasite which Manson named *tinea imbricata*. It is limited to certain moist, tropical countries, and thus far has been observed only in the islands of the South Pacific, where it has been known to spread from one island to another. It is also met with in Southern China.

The fungus thrives best at a temperature of 85° F. in a moist climate. Extreme heat is said to cause a too rapid proliferation of the growth, which gives rise to an inflammation of the skin, causing death of the fungus. Dry cold, as observed in the north-east monsoon, checks the spread of the eruption. It is met with in both sexes, and in youth more frequently than in the aged, which conforms to what has already been observed in other fungi. It is an extremely contagious disease, although its fungus is less hardy than the trichophyton. Many authors still regard it as a variety of ringworm, developing in an environment most congenial to vegetable growth.

Pathology and Anatomy.—The *tinea imbricata* when placed under the microscope closely resembles the trichophyton, although Manson claims certain distinctions in both spores and mycelium. Siegfried¹ speaks of the abundance of the mycelium, while the spores are sparsely found. It attacks only the subcorneous layers of the epidermis, and never invades the skin proper. It has no predilection for the well-developed hair-follicles. Its rapid development, and consequent separation of the corneous layer from the rete, account for the large scales, together with their distal attachment. The sweat-glands are said to be affected, with a diminution of their secretion.

Diagnosis.—The disease with which *tinea imbricata* is clinically most closely allied is ringworm. Manson's experiments, in which both affections were inoculated on the same patient, gave two distinct clinical pictures, which may be condensed as follows:

First. Ringworm even when met with in the tropics, although sometimes extensive, seldom if ever affects the entire body or even an entire limb; whereas *tinea imbricata* when of long standing covers a very large area, generally a great part of the trunk as well as one or more limbs.

Second. Ringworm has a special predilection for the hairy parts, implicating the hair-follicles; while *tinea imbricata* seems to avoid the hairy parts and only attacks the fine lanugo hair-follicles of smooth surfaces.

Third. The trichophyton always produces a certain amount of inflammation, best seen at the margin of the patch; while *tinea imbricata* gives rise to no inflammation.

Fourth. Ringworm seldom spreads over a surface previously occupied;

¹ Turner, cited by Crocker: *Loc. cit.*

² Siegfried, cited by Crocker.

while *tinea imbricata*, on the contrary, never, if left to itself, gives up the ground it has once acquired. Thus, as soon as the epidermis is reproduced the spores which have been left behind germinate, the mycelia burrow between the epidermis and rete, throwing off the former, and so on in never-ending series.

Fifth. In ringworm the scales are small and branny, often almost entirely absent, and sometimes form crusts with dried serum at the margin of the patch; while in *tinea imbricata* scales are always present, always abundant, and always large, often an inch in length by a fourth or even half an inch in breadth.

Sixth. Inoculation with the fungus of *tinea imbricata* produces *tinea imbricata*; while inoculation with the fungus of *tinea circinata* produces *tinea circinata*.

Seventh. The fungus in *tinea imbricata* is found in greater profusion than in ringworm.

Eighth. *Tinea circinata* is worldwide in its distribution; *tinea imbricata* is confined, as yet, to a limited area.

Prognosis.—This is invariably favorable, as the fungus readily yields to treatment and the general health is not affected, although the most radical measures are sometimes adopted for its relief.

Treatment.—The scales are first removed by taking a warm alkaline bath; for this Crocker recommends the sulphide of potassium, first soaking the parts with oil for twenty-four hours, when a warm bath with potash soap will be found especially efficient. After this any of the applications recommended in *tinea circinata* may be applied. Manson has found iodine to be the most effective. He uses it in the form of *linimentum iodi*, which should be used double the strength given in the *Pharmacopœia*. A limited surface should at first be painted, and increased as the toleration of the skin will permit. To prevent reinfection the clothing should be thoroughly disinfected or burned.

PODELCOMA. (W. T. CORLETT, M. D.)

Synonyms.—Mycetoma; Fungus foot of India; Madura foot; Tubercular disease of the foot; Ulcus grave; Fr. Fongus du pied.

Definition.—Podelcoma (from *πόδος* (*pod-*), foot, and *ἔλκος*, a sore) is applied to an endemic disease usually affecting the foot, less frequently the hand, and still less frequently other parts of the body, such as the shoulder and scrotum. It is characterized by the formation of tubercles and hypertrophied masses, which are perforated by sinuses discharging a sero-purulent fluid containing small fishroe-like bodies, and which runs a very chronic course. The disease is extremely rare, excepting in India, and is met with in rural districts.

Symptoms.—The disease often appears after some slight injury, such as the prick of a thorn, an abrasion, etc., but, as it is of slow development, these slight injuries are usually lost sight of before any perceptible symptoms appear. About a fortnight is said to be the incubation period.

Notice is usually attracted to the disease by the appearance of a tubercle, which gradually enlarges, so that at the end of from four to six months it may attain the size of a pea to a small marble. This gives rise to no acute pain, although there is slight tenderness, and as the disease progresses the patient complains of a dull ache which is subject to exacerbations. At first the skin retains its normal color; later it takes on a dark-red, bluish, or pur-

plish hue. The base of the tubercle is firmly attached and merges into the surrounding derma, which is also indurated. Other tubercles form, the general tumefaction increases, and at a period varying from six months to two years the parts are found to be misshapen and covered with numerous eminences, and sometimes blebs, in the center of which the external opening of a sinus is found. At this time the disease looks not unlike a carbuncle. These sinuses permeate the deep structures of the foot or other part in all directions, piercing bones and muscles, anastomosing with each other, and often leading to cavities or cysts. From these sinuses there oozes a seropurulent fluid containing small bodies that have been likened to gunpowder, small shot, or fish-roe. These bodies are of two kinds, the white or pink and the melanotic or black, and, according to Boyce and Surveyor,¹ form two varieties of the disease.

A favorite position is on the sole of the foot (see Plate 26), in which case the concavity of the arch gradually becomes obliterated and the sole forms a convex surface in its antero-posterior direction. Again, the disease first makes its appearance in one of the prominences at the base of the fingers or toes, leading to deformity of the parts. A striking feature is the exaggerated extension or flexion of the toes, according as the disease attacks the plantar or dorsal aspect of the foot. Bocarro² maintains that discharging sinuses, although a prominent symptom, are not invariably present, and that there may be one or more sinuses without an external evidence of a tumor.

The disease is usually limited to the region first affected, and for the most part the general health remains unimpaired.

Etiology.—The disease is due to a fungus, *chionophye Carteri*, named in honor of Vandyke Carter, who first called attention to its parasitic nature. It is endemic in India, and especially in Madura; hence the name, "Madura foot," often applied to it. Cases have been reported, however, in the United States,³ Canada,⁴ and in Italy.⁵

It is a disease of the country, is usually seen in those who are in the habit of going barefoot, and is more common in men than women. In 100 cases collected by Bocarro in the Hyderabad Civil Hospital, 8 only were women. In regard to age, he found it occurred more frequently in youth, although old age was not entirely exempt. The greatest number were met with between ten and twenty; in many the ages ranged from twenty to forty, while after this the disease was infrequent. Mohammedans were especially prone to the disease, probably from their custom of removing the foot-covering. No authentic case has been observed in the lower animals.

Pathology and Anatomy.—Under the microscope the fish-roe or mulberry-like bodies are found to be made up of fungus elements (Fig. 284). The fungus bears a close similarity to that found in actinomycosis hominis, and Kanthack⁶ and others have endeavored to prove their identity. According to the most recent observations by Boyce and Surveyor,⁷ there is a marked difference between the white and black varieties of mycetoma, as well as between this disease and actinomycosis. According to these writers, the

¹ Boyce and Surveyor: *Trans. Path. Society of London*, Apr. 18, 1893.

² Bocarro: "An Analysis of One Hundred Cases of Mycetoma," *Lancet*, London, 1893, ii. p. 797.

³ Kemper: *American Practitioner*, Sept., 1876; and Hyde: *Journ. Cut. and Genito-urin. Dis.*, Jan., 1896.

⁴ Adami: *Trans. Am. Assoc. of Physicians*, 1895.

⁵ *Monatshefte f. Prak. Dermat.*, 1890, p. 361.

⁶ Kanthack: *Journal of Pathology and Bacteriology*, Edinburgh and London, Oct., 1892, i. pp. 140-162.

⁷ *Loc. cit.*

PLATE 26.

I



2



Podelcoma (Vincent).

fungus of poddelcoma consists of a dense network of mycelia, the individual filaments of which are most readily distinguished at the periphery. They are long and slender, no septa can be made out, nor has any dichotomous division of the filaments been observed. Under the microscope these filaments resemble very closely those found in actinomycosis. When fresh the filaments have a thin cell-wall and contain a finely granular protoplasm. Neither spores nor motion of the filaments can be seen. The main difference between them and those of actinomycosis is the rapidity with which they take up aniline stains. Some filaments are slightly bulbous at their extremity, although no spores have been detected at this point. The mycelia are brittle and break up into short pieces. These observers also place the fungus in the streptothrix group.



FIG. 284.—Parasite in poddelcoma, fragment of a colony (Vincent).

Diagnosis.—By many authors this disease is regarded as identical with actinomycosis. But the latter disease is usually contracted from one of the lower animals, and is therefore often seen in herdmen or those who have to do with grain; while mycetoma is not met with in the lower animals. Mycetoma usually attacks the foot or hand, while actinomycosis most frequently appears on the upper part of the body, and often is secondary to actinomycosis of the internal organs; whereas mycetoma seldom affects the internal viscera or impairs the general health. The former is more rapid in its course and more frequently terminates fatally; while mycetoma is slow in its course and is quite amenable to treatment.

If subjected to treatment, the prognosis is favorable as to the life of the patient. If allowed to go untreated, the disease progresses until finally the patient succumbs to exhaustion or some concurrent malady.

Treatment.—This is purely surgical, and consists in the destruction or removal of the part affected. This may be done by the actual cautery, electrolysis, or the knife. When extensive the part should be amputated well beyond the point of infection.

ACTINOMYCOSIS OF THE SKIN. (W. T. CORLETT, M. D.)

Synonyms.—“Lumpy jaw”; Ger. Aktinomykose; Fr. Actinomycose.

Definition.—A contagious disease affecting the subcutaneous tissue, leading to suppuration and the formation of fistulous openings, pursuing a very chronic course, and caused by the ray fungus.

It is quite recently that general attention has been called to actinomycosis, although Langenbeck met with a case in man as early as 1845. The notes and drawings of this case were not published, however, until after the author's death, when Israël¹ gave the first detailed account of the affection. Previously, Hahn² in 1870 and Bollinger³ in 1877 observed the disease in the jaws of cattle. The latter noted peculiar sulphur-yellow bodies in the discharge, which Harz studied and called actinomyces or ray fungus (*ἀκτίς*,

¹ Israël: *Virchow's Archiv*, vol. cxxvi. pp. 11-58.

² Hahn, cited by Boyce and Surveyor: *Lancet*, Sept., 1894.

³ Bollinger: *Centralblatt f. die med. Wissenschaften*, 7 July, 1877, p. 481.

ray, and *μύκης*, mushroom), and the disease actinomycosis. Ponfick¹ in 1882 established the identity of the disease as described by Bollinger in the ox and by Israël in man, while Majocchi² first noted its occurrence in the skin.

Symptoms.—The disease is insidious in its development, and months, sometimes years, elapse before it is brought before the notice of the physician. At this time there appears, either on the side of the neck or face, especially in the submaxillary or supraclavicular region, rarely on the fingers (unless podelcoma prove to be a variety of the disease, as some suppose), a diffused, indurated subcutaneous tumor, having a lumpy feel and usually accompanied with but little pain. The skin presents a dark-red, purplish, or livid hue, and Derville³ has called attention to certain maculæ which appear on the skin, and which he considers pathognomonic of the disease. They vary in color according to the complexion of the individual—violaceous in blonds and black or slate-colored in dark-skinned people. They vary in size, ranging from a pinhead to a bean, and mark the site of future fistulous openings.

Or the disease may have progressed still farther, when the skin will present soft, fluctuating points, which finally burst, discharging a sero-purulent or sanguineous fluid containing small, pale-yellow or sulphur-colored granules the size of a small pinhead to a hempseed, round and having a mulberry-like contour—the actinomyces.

One or more fistulæ may be present. There is usually a considerable undermining of the skin, and deep burrows are not infrequently met with. Only late in the course of the disease or when the internal viscera are involved does the general health show impairment, at which time the temperature may rise to 102° or even 104° F. There is little or no enlargement of the lymphatic glands.⁴

Etiology.—The disease is more frequent in men than in women, and is usually seen in young adults who have to do with horses, cows, or grain. Actinomycosis of the skin is nearly always secondary to the involvement of the deeper structures or the internal viscera, such as the lungs, liver, or intestinal tract.

The disease is usually contracted from cattle, horses, and possibly some other of the domestic animals. Baracz⁵ gives an instance in which the disease was communicated directly from one individual to another, and Murphy⁶ cites a case where a dog was supposed to be the source of contagion. The fungus is said to grow also on corn and hay. As it does not attack the surface of the skin primarily, there must be an abrasion or some other port of entry, such as a carious tooth, or it may be inhaled into the air-passages or gain access to the digestive tract. The disease has been recognized most frequently in Germany and Austria, although of late several cases have been reported in France and Italy.

Pathology and Anatomy.—The gross lesions in the disease are due to an inflammation set up by the presence of the actinomyces or ray fungus. This, as previously stated, is of considerable size, measuring from 0.18 to 0.60 mm. in diameter. After staining by Gram's method the fungus may be closely studied under the microscope, when it will be found to be composed of a central network of closely interwoven threads. Radiating from this

¹ Ponfick: *Actinomykose des Menschen*, Berlin, 1882.

² Majocchi: *Ateneo med. parmese*, Parma, 1887, i. 67-70.

³ Derville, cited by Monestîè: *Journ. des Sc. médicales de Lille*, Aug., 1895.

⁴ Monestîè (*loc. cit.*) has usually found the lymphatic glands slightly enlarged.

⁵ Baracz, quoted by Crocker: *Loc. cit.*

⁶ Murphy, quoted by Hyde: *Loc. cit.*

knot-like mass are threads which divide dichotomously and terminate in Indian-club-shaped extremities. These bulbous ends are supposed to contain the fructifying bodies, and the radiating threads the mycelia of the fungus. The latter may be cultivated in nutrient media, when the same tendency to develop in colonies is observed, thus forming the mulberry-like bodies which constitute the ray fungus¹ (Fig. 285).

Diagnosis.—Doubtless many sarcomata and osteosarcomata, so called, are really cases of actinomycosis; for the two diseases bear a close clinical resemblance, and the microscope alone will in many cases enable one to differentiate between them.

Again, scrofuloderma is readily mistaken for the affection, and the fungus may be mistaken for particles of inspissated pus. It should be borne in mind that actinomycosis often occurs in vigorous, well-nourished young people, and the lymphatic glands are to a less extent involved; while in strumous subjects the general condition of the patient is at once apparent, and glandular enlargement is always a conspicuous feature.

Care should also be taken not to mistake actinomycosis for a suppurative process occasioned by a carious tooth. In all cases the microscope should be called into requisition, when a correct diagnosis may be made.

Prognosis.—This is becoming more favorable as the disease is better understood. Undoubtedly errors of diagnosis or failure to recognize the disease in an early stage accounts for many cases that pursue an unfavorable course and terminate fatally.

Treatment.—In mild cases, when the disease is situated superficially, curetting may be performed, the cavity afterward to be flushed with some antiseptic solution, such as corrosive sublimate (1 : 500–5000) or tincture of iodine (ʒj to ʒxvj). Rydygier has found a 1 per cent. solution of the potassium iodide injected into the parenchyma of the tumor of great value. When severe, and in many cases, removal of the diseased part with the knife is the best procedure.

Of internal remedies the potassium iodide (ʒss per diem) is sometimes followed with benefit.

TINEA VERSICOLOR. (W. T. CORLETT, M. D.)

Synonyms.—Pityriasis versicolor; Chromophytosis; Mycosis microsporina; Chloasma (Wilson); Phytosis versicolor; Dermycosis furfuracea; Ger. Kleinflechte.

Definition.—A mildly contagious affection of the skin due to a vegetable parasite, and characterized by variously sized, irregularly shaped, furfuraceous patches of brownish or fawn color, situated for the most part on the trunk.

Symptoms.—The eruption usually appears on the breast or back, less frequently in the groins and axillae, in the form of small, split-pea-sized

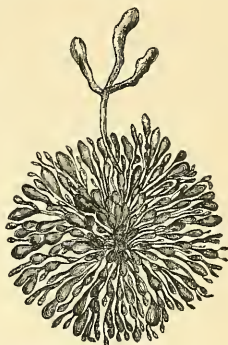


FIG. 285.—Actinomyces granule (Ponfick).

¹ Bostroem: "Untersuchungen über die actinomykose des Menschen," *Ziegler's Beiträge*, vol. ix., 1891, pp. 1–400.

macules, which are not perceptibly raised above the general level of the skin. They are discretely scattered over the part affected, are round or oval in shape, with a well-defined margin, and occasion little or no itching. In most instances the itching is noticeable only when the patient perspires.

Their color varies in different individuals as well as in different countries, being almost white in the negro, while in the Caucasian they are of a brown or fawn color, which within the tropics assumes a darker hue. They give rise to no exudation, and are covered by adherent branny, furfuraeous scales which may be more readily seen by scraping with the finger-nail, when an irregular, scaly furrow will be left behind.

The individual lesions increase in size, often coalesce, presenting large, irregular plaques which form the main center of the disease. Thus the chest over the sternal region, the back between the scapulæ, or the abdomen around the umbilicus may present silver-dollar to palm-sized areas of the eruption, with numerous islets scattered more discretely as the distance from the focus of the eruption increases. It seldom extends beyond the trunk, although occasionally it is met with on the thighs, arms, and neck. I have never seen it mount above the collar, and have on several occasions observed the line of demarkation at this point clearly drawn. There are, however, cases reported in which the eruption extended to the face, and Payne¹ has observed it on the scalp in a patient having the disease on other parts of the body. The covered parts are most frequently affected, because they afford the most favorable conditions for the development of a fungus superficially situated on the horny layer of the epidermis, as is the case in tinea versicolor. If the daily use of soap and water be withheld from the face and hands, and the atmosphere be moist and warm, these parts will readily become involved.

According to Duhring,² the plaques sometimes present a reddish tint; this is especially so during very warm weather or in delicate-skinned persons who perspire freely. Geber³ has observed a coppery hue when the affection attacks the fold between the scrotum and inner surface of the thigh. Bateman speaks of a pityriasis nigra, which Willan observed in children born in India and brought to England,⁴ while Taylor⁵ attributes the color in a case which changed from a mahogany to an ink-stain or black to the elimination of the potassium iodide which the patient had been taking. Unna⁶ mentions an acute variety in which resolution takes place in the center, leaving a ringed margin.

The course of the disease varies greatly. Sometimes the eruption is limited to a few finger-nail-sized spots which remain stationary; at other times the lesions rapidly increase in size, give rise to marked itching, and after extensive areas are involved remain stationary for years.

It is a disease of adult life, rarely seen before puberty and more seldom in advanced age. Exceptions to this, however, are met with; thus Smith of Dublin⁷ reports the case of a girl aged twelve years in whom the disease was of long standing. Phillips⁸ has also reported the disease in a boy aged seven years and nine months, with typical macules of the chest and back. It is said to be somewhat more common in men than women.

¹ Payne, cited by Crocker: *Loc. cit.*

² Duhring: *Dis. of the Skin*, Philada., 1882.

³ Geber: in *Von Ziemssen's Diseases of the Skin*, 1885.

⁴ Bateman: *Cutaneous Diseases*, London, 1814.

⁵ Taylor: *Am. Journ. Syph. and Derm.*, p. 100, 1873.

⁶ Unna: *Vierteljahrsschr. f. Dermat. u. Syphil.*, 1880, Heft 2 u. 3.

⁷ Smith (Walter): *Journ. Cutan. and Ven. Dis.*, Jan., 1882.

⁸ Phillips, quoted by Crocker: *Loc. cit.*

Etiology.—Willan and Bateman, who named the disease and gave an accurate description of it in 1814, observed that it occurred more frequently in those who wore flannel. In 1846, Echstetd of Griefswald¹ discovered that it was due to a fungus, which Robin² called *microsporon furfur*. In more modern times the growth of this vegetable parasite has been ascribed to various debilitating conditions, such as phthisis, etc. Robinson³ says its appearance upon the chest of those who do not sweat greatly and who change their underclothing sufficiently often is to be regarded with suspicion, as these people frequently develop tuberculosis of the lungs later. The free perspiration which accompanies this affection, together with the wearing of flannel which is infrequently changed, probably has more to do with its production than any special state of the system. De Molènes and Costilhes⁴ claim that the most favorable condition for the development of the parasite is produced by gastro-intestinal disturbances which give rise to seborrhea, and which by decomposition on the skin result in the formation of certain fatty acids in which the *microsporon furfur* thrives.

The *microsporon furfur* is one of the lowest forms of vegetable growth that attack the skin, and finds its proper nidus in the most superficial cells of the epidermis. It is less tenacious of life than the forms previously considered, and is more readily disturbed by bathing, friction, and other external conditions. It is contagious only to a limited extent, probably because the soil and environment mentioned are not present in all individuals. Köbner⁵ was the first to demonstrate its contagious nature by inoculating himself as well as one of the lower animals. The main etiological factors, therefore, are youth (between fifteen and forty), the wearing of flannel next the skin, the infrequent use of soap and water, and a warm, moist atmosphere.

The disease is far more frequent than statistics would indicate; thus, as Hyde mentions, in examinations for enlistment in the army service and by those who examine extensively for life insurance the affection is frequently encountered in those who are unaware of its presence or neglect it on account of the slight amount of discomfort it gives them. The combined report of the various members of the American Dermatological Association gives a statistical frequency of 10.2 to 1000 of all cases reported. In France, Hublé found the disease 6.8 times in examining 1000 supposed healthy recruits, while in India and other tropical countries the disease is said to be exceedingly common.

Pathology and Anatomy.—The *microsporon furfur* (Fig. 286) is the most easily recognized of all the mould fungi—first, because it is found in abundance in the scales and scrapings from the disks; second, on account of its peculiar arrangement and distinctive feature of the elements themselves; and third, in the absence of all cutaneous irritation and extraneous products of inflammation.

According to Hyde, it is more readily stained by eosin and methyl-violet than the trichophyton or the achorion. The spores are arranged in numerous clusters surrounded by a close network of mycelia. Their number varies from a half dozen to several hundred, although, as stated by Robinson, their usual number ranges from twenty to fifty. They are rounded or oval in shape, and larger than those of the *microsporon*, measuring from 5 to 7 mm. in diameter (Robinson), although if examined from the same plaque,

¹ Echstetd: *Froriep's Notizen aus dem Gebiete der Natur u. Heilkunde*, 39 B., Juli u. Sept., 1846.

² Robin: *Histoire naturelle des végétaux parasites*, Paris, 1853.

³ *Loc. cit.*

⁴ De Molènes and Costilhes: *Ann. Dermat. et Syphil.*, 1892, p. 436.

⁵ Köbner: *Klinische u. experimentelle Mittheilungen aus der Dermat. u. Syphil.*, Breslau, 1864.

they are fairly uniform in size. They consist of a transparent protoplasm, sharply contoured, and contain a highly refracting nucleus. Free spores are also scattered over the field. The mycelia, which are also abundant, are made up of a homogeneous or slightly granular substance, often containing spores, especially at the ends and joints. They may be straight or curved and wavy, more rarely branched, and are shorter than the vegetable fungi previously considered. Another distinctive feature is that they do not invade the deep structures of the skin, such as the follicles and glands,



FIG. 286.—*Microsporon furfur*, fungus of pityriasis versicolor; $\times 700$ (Kaposi).

neither do they find a suitable soil in the structure of the hairs or nails, but thrive only in the superficial cells of the stratum corneum.

Their abundance in this structure, together with the highly refractive property of the conidia, accounts for the peculiar color of the eruption.

Diagnosis.—Although the disease is often overlooked by the patient and mistaken for other affections by the physician, there is really no difficulty in making a correct diagnosis. The affections most liable to be thus confounded are chloasma, lentigo, seborrhea of the chest, pityriasis rosea, and macular syphilide. By the laity all discolorations of this kind are attributed to the liver, and medical men have been known to fall into the same error.

From chloasma it is distinguished by its appearing on parts covered by the clothing, while chloasma usually occurs on the face and hands. Again, chloasma, although of a somewhat similar color, is situated deeply in the epidermis, the stratum mucosum, and is not removed or rolled up by scratching with the finger-nail. The furfuraceous desquamation so characteristic of tinea versicolor is absent in chloasma. The same applies also to lentigo.

Seborrhœa congestiva, or *eczema seborrhoicum*, is usually of a reddish color, accompanied by more itching, and the scales have an oily consistence. When scratched a watery exudation appears, and the scalp is also usually the seat of glandular disturbance.

Pityriasis rosea bears only a slight resemblance to *tinea versicolor*. Its rapid course and wide distribution readily distinguish it from the latter disease.

Syphilis sometimes presents maculæ not unlike *tinea versicolor*, but other evidences of syphilis are generally present, or a history may be obtained of former disturbances, such as mucous patches in the mouth and throat, or a non-itching eruption of a more or less coppery color appearing on the forehead, trunk, and extremities; also, falling of the hair, adenopathy, and the initial lesion of syphilis. But all of these diseases may be eliminated by the microscope, there being in them no special micro-organism present, while the fungus is readily recognized in *tinea versicolor*.

Prognosis.—This is invariably favorable, from ten days to a fortnight being sufficient to effect a cure. If untreated, however, the disease lasts for years. It never affects the general health. Like other diseases of this group, relapses are common.

Treatment.—Any of the mild parasiticides mentioned in the treatment of ringworm will prove equally efficacious here. The patient is directed to take a warm bath, with the free use of soap (soft or potash soap preferred), when the application of a saturated solution of sodium hyposulphite twice a day will usually be all that is required. In my experience the sulphur ointment (U. S. P.), applied twice daily and thoroughly rubbed into the patch, has given the best results.

Besnier¹ advises, in addition to the hot soap-bath, which he gives night and morning, the following ointment, which is to be kneaded into the affected area for several minutes before retiring at night:

℞. Resorcin,	
Acid. salicyl.,	gr. xv-xlv;
Sulph. præcip.,	ʒss;
Lanolin., vaselin., et axung.,	āā. ʒvj.—M.

The under-clothing should be boiled and changed frequently. One week, it is claimed, is sufficient to eradicate the disease.

ERYTHRASMA. (W. T. CORLETT, M. D.)

In 1849,² Burchardt described a micro-organism which he found on the skin, and to which he gave the name *microsporion minutissimum*. Soon after this v. Bärensprung³ recognized the parasite in a special form of cutaneous eruption, which he called erythrasma (*ἐρυθράς*, red).

Definition.—This disease occupies a clinical position midway between *tinea circinata* and *tinea versicolor*, and is characterized by small, variously sized, roundish patches of a color varying from a slight red to a brown. They are covered with fine, powdery scales, and are situated between the folds of the skin, such as the axillæ, nates, etc., and about the genitalia.

Symptoms.—As there are no marked subjective symptoms and as the eruption is situated where its presence may be readily overlooked, few cases are brought to the notice of the physician. The plaques may be one or more in number, and in size range from a five-cent nickel to several inches in diameter. They are not perceptibly raised above the level of the skin, have an irregular outline, are dry or have an unctuous consistency, and are of a reddish-brown or orange color. There is little or no irritation present.

¹ *Loc. cit.*

² Burchardt: *Med. Zeit. d. Vereins f. Heilk. f. Preussen*, 1859, No. 29.

³ Bärensprung: *Ann. der Charité Kranken.*, 1862, Bd. x.

The disease is said to be more common in men than women, and occurs in young adults or in those of middle age.

Pathology and Anatomy.—As its name implies, the microsporion minutissimum (Fig. 287) is the smallest in the group of vegetable parasites. A power of six hundred diameters is required, when the following characteristic features may be observed: The growth is composed of fine threads of mycelia, which are jointed, although they are not branched, the segments being of very unequal length and in thickness not exceeding 0.6 mm. The mycelia are neither straight nor markedly curved, but are tortuous and often



FIG. 287.—*Microsporion minutissimum* (No. 12 immersion) (Corlett).

form a very fine network. Conidia have not been found, although the field is thickly studded with granular material. According to Payne,¹ the mycelia are situated between the epidermic scales and near their free margin. Some of the threads have a beaded appearance resembling spores, with doubtful groups of granules scattered over the field.

Weyl² found the mycelia of exceedingly variable length, twisted in wavy lines, and always narrow and pale. Numerous small bacteria and zoöglea were also present.

The **diagnosis** can offer no difficulty if the special characters of the disease are borne in mind; it chiefly lies between *eczema marginatum*, *tinea circinata*, and *tinea versicolor*. The microscope will readily enable one to differentiate between them.

The **prognosis** is favorable, and the **treatment** of the affection is the same as that given in *tinea versicolor*. Like other diseases of this group, relapses are not uncommon.

MAL DEL PINTO. (W. T. CORLETT, M. D.)

Synonyms.—Mal de los pintos; Tiña (Mexico); Quirica (Panama); Carate or Cute (Venezuela and Granada); Pinta disease; Spotted sickness.

The first authentic record of the disease is given in the *Encyclopædia of Polanko*, Mexico, in 1760. It was prevalent among the Aztec Indians in

¹ Payne: *Observations on Some Rare Diseases of the Skin*, London, 1859.

² Weyl, in *Ziemssen's Handbook of Skin Diseases*, New York, 1885.

the lowlands of Southern Mexico, where it had been endemic for centuries. Alibert also described the disease in his edition of 1832. Of modern writers, Hirsch,¹ Iryz,² and Lier³ may be consulted.

Definition.—A peculiar discoloration of the skin occurring in variously sized and shaped scaly patches, met with in certain tropical regions, and due to a fungus which may be transmitted from one person to another.

Symptoms.—The disease usually appears on the uncovered parts, such as the face, hands, and feet (the palms and soles excepted), although it may extend over the whole body surface, including the scalp. It occurs in the form of dry, scaly spots, which vary in size according to the length of time they have existed; they are not raised above the general surface, they extend at the periphery, and in color vary from a dull-white or grayish tint to a red, blue, or black.

There are two varieties of the disease: the first comprises the grayish-blue or black eruption, which attacks the more superficial parts of the epidermis, while the second variety attacks the rete mucosum and corium, and is of a red or whitish color.

The black variety resembles gunpowder burnt into the skin or tattoo-marks. This when situated on the face presents a somewhat striking appearance which has given rise to the name *carate*, which signifies, "Look at his face!" The superficial variety yields readily to treatment and leaves the skin in its normal condition.

The subepidermic variety is subject to less variation in color, and retains its original tint throughout the entire course of the disease. Mal del pinto may continue many years or the entire lifetime of the patient, as it is rebellious to treatment on account of its deep situation. Ulcerations sometimes occur in this form.

At first the lesions in mal del pinto are furfuraceous, later the scales become larger. There is a peculiar mousy odor emanating from the body of those affected with the disease. There is marked itching present, although the general health does not suffer. When the scalp is invaded the hair loses its gloss, becomes debilitated, and falls out. It attacks dark races in preference to the Caucasian, is equally prevalent in men and women, and is limited to the low countries within the tropics of the American continent.

The disease is caused by a fungus which is composed of mycelia and spores. The former are tapering, branched threads to which conidia are sometimes attached. The spores are round or oval, measuring about 8 micromillimeters in diameter.

The **treatment** is the same as recommended in tinea trichophytina and other diseases of this class.

B. ANIMAL.

SCABIES. (ALFRED E. REGENSBURGER, M. D.)

Synonyms.—Itch; Fr. Gale; Ger. Krätze.

Definition.—Scabies is a disease of the skin presenting various lesions, produced, primarily, by the *acarus scabiei* and augmented by the scratching which the affected subject has recourse to in order to alleviate the itching which the parasite causes.

¹ Hirsch's *Geographical Pathology*, vol. ii. p. 379.

² Iryz: *Med. Record*, 1882, p. 175; also *Brit. Med. Journ.*, vol. ii., 1882, p. 903.

³ Lier: *Monatsh. f. prakt. Derm.*, vol. xiv., 1892, p. 447.

It is a most important disease to be conversant with. It is of quite frequent occurrence and is highly contagious. Its diagnosis should, as a rule, offer no difficulties; its prognosis is very good, as it is a decidedly curable affection, and its treatment is very satisfactory if properly carried out.

Symptoms.—The irritation caused by the biting, boring, and moving over the surface of the skin of the acari gives rise to a sensation of itching. This is the earliest and most constant symptom. The itching is usually confined at first to the hands and abdomen, but soon becomes general. In the beginning it may not be severe, but after a while it may be unbearable. It is particularly marked at night, which is accounted for by the fact that the parasite becomes active when the body has been warmed up by the bed. This symptom is rarely absent. The itching induces scratching, which in its turn aggravates the eruptions which manifest themselves.

These eruptions are composed of various elementary lesions. There is a commingling of papules, vesicles, pustules, etc. which presents a characteristic *polymorphous* aspect. Urticaria, furunculosis, or deeper inflammatory processes, abscesses, adenitis, etc., may complicate or be combined with the scabies.

A further peculiarity of these eruptions is their *distribution*. Their favorite seats are where the skin is thin and easily penetrated by the acarus, as in the interdigital spaces, on the thumbs, at the inner line of the wrists, the anterior aspect of the forearms, the anterior borders of the axillæ, the abdomen, the flexor surfaces of the thighs, around the malleoli; on the genitals in men and around the nipple in women: also over seats of pressure in the groin when a truss is worn; around the legs where the garters fit; over the ischia very frequently in tailors and shoemakers, who sit for a long time on hard seats; and, in children, over the buttocks, soles of the feet, and palms of the hands.

The *polymorphism* and *distribution* of the eruption are, in the absence of all other signs, enough to base a diagnosis upon. They alone are pathognomonic.

The *cuniculus*, furrow or canal, of the acarus (Fr. *sillon*; Ger. *Milbengang*) is a symptom of great value, furnishing positive evidence of scabies, and being found in no other affection. The female parasite begins to dig this canal within half an hour after being placed on the skin. She attaches or fastens herself to the epidermis, through which she bores until she reaches the *rete mucosum*, from which she draws her nourishment and along which she continues to burrow.

The *cuniculus*, or canal, usually attains a length of from 5 mm. to 1 cm. or more, but very rarely exceeding 3 cm. It assumes the form of the letter S or C, or that of a comma or of a horseshoe, and often looks like a skein of silk run under the skin, of a dirty-grayish color, though at times it may be reddish, blackish, or bluish, owing to the occupation of the individual.

When a piece of skin in which a *cuniculus* is situated is excised and carefully examined by the naked eye, or, better, with a magnifying glass, it is found to be arched, and a number of minute black spots or dots are observed along its upper surface or roof, which have been looked upon by some (Hardy and Bazin) as being the feces of the parasite, while others (Gudden, Bourguignon) regarded them as the breathing-holes, and, again, others (Hebra) considered them as dirt.

The *cuniculus* has two extremities—one which is open where the acarus entered, and the other which is closed and at the same time swollen and elevated, constituting the *acarian eminence* of Bazin, where we will discover

the parasite enconcealed. By inserting a pin or needle at the free or open end, and laying the cuniculus open to its other or closed end, then scraping it back and forth, we will often succeed in bringing away an acarus clinging to the pin or needle, and looking like a minute whitish speck whose circular contour will distinguish it from a piece of epidermis.

Very often the cuniculus is seen in the neighborhood of or passing over or away from a papule, vesicle, or pustule. It is best searched for in the interdigital spaces, on the anterior borders of the axillæ, and along the upper surface of the penis in men and about the nipple in women.

In many instances, if the disease has lasted a long time or if the patient has been over-treated, the cuniculus is effaced and cannot be demonstrated. This sign can also not be trusted to in children, as its color is almost like that of the skin and its site is sometimes occupied by a pustule. The *finding of an acarus* would certainly be pathognomonic.

To extract the parasite from its cuniculus is not always an easy matter. It requires time, patience, and practice, and even then one will very frequently fail, so that the diagnosis is generally made without the acarus having been seen.

The disease is mostly absent from the head and face.

In the variety known as *scabies Norvegica*, or Norwegian scabies, the *Borkenkrätze* of the Germans, the head and face are affected. It occurs in those who have a tendency to the development of eczema and when there is a good deal of crusting, whence also the name *scabies crustosa*.

Etiology.—It is always transmitted by contagion. Examining patients having scabies is not without danger. It is oftenest by sleeping together that the affected individual gives it to the one free from it.

Travelers and others, who are forced to rest in sleeping compartments of railway carriages, in bunks in cabins on steamers, and in strange beds where the bedding or sheeting has not been thoroughly cleaned after a person suffering from scabies has occupied them, are very apt to catch it. Handling tools and toilet articles used by those affected has been the means of propagating the disease. Animals suffer from a similar malady, and their contact, when so ailing, with man may cause eruptions on him.

Anatomy.—To thoroughly understand the disease it is necessary to be familiar with the acarus scabiei and its characteristic features, a description of which is here given:

The acarus scabiei or sarcoptes (σάρξ, flesh, and κοπέω, to cut) hominis is a member of the class *Arachnida*, division *Acarina*, and family *Sarcoptidae*. To the naked eye it appears as a small grayish or reddish-white round speck, which, when placed upon a glass slide slightly warmed by being gently breathed upon, is seen to move.

The female (Fig. 288) is the burrower, and is one-third of a millimeter long by one-quarter of a millimeter wide. She is of more importance than the male. Under the magnifying power of the microscope the parasite is seen to be of an ovoid or spherical form, and to present an anterior and a posterior surface for examination.

The posterior surface is convex. Numerous concentric or parallel lines are discerned running over it, and a number of fine hairs are scattered about here and there. It is also studded with a great number of tubercles or spines, which have been very aptly compared to the teeth of a saw.

The under or anterior surface is more concave, and the hairs and parallel lines, while also present, are less abundant than on the posterior surface, but the spines are totally wanting. On this surface of the parasite are imbedded

the eight legs with which it is supplied. They are jointed, arranged in pairs, and cone-like in form, being broadest near the body of the parasite, from which they spring, and thinnest at the opposite or free end. The four

anterior legs are provided with suckers; the four posterior ones have none, but are guarded by bristles. Between the two pairs of front legs the head is situated. It is tortoise-shaped, capable of elongation and retraction, and consists of two claw-like, three-jointed mandibles bordered or flanked externally on each side by a three-jointed palpus surmounted by bristles.

On the under surface of the head is a slit, which is the mouth. Behind this are the esophagus and alimentary canal. The respiratory organs are absent.

In the fecundated female the granular-appearing ovary is discernible. The *male acarus* is smaller than the female, measuring one-fifth of a millimeter in length and one-sixth of a millimeter in breadth. It has a sucker

instead of a bristle, as in the case of the female, on each posterior fourth hind leg, which is supposed to be for the purpose of enabling the parasite to fix itself in the act of copulation. Between the two hind legs a projection appears, which is the penis.

The larvæ, or young acari (see Fig. 289), are much smaller and have but six legs. It is only after having shed their skin or moults two or three times that they appear as mature parasites with eight legs. The *eggs* are small round bodies $\frac{1.5}{100}$ milli-

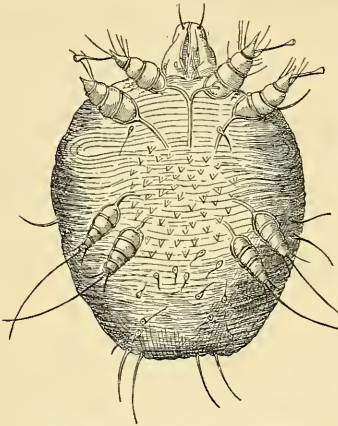


FIG. 288.—Female acarus (after Anderson).

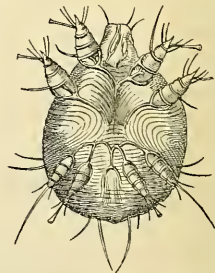


FIG. 290.—Male acarus (after Anderson).

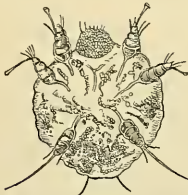


FIG. 289.—Larva (after Anderson).

meters long, containing fine yellowish granular contents, from which the young acari are developed.

The *female* is supposed to live three or four months. She bores and bores and continues to lay eggs during her whole lifetime. The number of eggs which she lays has been estimated at from twenty-four (Hebra) to fifty (Gudden). After she has once entered her canal she is prevented from re-

tracing her steps by the dorsal tubercles or spines which are on her back. Ten to fifteen eggs are usually found in a furrow. Five to fourteen days intervene between the laying and the hatching of an egg. Fourteen days are required for the young acari to develop.

The *male acari* (see Fig. 290) run over the surface and hide under the crusts and scales. The *larvæ*, or young acari, upon being released from their eggs and furrows, wander over the surface of the skin, the male meeting and impregnating the female, who then, as we have seen, begins to burrow her *cuniculus* and lays eggs until she dies. This is repeated as long as the disease lasts.

Diagnosis.—The phenomena here detailed will suffice for a diagnosis.

Eczema does not present the same localization or distribution. If found in the same places, others not attacked by scabies will also be involved.

The vesicles of scabies are more pointed and isolated than in eczema, and when they break down do not leave crusts.

Eczema presents separate exuding patches, and also infiltrations, which are not encountered in scabies. Eczema is non-contagious. Over-treatment may now and then obscure the diagnosis, but time and soothing measures will enable the true nature of the trouble to become manifest.

Prurigo commences early in life, and has periods of remissions, and then relapses. It mostly is seen on the extensor surface of the limbs, instead of on their flexor aspect, and also on the back and above the nipple level. If an itchy, papular eruption be seated on the belly and penis, it may be safely put down, nine times out of ten, as scabies. Further, in prurigo there will be no vesicles and pustules.

Ecthyma situated on the hands, feet, and buttocks in children may be regarded as pathognomonic of scabies.

Prognosis.—Left to itself, scabies does not get well, but lasts an indefinite period. Changes in the patient's health and hygienic surroundings influence the disease. Great hyperpyrexia or an acute disease may cause the scabies to abate in violence, remaining latent in some cases, as it were, only to break out again in all its old fury after the establishment of convalescence. A case of scabies should be cured in from two to four weeks. The parasite may be destroyed in very much less time, but the secondary eruptions take that period to heal.

Treatment.—Before attempting to carry out any of the various methods in vogue for the cure of this affection the condition of the patient's skin must be considered. If the skin be in a highly irritated state or covered with acutely inflamed eruptions, it must be treated by bran baths, soothing ointments, like—

℞. Zinci oxidi,	ʒj ;
Ung. aq. rosæ,	ʒj.—M.,

or subnitrate of bismuth in the same proportion ; or sometimes by a soothing lotion, as the linimentum calcis, etc. As soon as the skin has been got into a proper condition we may proceed to treat the disease by any one of the numerous approved methods.

In the treatment of scabies three indications are to be met, to wit :

First. To remove the cause, which is done by destroying the acarus.

Second. To cure the concomitant or secondary eruptions.

Third. To prevent reinfection by *appropriate prophylactic* measures.

The remedies principally employed to carry out the first two conditions are sulphur, tar, styrax, green soap, and beta-naphthol.

Sulphur is used in various forms and combinations. If the patient be an adult and his skin be not over-sensitive, there is no treatment that can be so confidently recommended as that of Bazin and Hardy, perfected at the Hôpital Saint Louis in Paris. It may be divided into three stages:

First. The patient scrubs and washes himself with green soap (*sapo viridis*) and lukewarm water, barring the head and face, for twenty minutes.

Second. The patient then soaks in a lukewarm bath for twenty minutes.

Third. The treatment is ended by rubbing in all over the body, for twenty minutes, excepting the head and face, paying special attention to the parts covered by the eruption, the following ointment, known as *Hardy's modification of Helmerich's pomade*:

R̄. Potassium carbonatis,	ʒj ;
Sulphuris præcipitati,	ʒij ;
Adipis,	ʒjss.—M.

The potash serves as a solvent for the epidermis and to aid the sulphur in coming into more intimate contact with the acari. The ointment should be well rubbed up, so as to contain no particles of the potassium, as otherwise the skin will be badly scratched by it. The patient allows this ointment to remain in contact with the body for twenty-four hours.

A bath is then given, and the skin where excoriated is dressed with oxide of zinc (ʒj), and ung. benzoini (ʒj), and a little starch may be dusted over this. This rarely fails to cure, and if it does not, it may be repeated once or twice, remembering, however, never to over-treat the disease. If any irritation remains, bran baths taken for a week or two will usually remove it.

The treatment by *Wilkinson's* salve, modified by Hebra, has found much favor:

R̄. Flor. sulphuris,	
Olei fagi,	āā. ʒvj ;
Cretæ albæ,	ʒiv ;
Saponis viridis,	
Adipis,	āā. lbj.—M.

This is rubbed in four consecutive times at intervals of twelve hours, or four times in forty-eight hours. Starch-powder is dusted over it. A bath may be given in a week. When there is a good deal of secondary eruption it is well suited. In this combination the soft soap softens the epidermis, the chalk tears open the furrows, the sulphur destroys the acari, the tar modifies the action of the sulphur and cures the secondary eruptions. Some prefer *Weinberg's* ointment:

R̄. Flor. sulphuris,	
Styracis liquidī,	
Cretæ albæ,	āā. ʒj ;
Saponis viridis,	
Adipis,	āā. ʒij.—M.

The patient is rubbed with the above every morning and evening, and a bath given on the third day. In Belgium, *Vlemingke's* solution is much used:

R̄. Calcis vivæ,	ʒss ;
Sulphuris,	ʒj ;
Aq. font.,	ʒx.

Boil down to ʒvj and filter.

The patient is well soaped in a bath of lukewarm water, and the solution is then thoroughly daubed on the body. It is efficacious, but too severe in its action for indiscriminate use. Two applications will cure, as a rule.

Within late years beta-naphthol has been much employed in a 10 per cent. ointment. Kaposi warmly recommends it. A good formula is—

℞. Beta-naphthol,	ḡss ;
Saponis viridis,	ḡjss ;
Ung. petrolei,	ḡijj.—M.

It is applied by friction every morning and every evening for five or six days, and a bath given every second day.

Styrax, or balsam of Peru, may be used in ointment by being rubbed into the affected parts for three nights in succession, and followed by a lukewarm bath on the fourth day. Anderson formulates as follows :

℞. Styracis liquidi,	ḡj ;
Adipis,	ḡij.—M.

Wolff uses—

℞. Balsami Peruviani,	
Vasellini albi,	āā. ḡj.—M.

The foregoing formulæ are all too strong for children, but any one of the following ointments, rubbed in over the affected parts every morning and evening for three days, and then removed by a bath, will answer :

℞. Flor. sulphuris,	ḡj ;
Adipis,	ḡj.—M.

Or,

℞. Sulphuris,	
Balsami Peruviani,	āā. ḡj ;
Adipis,	ḡj.—M.

The use of styrax, balsam of Peru, and beta-naphthol deserves a word of caution. These substances are not wholly innocent. They sometimes give rise to acute nephritis, and should therefore not be applied when kidney disease or any predisposition thereto be found or suspected. When using naphthol, balsam of Peru, and styrax it is always advisable to examine the urine from time to time, to be sure that the kidneys are not injured by their employment.

In testing the urine for albumin it is well to remember that during the employment of these agents there appears in the urine a resinous substance which possesses the property of being precipitated by heat and nitric acid, just as albumin, but differs from albumin by being soluble in alcohol and ether.

A number of other remedies have been used with more or less success in the treatment of this malady, but possess no advantage over the ones given.

Losophan, oxynaphthoic acid, and thioresorcin are late additions to our therapeutic armamentarium in this disease, but have nothing to especially recommend them.

Oxynaphthoic acid may be used in a 15 per cent. (gr. lxxv ad ḡj) ointment ; thioresorcin in a 10 to 20 per cent. (gr. l-e ad ḡj) ointment. Saalfeld uses losophan as a lotion in the strength of 1 or 2 per cent. (gr. v-x ad ḡj) dissolved in diluted alcohol (3 parts alcohol and 1 water) or in the form of 1 to

10 per cent. (gr. v-l ad ʒj) ointment made with vaseline or vaseline and lanoline. If the skin is much inflamed, it must not be used, as it possesses irritating properties.

There remains for consideration the third indication in the treatment—appropriate prophylaxis to prevent reinfection. Unless this be strictly attended to relapses cannot fail to recur indefinitely. All under-clothing and bed-sheeting must be thrown away and new articles obtained in their stead if the patient's pecuniary circumstances will permit. If not or economy be an object, these things must be thoroughly disinfected by being boiled, washed, and then ironed with very hot irons. Exposing them to sulphur vapor or to a temperature of 120° C (248° F.) in an apparatus constructed for that purpose will likewise meet the requirements. An additional precaution against reinfection may be taken in not using the sheeting and under-garments so treated for fourteen days, as the parasite cannot live that length of time without nourishment.

Another point which, while not an integral part of the treatment, cannot be too strongly emphasized, is never to over-treat the disease, and not to be chary of soothing remedies when inflammatory symptoms are marked.

Finally, we must not content ourselves with treating one member of an affected family at one time if several are affected. They must all be treated at the same time. If this is not done, we will not succeed in curing the disease. The physician must insist upon all those who are suffering from the malady in the same family being treated at the same time, or failure will be the result, and the blame will justly rest upon his shoulders.

PHTHEIRIASIS. (ALFRED E. REGENSBURGER, M. D.)

Symptoms.—This disease presents itself under three different forms, each of which depends upon the presence of a different parasite, and each of which is found upon a different part of the body. They are—

First. Phtheiriasis capitis, caused by the pediculus capitis and affecting the head.

Second. Phtheiriasis pubis, dependent upon the pediculus pubis, invading especially the pubic and also other hairy regions, excepting the head.

Third. Phtheiriasis corporis, recognizing the pediculus corporis as its cause and infesting the non-hairy parts of the skin.

PHTHEIRIASIS CAPITIS.

Synonyms.—Pediculosis capitis ; *Pediculus capitis* ; Head-louse ; Fr. Pou de la tête ; Ger. Kopflaus.

This is essentially an affection of neglected and badly-fed children, although adults do not entirely escape it. The *pediculus capitis* is of a grayish-white color. Some authorities have advanced the statement—the correctness of which is, however, far from being universally accepted—that these lice take the color of the race of those affected ; that is, that they are grayish-white if on a Caucasian, black if on a negro, and yellowish-brown if on a Chinese or Japanese (*nimicry*).

The parasite (see Fig. 291) is one to two millimeters long and about one millimeter broad. Its head is triangular, and there are brownish markings on its body. The female lays a number of lentil-shaped eggs or nits (Fig. 292), which are of a shining whitish color, and are glued by her with a sticky secretion to the hair close to its emergence from the scalp, the distance at

which they are situated from the skin being somewhat of a criterion of the length of time the affection has lasted. They are hatched in six days and are matured in eighteen days.

The pediculus placed on a susceptible soil increases amazingly. According to Lesser, the female if left undisturbed for eight weeks may have a progeny of 5000.

Symptoms.—This louse causes a good deal of itching, which induces scratching and creates more or less irritation and inflammation of the scalp. Excoriations, irregular patches of moist eczema, pustules, and crusts are soon present.

These lesions are most marked on the back of the head, which is the region oftenest attacked. Swelling of the cervical and occipital glands rarely fails to appear in chronic cases.

In healthy adults irritation and a slight eruption may be the only symptoms. Boils and adenitis ending in suppuration are fre-



FIG. 291.—Male pediculus capitis (after Kuchenmeister).

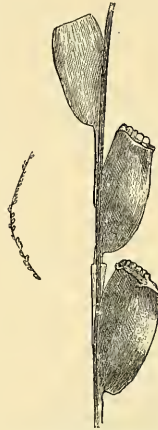


FIG. 292.—Nits of pediculus capitis (after Käpösi).

quently superadded in the scrofulous. When it occurs in children who are weakly and inclined to eczema an eczematous condition of the head is rapidly produced.

In case this takes place in those who are negligent of the rules of personal cleanliness and hygiene, the secretions from the eczema mat and glue the hair together, resulting in a foul, vile-smelling, filthy mass alive with lice, the so-called *plica polonica*. This condition is rarely seen in the United States.

Diagnosis.—The diagnosis offers very little difficulty. The detection of the parasite or its shining nits in the hair of the head settles the question. An epithelial scale will not give rise to error when it is borne in mind that it is centrally transfixured by the hair, and is easily removable, while a nit is situated unilaterally, and is more adherent to the hair. It is a good rule to follow in every case of severe itching of the back of the head, complicated with eczema in children, to look for the pediculus and its nits or eggs.

Treatment.—Binding the head up with cloths saturated with ordinary kerosene oil for twenty-four hours, then washing with soap and water, and finally keeping cod-liver oil applied as long as the eruption lasts, is a most effective way of treatment. This method was used in Vienna by the elder Hebra, and has not been improved upon. It is well to caution the patient,

and if a child those entrusted with its care, against the inflammable nature of the kerosene, so that accidents may be avoided.

The unguentum hydrargyri ammoniati, or white precipitate ointment, is often prescribed in English-speaking countries. Tr. staphisagriae is also much used. Bichloride of mercury (1 : 250) (gr. ij ad ʒj) may be employed in solution if there be not too much excoriation. For fastidious folk I am in the habit of ordering ablutions of the head morning and evening for two days, supplemented on the third day by a good shampoo of soap and water, and the following, which is an elegant and efficacious lotion :

R. Hydrargyri bichloridi, gr. ijss ;
Acidum acetici aromatici, ʒj.—M.

The removal of the unsightly dead and empty nits from the hair is facilitated by the use of diluted acetic acid or vinegar. Cutting the hair short is rarely required. Should any accompanying eczema not subside after destruction of the parasites, it will be easily cured by the usual remedies.

PHTHEIRIASIS PUBIS.

Synonyms.—Pediculosis pubis ; Pediculus pubis ; Phtheiri-
asis inguin-
alis ; Crab-louse ; Crabs ; Fr. Pou du pubis, Morpion ; Ger. Filzlaus.

The pediculus pubis (Fig. 293) is the least commonly met with of the three varieties of lice. It is mostly found on the hairy parts over the pubis, which is probably owing to its being transferred to this locality in the act of impure sexual intercourse and from using unclean water-closets.

All the hairy parts of the body except the head may be attacked by this parasite. It is broader than its analogue on the head. It measures about 2 millimeters in length and from 1 to 1½ millimeters in breadth. In appearance it resembles a crab, whence it is popularly called crab-louse or crab.

This pediculus attaches itself so firmly by its six front feet or legs to the hairs close to the skin that it requires some force to remove it with a forceps from this location. It is on the beard, eyelashes—giving rise here to a rebellious blepharitis—and eyebrows that it is

encountered next in frequency to the pubis. Its nits are similar to those of the pediculus capitis, and are fastened to the hairs in a like manner.

Symptoms.—Itching is complained of, which leads to an examination of the patient and to the discovery of the parasite and its nits. Prurigo and eczema are concomitants at times. Another sign, which when present must be regarded as pathognomonic, is the *macula cœrulea*, *peliosa typhosum*, *exanthema cœruleum*, *tache bleue* or *tache ombrée*.

These maculae may be described as grayish or bluish spots of about the size of a dime, neither raised nor depressed, but on a level with the surrounding skin. They have a predilection for the upper and inner part of the arms and inner sides of the thighs, sides of the thorax, chest, and back, seemingly situated in the line of travel of the parasite from one part to another.

They are most common in persons of a delicate skin, who do not scratch

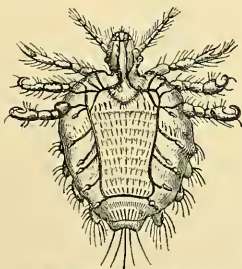


Fig. 293.—Pediculus pubis (after Schmarda).

much. Falot and Moursou first called attention to their diagnostic importance in 1868. But, thanks to Duguet and Mallet, indisputable clinical proof was furnished in 1882-83. They produced the maculæ cœruleæ by inoculations made with a lancet smeared with a paste of the crushed lice and water.

Diagnosis.—A careful examination of the pubic region will mostly always bring to light the offending parasite or its nits.

Treatment.—Blue ointment, the unguentum hydrargyri, is a favorite remedy with many. It should never be used. It is dirty, causes in many instances a severe inflammation of the skin, and its absorption has produced mercurial poisoning. Washing the affected parts with the bichloride-of-mercury lotion, referred to under the Treatment of Phtheiriasis Capitis, or with tr. staphisagriæ, or with a lotion of carbolie acid, 4 : 100 (gr. xx ad ʒj), is preferable; and these are all excellent remedies.

Numerous other parasiticides are employed with equally good success. Soothing lotions or ointments will without difficulty control any remaining dermatitis or eczema requiring treatment.

PHTHEIRIASIS CORPORIS.

Synonyms.—Pediculu corporis; Pediculus corporis seu vestimenti; Body-louse; Fr. Pou du corps; Ger. Kleiderlaus.

The pediculus corporis (Fig. 294) is of a dirty grayish-white color, and the longest of the three kinds, attaining a length of 3 millimeters. This parasite lives in the clothes, and only visits its victims for the purpose of obtaining nourishment. Search is to be made for it in the clothing, where the under-garments enclosing the body are thrown into folds, as about the neck, wrists, and waist.

The neck, clavicles, shoulders, back in the interseapular space and parts surrounded by folds of the clothing, as the wrists, waist, etc., are its favorite hunting grounds. The whole body may be overrun by it. Eczema, impetigo, furuncles, and abscesses are always present if the affection has existed any length of time.

Numerous deep excoriations caused by the nails of the subject in the act of scratching follow in the wake of the parasite, and are replaced in the process of healing by a darkened pigmented area. Frequently a darkened or blackish discoloration of the skin (*melanoderma*, *melasme phtheiriasique*) becomes manifest.

The parasite does not bite, but introduces its proboscis into a follicle, draws its sustenance through it, and after it has satisfied itself withdraws it. The space bored or made by it is filled up by capillary hemorrhage, which, appears as a small red speck surrounded by the circular wall of the dilated follicle. This appearance is pathognomonic. Numerous scratch-marks are often visible in its vicinity, and cicatrices resulting from them if the disease has lasted some time. Vagabonds, tramps, and people of that ilk are the ones who suffer mostly from this louse.

Diagnosis.—Sometimes it will be impossible to find the louse or its nits either on the skin or in the clothes, especially if the patient has put on fresh under-clothing just prior to the examination. Then the presence of excoriations, pigmentations, and hemorrhagic spots on the seats of predilection will reveal the true nature of the trouble.



FIG. 294.—Body-louse (Küchenmeister).

The physician should never allow the social position of the patient to stand between him and the diagnosis.

Treatment.—The treatment may be summed up in one sentence : change the under-clothing and subject the patient to a good bath with plenty of soap. If the clothing cannot be thrown away, exposing it to the fumes of sulphur or to a temperature of 100° C. (212° F.) to 110° C. (230° F.) will destroy the vermin. Carbolic acid as a lotion, 1:100 (gr. v ad. ʒj), and powdered stavesacre are good remedies.

DEMODEX FOLLICULORUM. (ALFRED E. REGENSBURGER, M. D.)

Synonyms.—*Acarus folliculorum*; *Steatozoon folliculorum*; Human pimple-mite; Fr. *Acare des follicules*; Gr. *Haarbalgmilbe*.

Berger, Simon, and Henle discovered almost simultaneously the demodex folliculorum (Fig. 295) in 1842-43. It is an inhabitant of the sebaceous glands and hair-follicles, having a special preference for those of the nose, forehead, and cheeks. It can be easily obtained by pressing on a hair-follicle or sebaceous gland in the regions named and squeezing it out, or by exerting pressure in passing a spatula over them. It measures 0.3 to 0.4 millimeter in length and 0.03 millimeter in breadth. Put in glycerine under a low power of the microscope, it is seen to consist of a head and a tail-like body. On each side of the head are four legs, eight in all. Variations in size and in the number of legs occur, which is probably due to the age of the examined mite. There are very few healthy persons in whom it cannot be found. They are most common in individuals suffering from acne and seborrhœa oleosa. In the human subject they are of no clinical or etiological importance.

No bad symptoms are ascribed to them, consequently treatment is uncalled for. In the lower animals, dogs, cats, pigs, etc., they are far more important, producing various pathological phenomena, such as loss of hair, furuncles, abscesses, loss of strength, and sometimes ending in death.



FIG. 295.—*Acarus folliculorum* (after Küchenmeister.)

FILARIA MEDINENSIS. (ALFRED E. REGENSBURGER, M. D.)

Synonyms.—*Dracunculus*; Guinea-worm disease; Fr. *Ver de guinée*, *Dragonneau*, *Filaire de Médine*; Ger. *Peitschenwurm*.

The dracunculus is a very long nematode worm, 50 centimeters to 2 meters in length by 0.02 millimeters in breadth. Its habitat is the subcutaneous areolar tissue, where it takes up its abode while yet of microscopic size. On the authority of Küchenmeister the dracunculi may be regarded as "the fiery serpents" which "bit the people, and many people of Israel died," so that Moses was probably the first to mention the worm. It is a disease of the tropics. It is endemic in many places of Asia and Africa. It is most frequently seen in Upper Egypt, Nubia, Arabia, Persia, East India, Senegal, the Gold Coast, Gaboon, Granada, and in some of the West India islands.

It has a predilection for stagnant pools, damp and wet soil. During wet seasons and after inundations it is most found.

Symptoms.—The feet and legs are oftenest affected, and the thighs and

arms are not strangers to it. It has also been found in other parts of the body. One or more worms may be present in a given case. It may give rise to no symptoms for months. After an indefinite period, varying from eight to twelve months, during which time it has reached maturity, it makes its presence felt. There may be general symptoms—headache, fever, nausea, debility, and colic.

Some local pain and the feeling of a cord under the skin near the painful spot announces its location. A boil usually forms and breaks, disclosing the head of the worm. How it enters the system is yet *sub judice*, some holding that it finds its way through the intestinal tube, others that it enters directly through the skin.

Diagnosis.—The finding of the worm is the only indisputable symptom.

Treatment consists in the mechanical removal of the worm. This is accomplished in those countries where the affection prevails by tying a piece of twine around the head of the worm, if it can be got at; and if not, by exposing it first by an incision. The twine is then fastened to a piece of wood, and given several turns daily till the worm is removed.

Electrolysis has been recommended by Christie in Anderson's text-book on diseases of the skin.

ANIMAL PARASITES OF MINOR DERMATOLOGICAL IMPORTANCE.

(ALFRED E. REGENSBURGER, M. D.)

Cimex Lectularius.—Synonyms.—Bed-bug; Fr. Punaise des lits; Ger. Bett-wanze.

The *cimex lectularius*, or bed-bug, bites the skin, producing an urticarial elevation, in the center of which appears a red spot made by the bite, which does not fade on pressure. It may simulate idiopathic urticaria, but is differentiated from the latter by the fact of the wheals disappearing in the daytime, to reappear again at night; moreover, the hemorrhagic spots made by the bite of the parasite will be seen in the centers of some of the urticarial patches; besides, the finding of the bed-bug in its wonted haunts in the crevices of the bedstead, the wall, or in the wainscoting will dispel any further doubt.

Powdering repeatedly the beds, crevices of the bedsteads, the bedding, and hiding-places of the parasite with powdered stavesacre or with "Buhach" Persian powder will rid one of these unwelcome guests. Washing with diluted toilet vinegar or eau de cologne relieves the itching.

Pulex Irritans.—Synonyms.—Common flea; Fr. Puce commune; Ger. Gemeiner Floh.

Urticarial patches and hemorrhagic specks follow the bites of the *pulex irritans* or common flea. The hemorrhagic specks may be so numerous as to be mistaken for purpura (*purpura pulicosa*).

The appearance of new urticarial spots, which surround recent bites in the shape of inflammatory areolæ, will prevent errors and clear up the diagnosis. Dusting with pulv. pyrethri or perfuming the body with the scent of one of the essential oils will keep, for the time being, these pests away.

Pulex Penetrans.—Synonyms.—Chigo or chiggre; Jigger; Sand-flea; Fr. Puce de sable, Chique; Ger. Sandfloh.

The *pulex penetrans* is met with in Brazil, Mexico, Central America, and other tropical countries. The impregnated female enters the skin of the feet, legs, or toes, and sometimes it gets in under the nails. After a short sojourn

it causes abscesses, boils, vesicles, pustules, and adenitis. It must be removed with a needle or appropriate instrument.

The natives extract the parasite with a hot needle, and treat the wound by dusting with powdered tobacco. As a prophylactic measure it is recommended to anoint the feet with benzine or with one of the essential oils. What is more important, is not to go barefooted in countries where the jigger exists.

Ixodes Ricinus.—Synonyms.—Wood-tick ; Fr. Pou de bois, Tique ; Ger. Holzbock, Zecke.

The female insect inserts her head into the skin and imbibes the blood until she swells up to the size of a small cherry-stone. After having satiated herself she drops off. No attempt should be made to remove the insect forcibly, as by so doing its body may be torn from its head, the latter remaining in the skin and causing a tender elevated spot or papule. It is preferable to touch the parasite with benzine or turpentine, which induces it to loosen its hold and to drop off.

Dermanyssus Avium.—Synonyms.—Bird-mite ; Fr. Dermanysse des oiseaux ; Ger. Vogelmilbe.

The dermanyssus avium infects birds. It is found in henneries and bird-cages. It may attack the hands and forearms of those handling birds and poultry, producing an itchy papular eruption. Lotions of carbolic acid, 1 : 100 (gr. v ad $\bar{5}j$), or bichloride of mercury, 1 : 1000 (gr. ss ad. $\bar{5}ss$), relieve the itching.



FIG. 296.—*Leptus autumnalis* (after Küchenmeister).

Leptus Autumnalis.—Synonyms.—Harvest-bug ; Autumn-bug ; Fr. Rouget ; Ger. Erntemilbe.

According to Schmarada and Mégnin, the leptus autumnalis is the larva of the trombidium autumnale. Its home is the grass, bushes, and trees. It molests those whom vocation or pleasure calls into the garden, fields, or woods. Carbolic-acid lotion, 1 : 100 (gr. v. ad $\bar{5}j$), or an antipruritic ointment or lotion, may be used for its bites. Mégnin advises inunctions of benzine.

Culex Pipiens.—Synonyms.—Gnat ; Fr. Cou-sin ; Ger. Schnake.

Uncovered parts of the body are bitten by this parasite, producing irritation, itching, and wheals. Strong ammonia locally relieves the unpleasant sensations of the bites.

Cysticercus Cutis Cellulosæ.—Synonyms.—Bladder-worm ; Fr. Cysticercue du tissu cellulaire ; Ger. Hautfinne.

The larva of the tænia solium, called the cysticercus cellulosæ, has in some instances invaded the subcutaneous cellular tissue.

Small round, non-painful, fluctuating tumors, covered by normal colored skin, are noticed. Their nature cannot be foretold until they are punctured, when their contents are found to contain liquid in which there are cysticerci and their hooklets.

Echinococcus Hydatid.—Cases have been published where this parasite has been found in the skin.

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Genito-urinary diseases

