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OUR PREPARATION FOR THE X-RAY WORK OF THE WAR*

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THE medical profession of the United States has reason to feel proud of its response to the call to national service. At the present time more than one-tenth of the total number of physicians in this country have received commissions in the Medical Officers Reserve Corps. It is safe to say that this is equaled by no other profession or class. The doctor has been called upon to make immense sacrifices since, in most cases, his income depends entirely upon his own personal efforts and stops when he enters the service. He has been actuated by a high sense of patriotic duty, and has responded to the country's call until there is now little fear that the number will not be sufficient for all needs.

This is true not only of the general profession, but also of the several specialties, and is particularly applicable to the one we represent. The American Roentgen Ray Society was one of the first of the national societies to realize the necessity for making preparation for the part its members were to take in the inevitable struggle. Months before war was declared, the president of the society, Major Cole of New York, ably seconded by Major Manges of Philadelphia, who has since succeeded Major Cole as president, and assisted by a Committee of Preparedness, carried on a propaganda to interest the roentgenologists of the country in military roentgenology. It was soon discovered by this committee that the number of qualified roentgenologists in the United States was comparatively small and that some plan would need to be devised to train men for this work. It had been emphasized by surgeons and roentgenologists who had returned from active service in Europe that the best work in the localization of foreign bodies could be hoped for only if the roentgenologist were a trained physician. A non-medical technician or mechanician, however skilled, could not possibly coöperate with the surgeon as could the roentgenologist with broad medical training.

By the advice, then, of the Committee of Preparedness, the Surgeon General's Office decided that the *x*-ray work in all military hospitals, both in this country

*Read before the Philadelphia Roentgen Society, December 12, 1917.

and abroad, would be directly in charge of medical roentgenologists. The problem then was to get a large number of men in training immediately for this work. This same committee, acting with representatives from the Surgeon General's Office, then organized schools for instruction in military roentgenology in nine different cities in various parts of the country. In each of these cities instructors were selected who had adequate hospital facilities available. These instructors met in New York and, after an extended conference, laid out a course of instruction to be followed at all of the schools. The instructors were all commissioned in the Medical Reserve Corps and assigned to duty for this special work. Selected students, who were also commissioned in the Reserve Corps, were then ordered to report to these instructors for courses of varying length, dependent upon the ability and previous experience of the student. Even men with much previous experience in *x*-ray work have found these courses of great value.

The roentgenologist who goes to foreign service soon finds that his work differs greatly from that of civil practice, and that his special training in military roentgenology is invaluable.

Up to the present about two hundred men have finished the course of training at these schools and are well qualified for their special work. Some of them are already in France and others are doing the great amount of *x*-ray work called for at the various base and general hospitals in this country.

It now seems expedient to concentrate the work of instruction at the school in New York City, where we have assembled and equipped for operation all of the various types of apparatus adopted for use in the service. The plan now also includes a preliminary course at one of the Medical Officers Training Camps located at Fort Oglethorpe, Georgia, and Fort Riley, Kansas. At these camps the doctor, fresh from civil practice, finds himself immediately in a military atmosphere, a part of a military organization, and under the guidance of a trained corps of instructors who have become specialists in different branches of medical military work. Roentgenologists will now enter the service through these training camps and, after one month's instruction in the general training provided at the camp, will undergo another month's training in roentgenology under an experienced instructor who will be sent to the camp for that purpose. At the end of this time those who are considered eligible will be sent for final training to the school in New York.

When the schools for instruction were first established we were greatly handicapped by lack of any precedent for our guidance and by the fact that none of our otherwise experienced roentgenologists had had special experience in roentgenology as applied to military conditions. It was believed, however, that much good would be accomplished by attempting to standardize the methods of *x*-ray men who had had considerable experience in general *x*-ray work and this belief has been justified by the results. Many roentgenologists have now finished the course of instruction and are all much better qualified to carry out their work in military hospitals than they were before, although they had had previously many years' experience in *x*-ray work.

We have now reached the time when we must draw largely from among men with relatively little experience, but our curriculum and methods of teaching are well established and we feel confident that a sufficient number of men can be prepared to do efficiently the *x*-ray work of the war. The lack of experience in strictly military roentgenology is not now so apparent because Major James T. Case has recently returned from France, where he was in charge of *x*-ray work with the American Expeditionary Forces. He will be in conference for some time with the instructors in this country in order to make all methods directly applicable to conditions as they exist at the front.

The work of instruction will now be greatly facilitated also by the publication of a "Manual of *X*-Ray Work," originally conceived by the Committee of Preparedness of the American Roentgen Ray Society, and contributed to by a number of the prominent *x*-ray men of the country.

In addition to training medical men who are to be the directors of the *x*-ray laboratories, it has been found necessary to train men in the purely technical part of the work, that is the development of plates, the care of the *x*-ray apparatus, and the many routine duties about an *x*-ray laboratory. Men for this duty have been drawn from the enlisted personnel of the Medical Department and given a course of training at the Army Medical School in Washington. We have also found it necessary to secure the services of men who have had factory experience in order to provide for the installation and repair of our great mass of highly specialized apparatus. Men for this purpose have been commissioned in the Sanitary Corps.

Great strides have been made in the perfection and standardization of apparatus. It was realized at the beginning of the war that little change would be necessary in the apparatus used in civilian hospitals in order to adapt it to the large base and general hospitals of the army. The principal necessity was to standardize this apparatus in order to facilitate its manufacture in sufficient quantity, and to insure the elimination of unnecessary parts. A committee appointed by the Council of National Defense early last spring recommended a list of apparatus and supplies for use at base and general hospitals which has been closely adhered to up to the present time. Experience at the cantonment hospitals in this country and in the base hospitals already in France has suggested certain modifications and additions to the list and to the specifications. This revision will be completed within a few days, and, being the product of experience both at home and abroad, will, we hope, serve as an adequate standard throughout the war.

A very important addition to the apparatus of stationary hospitals is the "bedside unit." The necessity for being able to make *x*-ray examinations of a large number of patients without moving them from bed has been emphasized by many observers in France. This applies particularly to fractures of the hip and thigh and is practically always a fluoroscopic examination. Major Case now reports that fluoroscopic examinations of the chest are also made quite routinely in military hospitals in France without moving the patient away from his bed. The bedside unit adopted for our army has been developed by Major J. S. Shearer, S. C., Professor of Physics at Cornell University, who has been at the head of the teaching force at the School for Instruction in Military Roentgenology in New York City. This unit is so constructed as to be readily wheeled to the bedside, and to operate on any type of current either direct or alternating. Major Shearer has made use, for the bedside unit, of a special radiator type of Coolidge tube developed by Dr. Coolidge for use with the army portable apparatus. The radiator on this tube provides for the rapid cooling of the target so that the tube can rectify its own current. The addition of this bedside unit so completes the *x*-ray equipment of stationary hospitals as to leave little to be desired. The equipment of stationary hospitals, however, is only the beginning of the problem of furnishing adequate *x*-ray facilities for the examination of the wounded.

It is now thoroughly recognized that the wounded man's chances for recovery bear a very close relation to the time which elapses before he can receive adequate surgical care and be placed at rest in comfortable surroundings. The recognition of this fact has brought about the erection of evacuation hospitals much nearer to the firing line than was formerly thought feasible. These hospitals are so constucted and equipped that it is possible in them to give all necessary surgical treatment to practically all wounds, including the removal of foreign bodies. These semi-permanent evacuation hospitals are now placed, in certain instances, as near to the front as the very mobile field hospitals were in previous wars. It was never deemed advisable to place *x*-ray apparatus of any description in hospitals which were not equipped for the rendering of surgical aid, and which were too mobile to permit those operated upon to rest comfortably for sufficient time after operation. It is now possible to make efficient use of the *x*-ray at a much earlier stage in the treatment of the wounded than was formerly the case because of the erection of these advanced evacuation hospitals, corresponding to the British "casualty clearing stations." The *x*-ray apparatus for such a hospital must be more portable than a base hospital equipment, and must necessarily have its own source of power. No electric current will be available from local sources at such advanced posts.

Portable *x*-ray apparatus with its own power plant has been used by armies ever since the beginning of the Boer War. The earliest apparatus consisted of small induction coils with mechanical interrupters operated from storage batteries. Since that time many different types of mobile apparatus have been devised, some of them depending for power upon the motor of the automobile in which they were carried. None, however, have been free from serious defects.

In 1913 and 1914 a portable outfit was developed in the Medical Department of our own army by Major Wm. A. Duncan. This consisted of a gas engine of the marine type, operating a generator, on the shaft of which was a revolving disc for rectification of the current. This disc revolved in contact with brushes which were mounted directly on the box containing the transformer. This apparatus has been used on the Mexican border and at some posts in the army where local current supply was not available, but has never come into very general use because of its great weight, its relatively small output of current, and its liability to get out of repair. The necessity for a more readily portable and more reliable apparatus was apparent. The needs in this direction became known to Dr. Coolidge and he set himself the task of developing such an apparatus. Fortunately, he was able to secure a widely used gas engine which, with a few modifications, was readily adapted to the purpose. He succeeded in eliminating all moving parts from the apparatus by a radical modification of the Coolidge tube whereby it was rendered capable of rectifying its own current. A description in detail of this portable *x*-ray outfit will be published at an early date by Dr. Coolidge. It admirably fills the army needs for this type of apparatus since it is light, readily transportable in an ambulance or a small truck, gives sufficient output of current, and, above all, is exceedingly reliable. It is adapted for use in the evacuation hospitals mentioned before, or can be carried in a truck or trailer as the *x*-ray equipment of one of the automobile surgical units which are rapidly coming into use. The evacuation hospitals will each be equipped with as many of these portable outfits as seems necessary for the average amount of work. At times of unusual activity in a sector more of the portable outfits may be sent as separate units or forming a part of one or more automobile surgical units, which are brought up to increase the capacity of a particular evacuation hospital. The portable machine has even been found of real use in base hospitals as an accessory to the main apparatus, or as a substitute when the latter is out of order or when the current supply has failed.

We might continue this recital to tiresome length by describing the work that has been done in developing much accessory apparatus to render *x*-ray work on the wounded more rapid or more accurate. A large amount of work has been done on the *x*-ray table alone, upon the construction of which so largely depends the comfort of both the roentgenologist and the surgeon, as well as their safety from exposure to the ray. A table has now been devised which is very satisfactory from the standpoint of everyone, including the surgeon. Operating for the removal of foreign bodies under direct control of the x-ray has come to be a very common procedure at the front. For this reason it is necessary to have a table suitable both for operating and for x-ray examination. The top of such a table must, of course, be readily penetrable by the ray and, at the same time, should be strong and capable of resisting the action of liquids. The top finally decided upon was suggested by Capt. E. W. Caldwell of New York. It is called "bakelite," a substance made on a large scale in connection with the construction of aeroplanes, and is obtainable for our purpose in practically any quantity. It fulfills every requirement for the top of a combined x-ray and operating table.

I wish to mention only one other type of apparatus which is now almost complete and ready to be put into practical use. This is a stereoscopic fluoroscope designed by Captain Caldwell. A very large proportion of the x-ray work at the front is fluoroscopic. Only those who know by experience the difference between the image on the flat plate and that of the stereoscopic pair, can appreciate the really wonderful advance that is made when images on the fluorescent screen stand out with perfect stereoscopic effect. We confidently expect this to be one of America's great contributions for the assistance of the surgeon in his efforts to alleviate the condition of the wounded in war.

I wish to state in conclusion that this is the aim of all who are connected with this work—to be of the greatest possible assistance to the physician and the surgeon. We are training our men and constructing our apparatus with this single object,—to add to the comfort, the rapidity, and the accuracy of your work. We ask only that the surgeon will permit us to coöperate with him to the end that he may do better work, and especially that he will coöperate with us to bring about a standardization of the methods to be used when we are working together.

THE CAUSE AND PREVENTION OF THE CONSTITUTIONAL EFFECTS ASSOCIATED WITH THE MASSIVE DOSES OF DEEP ROENTGENOTHERAPY*

BY GEORGE E. PFAHLER, M.D.

PHILADELPHIA, PA.

ACTING upon the request of your president to prepare a paper upon some therapeutic subject, I concluded that nothing under the heading of deep roentgenotherapy is as important as the study of the constitutional effects following massive doses of the roentgen rays. These effects are an annoying feature that has developed since the advent of the Coolidge tube, not because of the Coolidge tube, but because of the fact that by no other means can such massive doses be obtained in a reasonable period of time, and by no other means can a large quantity of high tension current be maintained for an indefinite time.

I took up this subject before the 16th annual meeting of this society at Atlantic City, September 22–25, 1915.[1] At this meeting I acted upon the theory that the effects were chiefly due to the inhalation of the gases produced as a result of the action of the high tension currents upon the air, and the dust contained in

[1] PFAHLER: "The Cause and Prevention of the Constitutional Effects Associated with the Massive Doses of Deep Roentgenotherapy."—*Am. Jour. of Roentgenol.*, Vol. III (new series), No. 6, pp. 310–313. June, 1916.

* Read before the Eighteenth Annual Meeting of the American Roentgen Ray Society, New York City, September 20–22, 1917.

the air. At the same meeting, Dr. Lange,[2] in dealing with the same subject, took the view that the effects were due to an acidosis, but presented no experimental or clinical proof of an acidosis other than that he believed he obtained relief of symptoms from the administration of large doses of bicarbonate of soda.

CONSTITUTIONAL EFFECTS OR SYMPTOMS

Not all patients are affected. The patient may show no effects whatever from a course of treatment, and then show pronounced effects from another course of treatment, and again subsequently show no effects from a similar amount of treatment given in a similar manner.

Briefly, the symptoms consist, in their mildest form, of a general discomfort, a languor, lose of appetite, or the patient may have a violent attack of vomiting with nausea, and in these severe cases the attack may last from a day to two weeks. The symptoms may come on in a few hours, or the next day. In some instances nausea and vomiting appear before the patient leaves the table, and, rarely, the treatment must be interrupted to allow the patient to vomit. In other instances, the patient feels perfectly well while lying on the table, but after he gets up and attempts to dress, he becomes ill. At times this vomiting is propulsive and, apparently without warning, the vomitus is thrown out in bulk upon the floor. In the severe cases the patient is bedfast for a week or two. During this time there is gradual improvement, but the associated prostration is marked. Frequently patients do not become nauseated as a result of the first or second course of treatment, but at the third or fourth develop the symptoms, and after the patient has once developed the constitutional effects, they certainly seem more susceptible to them subsequently.

Diarrhea has occurred rarely in connection with abdominal treatments, and when this symptom has developed it has usually lasted from several days to two weeks. This symptom of diarrhea seems to occur in patients who are subject to attacks of diarrhea from trivial causes. Therefore, I have not been entirely convinced that the diarrhea has been due to the treatment, though this would seem entirely possible.

Women are much more frequently affected than men. Abdominal cases seem more likely to be affected than others, but the breast cases are almost equally affected, and the symptoms may arise no matter what part of the body is treated.

THEORY AS TO CAUSE

As originally expressed in 1915, I still believe that the inhalation of the gases generated are the most important factor, though probably not the whole cause. I am led to this belief *first* because at the very beginning of these observations the patients complained of the odors of these gases, even before the constitutional symptoms were produced, and at a time when no effort was made to eliminate the odor of the gases, some patients saying that it took a week or two to get the odor out of their hair; *second*, patients have complained of nausea on entering the rooms; *third*, the patients most likely to be affected are those who have previously been affected by odorous gases, and those who are nervous, high strung or highly sensitive. One patient complained of the fact that since having developed nausea as a result of this gas that now the odor of the gasoline in the automobile produces nausea. One must not lose sight of the possibility of a psychical factor such as is illustrated by the complaint of a patient who reported to one of my colleagues that she became nauseated when she passed his office.

On the theory that the odor itself might be an important factor, I tried to overcome this odor by the free use of various perfumes, but without success. I believe, therefore, that the odor as such is not the cause.

[2] LANGE: "The Cause and Prevention of the Constitutional Symptoms Following Deep Roentgenotherapy."—*Am. Jour. of Roentgenol.*, Vol. III (new series), No. 7, pp. 356-358, July, 1916.

Acting upon the theory that if an acidosis is produced, it might be produced by the acidity of the gases, I therefore tried to neutralize this gas by the free use of ammonia gas flavored with smelling salts. This seemed to do some good, but the results obtained were not sufficient to prove it as a cause, and I believe that the improvement obtained was due chiefly to the stimulating effects of the smelling salts.

Immediately after the recommendation of Dr. Lange as to the administration of bicarbonate of soda, on the theory of acidosis, I gave the patients bicarbonate of soda according to Dr. Lange's recommendation, but I could see no appreciable difference in the frequency or severity of the symptoms, and after the patients begged me not to give it to them (some of them insisting that it was the bicarbonate of soda that made them ill), I discontinued. Acidosis as a cause has not been disproved by me, nor has it been proven by anyone else of whom I know. I am hoping that some competent laboratory worker will give us definite data on this point. Unfortunately our research staffs have been so badly depleted by the requirements of medical men in the present war that this point of investigation may have to be deferred. Fortunately, Van Slyke and Cullen [3] have devised a simple technique by means of which the capacity of the plasma to combine with carbonic acid (formed by carbon dioxid), under definite tension is determined as a measure of the alkali in excess of acids other than carbonic; and this more simple method of determining acidosis may enable us to prove this point at an early date. My lack of success with the alkaline treatment may be due to faulty administration, for our judgment as to the quantity needed is at present based upon very crude methods of observation.

After considering all phases of the subject, and making continual observation during the past two years, I am more and more convinced that the chief factor in the causation of these symptoms is the gases produced by the high tension currents or the combination of these gases with dust particles. This seems to me to be proven by the fact that the more completely corona is eliminated and the more thoroughly the air is changed, the less these symptoms develop, and by the fact that while originally about one in four patients developed these symptoms, now about one in ten, though we have not completely eliminated the gas nor have we completely eliminated the sickness.

Against this view is the observation made by Dr. Zulick and myself in one case—that of a woman treated for uterine fibroids—who became nauseated after each course of treatment. After the fourth course of treatment she was free from all symptoms, and free from any evidence of tumor, and seemed to be perfectly well. We, therefore, introduced a lead cover over the diaphragm of the tube, which the patient could not recognize, and which eliminated absolutely all rays from the patient, and then gave her exactly the same amount of treatment as had been given previously, and under as nearly similar conditions as possible. After this course of treatment she did not get sick. In this observation, however, one must recognize the fact that at this stage the patient was robust and free from all symptoms, and we dare not conclude that she would have become sick had we given her the roentgen ray treatment.

With the idea of obtaining some definite information from animal experiments, I made use of guinea pigs, using four full-grown guinea pigs that were believed to be thoroughly healthy. One was kept for control, and simply fed and in all other respects treated the same as the pigs under treatment.

Pig No. 1 was placed in a box in which the pig could only breathe air and gas which was forced into the box by a rotary pump which removed the gas from the box containing the high tension rotary switch.

[3] Van Slyke, D.D., and Cullen, G.E.: "Studies of Acidosis, I. The Bicarbonate Concentration of the Blood Plasma, Its Significance, and Its Determination as a Measure of Acidosis."—*Jour. Biol. Chem.*, 1917, 30, 289.

After inhaling this gas continuously for two hours, it was inactive, but immediately began to eat when placed in the food box. This pig, which weighed two pounds at the beginning, lost 2½ ounces in the first twenty-four hours, and subsequent treatments with this gas seemed to have no further effect. The pig inhaled this gas for 2½ hours continuously during the period of four days, after which the experiment was abandoned, for this gas on this pig seemed to have no effect.

Pig No. 2, weighing 19 ounces, was exposed on August 6, 1917 to the roentgen rays for two hours—5 milliamperes, 9″ parallel spark, at a distance of 8″, and 6 millimeters of aluminum and glass as a filter. After this exposure this pig seemed more lively than Pig No. 1, which was receiving the gas at the same time, but did not eat for a half hour, though the next morning it seemed normal. The pig lost 1½ ounces in the first 24 hours. On August 7th, or a day later, the pig was treated for 2½ hours under like conditions, at the end of which time the pig had a convulsion. It appeared to be totally exhausted, and died during the night. Autopsy showed no gross changes. No microscopical studies were made because it could be assumed from the excessive doses given that changes in the tissues would have taken place, for this was an extreme test, and the radiation was approximately 1,000 to 1,500 times as much as would be given to a patient when one considers the relative size of the patient and the guinea pig.

Pig No. 3 was placed in a box receiving gases pumped from about the tube. The object of this test was to determine whether there was any difference between the gases coming from about the tube and those taken from the case of the transformer, as was done with Pig No. 1. Neither Pig No. 1 nor No. 3 received any roentgen ray radiation. After the first two hours of inhalation of this gas, the pig seemed to be weak and inactive. In fact, the pig seemed to be unable to stand up and was panting irregularly, and seemed to be sick. The temperature of the air in the box was 103° Fahrenheit. On the next morning the pig seemed to have recovered. After inhaling this gas again for two hours, symptoms developed similar to those of the day previous and when the pig was placed in the box for feeding with the other pigs, it crawled into a corner and refused to eat. The pig then received no treatment for three days. On the sixth day the pig was again placed in the box for four hours. At the end of this time it was found to be dead. Autopsy showed no gross pathology.

From these tests we learn what we have known before, *First*, that guinea pigs, as well as other small animals, can be killed by excessive doses of the roentgen rays. *Second*, it would seem that the gases from about the tube are more poisonous than the gases from the corona in the high tension case. I realize that the experimental evidence, as well as the clinical observations, is not conclusive.

The fact that the guinea pig died from excessive radiation might lead a superficial observer to conclude that the radiation is the cause of the symptoms, but it would not explain the sickness that develops in some patients even from a single dose of rays, nor the fact that the friend of a patient sitting in the same room became nauseated while that particular patient did not even show any symptoms. In the case of one patient whom I was treating for uterine fibroids, the patient became sick after each treatment, no matter how small the dose. We had divided the course of treatment into small portions so that she received only two or three doses in one day, and had an interval of one or more days between treatments. Finally she requested that she be given all of her treatment on one day so that she need only be sick once. This was against my judgment, but the patient insisted upon it, and to my surprise, and to her surprise, she developed no nausea and no constitutional symptoms. This patient received 10 doses on one day. One would think that whether constitutional symptoms are the direct result of the rays, or whether they are due to the gases, that the smaller the dose and the greater the interval between these doses, the less effect on the constitution, and yet this observation on a patient who seemed especially sensitive and who showed no symptoms after an excessive course of treatment, would seem to contradict such view.

TREATMENT

The Relief of the Symptoms After They Have Developed.—For this I have found nothing that is really satisfactory. One patient seemed to get relief from small doses of strychnia taken by mouth, but many others seemed to obtain no benefit from this, and objected to the bitter taste. Therefore, that was abandoned. Some patients seem to get relief from aromatic spirits of ammonia, and for a time we allowed the patient to inhale aromatic spirits of ammonia during the treatments and afterwards, and we believe the patients got some relief. A few patients received almost immediate relief from the administration of aromatic spirits of ammonia in a glass of hot water. Others concluded that the aromatics only made them vomit. I believe, however, that the administration of aromatic spirits of ammonia in hot water has given more satisfaction than anything else. When there is much exhaustion, rest in bed, plenty of fresh air, with hot liquids, seem to do most good. When the patient is not much exhausted, walking in the fresh air seems to bring relief.

Prevention.—The real treatment of this condition is the prevention of the symptoms completely, and toward this end I believe that the more completely one can eliminate gases and provide absolutely pure, fresh air in large quantities, the more will these symptoms be reduced. Toward this end, in my original discussion of this subject in 1915, as you will remember, I had developed an inhalation cone which permitted the patient to take air from the outside of the building to which could be added pure oxygen. The patients objected to this so much that I have abandoned it, and instead have introduced suction fans which are claimed to change the air of the room once every half minute. This, of course, is only theoretical, and depends not only upon the suction power of the fan, but upon the amount of air that can be allowed to enter the room. During the summer months, when the air is warm, this can be accomplished by plenty of open window space, but during the winter months, when the air must be heated, such a free use of air is impossible. Therefore, it should be our duty to first eliminate, so far as is possible, all corona. This can be tested in a dark room, and I must admit that up to the present time I have not succeeded in eliminating this completely. We have placed around the terminals of the tube, at the suggestion of Mr. Snook, "spun brass" which eliminates the corona from these areas. We have used speaking tubes as far as the reels to eliminate any corona from the wires, but we have not eliminated the corona from the contact points, about the reels, nor have we eliminated entirely the corona from the wires leading from the reels to the tubes, though for this we are using heavy insulated wire. The reels may be encased. This will not prevent the corona, but will prevent the escape of gases.

To remove the corona from the high tension case, which we found contributed most to the odor of the room, we are using rotary suction pumps and carrying the gas entirely outside of the room. With these measures we are using blowing fans with the purpose of blowing the gases away from the patient's head and toward the suction fan. As a result of these measures we have reduced these constitutional symptoms to about one-third of the number that formerly occurred. In other words, roughly estimated, we count on constitutional symptoms in about one out of ten patients.

This paper is not conclusive, and is submitted for discussion, with the hope that some one else has found something better.

TECHNIQUE OF ROENTGEN EXAMINATION OF THE SPINE WITH ILLUSTRATIONS OF CERTAIN LESIONS*

BY THOMAS A. GROOVER, M.D.

WASHINGTON, D. C.

THE technique for the roentgen examination of the spine embodies many of the elementary principles common to the examination of other parts of the body. My own technique for spine examinations, so far as I know, possesses no new or original features, and but for the kindly solicitation of our president I would hesitate to make this presentation to a body of trained roentgenologists.

In the first place the making of a satisfactory roentgenogram of the spine is not nearly so difficult as some imagine. I do not mean to infer that brilliant plates can always be produced, but plates of good diagnostic quality can nearly always be obtained, both in the anteroposterior and lateral projections, regardless of the size of the patient. There are certain patients, usually of the fat and indolent class, who do not have enough lime in their bones to cast very contrasty shadows, but mere size, although a handicap, is not necessarily an insurmountable obstacle to the production of roentgenograms of fair quality.

FIG. 1. FRACTURE-DISLOCATION OF TWELFTH DORSAL.

No paralysis. The fracture of the laminæ in this case evidently resulted in a spontaneous decompression. Patient died suddenly of pulmonary embolism ten days after accident.

In examinations of the spine below the level of the diaphragm it is desirable, whenever practicable, to have the gastrointestinal tract thoroughly empty, and the patient should be prepared just as for a kidney examination.

In posing the patient for the anteroposterior view care should be taken to have him be perfectly straight and symmetrical on the table, and the slightest rotation of the body should be avoided. It is possible to make any spine give the appearance of a scoliosis, with rotation of the vertebræ, by failing to observe this precaution. In examining the lumbar and lower dorsal spine I usually have the patient's knees flexed and an effort is made to obliterate the lumbar curve as much as possible.

In posing the patient for the lateral view the same precaution should be observed as to the rotation or torsion of the trunk. Sandbags should be used liberally in an effort to make the patient feel absolutely secure and steady. Failure to attend to these minor details often determines the success or failure of the entire procedure. As a general rule I prefer the straight lateral view to the oblique, although in the thoracic spine the latter will occasionally give the more information. I have often felt the need of some arrangement whereby the lateral exposure could be made without having to turn the patient on the side, as it is sometimes difficult, and unsafe as well, to turn a badly injured patient on the side, and is often

* Read before the American Roentgen Ray Society at the Eighteenth Annual Session, New York City, September, 1917.

very painful in carcinoma and other pathological conditions. So far I have been unable to think of any satisfactory or practical way out of the difficulty.

I would like here to stress the importance of the lateral view. I am sure we do not employ it enough. It is just as important to secure right angle views of the spine as of the leg or arm, and our diagnoses are as equally circumscribed by failure to do so.

Fig. 2. Compression Fracture of the Bodies of the Second and Third Lumbar Vertebræ.

There are six lumbar vertebræ, the sixth being partially sacralized.

In suspected lesions of the upper cervical region a view should be made through the open mouth.

Stereoscopic plates should be the invariable rule in all spinal examinations. I use generally the 10 x 12 and 11 x 14 sizes, and occasionally the 14 x 17. Diagnoses are not infrequently missed by failure to examine a large enough area of the spine, and I think that it facilitates the interpretation to view a large area on one or two pairs of plates rather than small sections on multiple plates. Somewhat better detail can, of course, be obtained by the use of smaller diaphragms, but I do not believe that it fully compensates for the loss in other respects.

I never employ a plate focus distance of less than twenty-four inches. Often it is twenty-eight or thirty inches, and in making the lateral views sometimes as much as three feet.

Compression is used in stout patients,

Fig. 3. Lateral View of Figure 2.

No paralysis. Recovery.

but not as a rule in the medium or thin. A large rubber bladder—the inside of a hand-ball—is used for compression purposes. It is frequently placed beneath the cone, not for the purpose of compression, but as a supplementary filter. In making the lateral projection it helps to steady the patient.

I rather prefer to do spinal work on a Cole table as by its use one can judge something of the illumination he is getting through, and regulate it accordingly.

I have for several years used the Coolidge

FIG. 4. COMPRESSION FRACTURE OF BODY OF ELEVENTH DORSAL.

No paralysis. Recovery. The prognosis in this type of injury is comparatively good.

tube exclusively in all of my work, indeed ever since they were first put on the market. I have heard it stated over and over again by the best men that they would not do good bone work. Perhaps they are right, but I am sure that the general average of my work has been better than it was previously with gas tubes. I have no doubt that the very critical observer will be able to pick out Coolidge defects in my plates, especially after he knows that they have been made with a Coolidge tube, but I have more than once been able to fool very keen observers who did not possess such knowledge, and I doubt exceedingly if anything of real diagnostic value has been lost by its employment.

I have not been able to notice much difference in plates made with a broad, medium, or fine focus. This can probably be explained by the fact that I uniformly employ a comparatively long plate-focus distance.

I use a constant setting of the rheostat for all bone work quite regardless of the

FIG. 5. COMPRESSION FRACTURE OF BODY OF SECOND LUMBAR.

No paralysis. Recovery.

FIG. 6. LATERAL VIEW OF FIGURE 5.

Fig. 7. Fracture-Dislocation of Second Lumbar.

The cauda equina begins usually at the level of the second lumbar.

Fig. 8. Deformity of Fourth and Fifth Lumbar, the Result of an Old Injury.

Low back pain, but good function. Note compensatory lateral curvature.

Fig. 9. Forward Dislocation of Atlas.

Recovery with a stiff, painful neck. No paralysis. Study of stereoscopic set of plates is always an advantage.

Fig. 10. Partial Forward Dislocation of the Fourth Cervical.

Recovery with a stiff, painful neck. No paralysis. Comparison with normal cases desirable.

Fig. 11. Complete Forward Dislocation of Third Cervical.

No paralysis immediately following injury, and injury not regarded as serious until paralysis began to develop and progress several days later. Death in two weeks following operation.

thickness of the part to be examined. The length of the parallel spark is determined with that particular setting of the rheostat. It must be actually and accurately measured. A constant setting of the rheostat

Fig. 12. Fracture of Transverse Processes of Second, Third, and Fourth Lumbar.

on the filament control will not suffice. I frequently test out the length of the parallel spark while the exposure is in progress, and always do so between the making of stereoscopic pairs where speed is not paramount.

Most of my failures to get fair results can be attributed to fluctuation either of the filament or high potential current. I have not tried the current stabilizer now coming into use, but feel that a perfectly stable current would eliminate my greatest source of failure.

In spine work I employ a spark length of from three to five inches, depending

Fig. 13. Destructive Lesion of the Upper Lateral Margin of Third Lumbar with Narrowing of Contiguous Joint Slit.

The lesion is believed to be tubercular.

upon the thickness of the patient. For the patient of average size a gap of four to four and a half inches is used, and a gap of five inches, which is never exceeded, is used only in the very stout, and occasionally for the lateral exposures. Much work is done with a back-up spark of only three and a half inches. A difference of an inch or even half an inch in potential as measured on the parallel gap may determine the worth or worthlessness of a plate.

I must confess to the very unscientific practice of never looking at my milliamperemeter. As a matter of fact with the rheostat setting employed, and with a back-up spark of four and a half inches, it registers about twenty-two milliamperes.

I must confess also that I guess at the time of my exposures which is doubtless a very bad habit. I give what I feel to be enough and let it go at that. As a matter of fact, merely for the purpose of embodying the figures in these notes, I found upon investigation that in making a single anteroposterior plate of the lumbar spine in a patient of medium size, I was giving an exposure of about sixteen seconds. In lateral views I give at least twice as long. Dr. Hickey at the meeting a year ago in Chicago when questioned as to the technique employed in his beautiful spine work, advised taking plenty of time in making the exposure. I can heartily concur in his advice. Speed in roentgenography is only necessary for the purpose of eliminating the blurring effects of motion, and is therefore not a prime requisite in the roentgenography of most of the skeleton.

The question naturally arises as to the danger of burns with the technique I have outlined. As to this I can state that I have heard indirectly of one instance where a mild erythema developed in one of my cases. In this case there had for some unknown reason been a marked drop in the tube resistance during the exposure, and the patient had received a rather large volume of rays of very low penetration. Trouble was not altogether unexpected in this case. A filter is used next to the diaphragm on the tube stand. Personally, after considerable experience I feel safe in using the technique described. Of course judgment must be exercised as to the repetition of exposures. Certainly if the danger were very great I would long since have been forced to abandon the technique.

FIG 14. TUBERCULOSIS OF EIGHTH DORSAL WITH ABSCESS FORMATION, INDICATED BY THE FUSIFORM SHADOW SEEN THROUGH THAT OF THE HEART.

Without careful observation such a shadow might under certain circumstances be mistaken for an aneurysm.

FIG. 15. INCOMPLETE SPINA BIFIDA OF ELEVENTH AND TWELFTH DORSAL.

This possibility must always be kept in mind especially in children.

MYELOCYTIC LEUKEMIA

THE treatment of myelocytic leukemia by radium and roentgen rays is still more or less in the experimental stage and in view of the favorable results obtained by both methods in isolated cases, it becomes a matter of increasing importance to study and record more extensive series of cases. Such an opportunity was afforded at the 32nd Annual Meeting of the Association of American Physicians, when Giffin, of Rochester, Minn., Stengel, of Philadelphia, Peabody, of Cambridge, Mass., S. Solis Cohen, of Philadelphia, and others, contributed experiences on the subject.

According to the report contained in the *Medical Record* for July 7 Giffin treated thirty patients by direct application of radium element over the spleen, using 5 to 10 mgm. of radium in a tube for from three to four hours, with a total exposure of 24 to 36 hours, and this seemed to him the best treatment for this affection. Stengel had 42 records available of 50 patients treated with roentgen rays, and in many of these the clinical improvement was far out of proportion to that of the blood condition. More of the cases had eventually better results clinically than those cases in which the improvement in the blood picture was noted. Leucocytic leukemia, like pernicious anemia, seemed to be a relapsing disease.

Dr. Peabody confirmed the favorable radium results from his own experience, but he thought that these patients should return for examination once every week or once a month. Unless some such system of control was instituted, patients were apt to return only when the symptoms appeared again, the spleen was enlarged and the blood count was very great.

S. Solis Cohen, who has observed the results from both kinds of treatment, thought radium was more prompt in getting results without much constitutional reaction.

SPONDYLOLISTHESIS OR LUMBOSACRAL DISLOCATION*

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NEW YORK, N. Y.

AS comparatively few cases of spondylolisthesis have been reported recently in medical literature, it must have been frequently overlooked, for unless thoroughly understood, such a dislocation in any part of the spine would not be realized or suspected without accompanying paralysis. A case which was evidently spondylolisthesis was reported by Herbiniaux in 1782, and is probably the first case on record. Very little notice was given to the condition until Killian, in 1853, took up the study of it seriously. Schlesier, up to 1892, collected 53 cases in skeletons and many more clinically. At the Hospital for the Ruptured and Crippled, within two years, the writer has examined five cases roentgenographically.

It is defined as "a forward and downward dislocation of the body of the last lumbar vertebra on the sacrum." Most authors agree that the fifth lumbar is most frequently subluxated. The name originated with Killian and is derived from the Greek spondylus (vertebra), and olisthesis (a slipping out or down).

This condition is one of extraordinary interest on account of the mildness of symptoms in most patients, where such a dislocation would be expected to seriously injure the nerves of the cauda equina. Various theories are advanced as to the eti-

*Read before Eighteenth Annual Meeting of the American Roentgenology Society, New York City, September, 1917.

ology, among which are tuberculosis of the spine (Killian), congenital anomalies (Braun, Swartz, Spaeth), fractures (Neugebauer), atrophy of the intervertebral cartilage (Rokitansky), injury other than fracture (Barnes, Lawrence). Chiari, in 1892, said that "the etiological factor furnishes the disposition only, from which the olisthesis may arise, but not necessarily so."

That it is said to be peculiar to women by obstetricians as in Edgar's "The Practice of Obstetrics," 1903, in which he gives violence as a main cause, is due to its importance as an obstruction to labor, but men, being more exposed to violence, should present the larger number of cases. The latter observation will no doubt be verified as the roentgen examination discloses the diagnosis, when others than obstetricians will have recognized and reported the condition.

Ralph Fitch,[1] in his paper showing a close study of his subject, makes the following statement: "No one can justly say that tuberculosis, fractures, congenital deformities, or any of the alleged causes may not produce spondylolithesis. A point which I wish to make is that none of these conditions is necessary for its production. The pathological conditions that may have been interpreted as tuberculosis, atrophy of cartilage, etc., may have been the result and not the cause of the condition." Goldthwait and others working with him have shown after an exhaustive study of the anatomy, that the structure of the lumbosacral articulations is subject to such predisposing variations as to render a spondylolisthesis very easily possible when undue strain is put upon them through violence or otherwise. Two types of spondylolisthesis have been reported; one, the unilateral type, in which the early symptoms of paralysis have been so pronounced as to render early diagnosis probable. Goldthwait studied the mechanics through which the condition is reached and in his well-known article on the subject [2] showed how easily a unilateral spondylolisthesis might be produced which, by compressing the cauda equina, caused paraplegia. He was so unfortunate as to bring about this condition while endeavoring to correct a

A

B

C

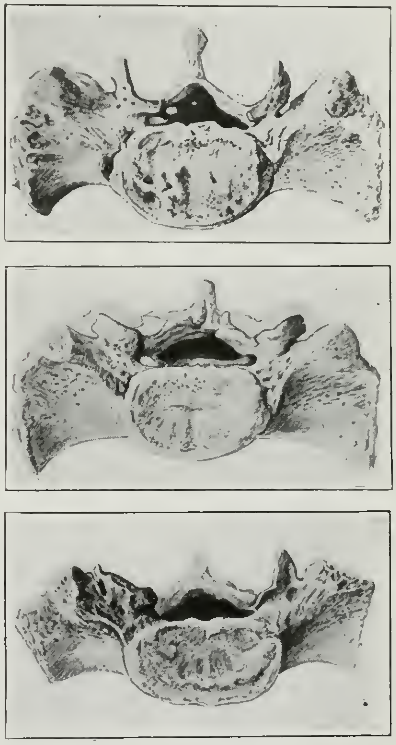

FIG. 1. COMMON TYPES OF LUMBOSACRAL ARTICULATIONS WHICH PRESENT ANATOMICAL PECULIARITIES. (GOLDTHWAIT.)

A. Shows sharply crescentric articulations. The lateral portions extend backwards almost at right angles articulating with the 5th lumbar process. This makes a very stable joint. B. Shows a flat articular surface with the axis nearly transverse. This provides a much less stable articulation than the preceding type. C. Shows both types in the same individual thus favoring the unilateral type of dislocation.

sacro-iliac dislocation. He notes, on the other hand, the gradual development and mildness of symptoms where the displacement is bilateral.

The majority of cases, believed to be the bilateral type, have been those in which the onset has been of so mild a character as to cause little disability, and gradually develop more definite symptoms.

[1] *Am. Jour. Orthop. Surg.*, May, 1913.

[2] *Boston Med. & Surg. Jour.*, March 16, 1911.

The backs of these patients present a characteristic posture, described by Dr. Royal Whitman in his book, "Orthopedic Surgery," as follows: "The trunk is displaced forward and downward in its relation to the pelvis. Thus the inclination of the pelvis is lessened or lost, and the lumbar lordosis is absolutely or relatively increased. The sacrum projects and the space between the ribs and the iliac crests is diminished." I wish, in this paper, to emphasize the value of the roentgen ray as a means of proving out the diagnosis. The accompanying reproductions of the roentgenograms, made stereoscopically, show

FIG. 2. DIAGRAMMATIC LATERAL VIEW OF THE SACRUM. (GOLDTHWAIT.)

Shows intermediate stage of dislocation with the articular processes resting on the body of the sacrum thus leaving space for the cauda equina.

FIG. 3. POSTERIOR VIEW OF FIG. 2. (GOLDTHWAIT.)

Shows the wide space left beneath the arch for the cauda equina.

FIG. 4. DIAGRAMMATIC LATERAL VIEW OF THE SACRUM. (GOLDTHWAIT.)

This shows that even in a complete stage of dislocation the posterior articulations still resting on the body of the sacrum leaves a space for the cauda equina.

FIG. 5. POSTERIOR VIEW OF FIG. 4. (GOLDTHWAIT.)

Shows sufficient space for the passage of the cauda equina between the arch of the 5th lumbar and the body of the sacrum.

the condition plainly. In view of this fact, it would seem the correct method of procedure to lose as little time as possible between the time of the patient's earliest symptoms and the making of the first roentgen examination showing the actual structural relations. This may be followed by other plates at intervals, if symptoms indicate, so that increased displacement may

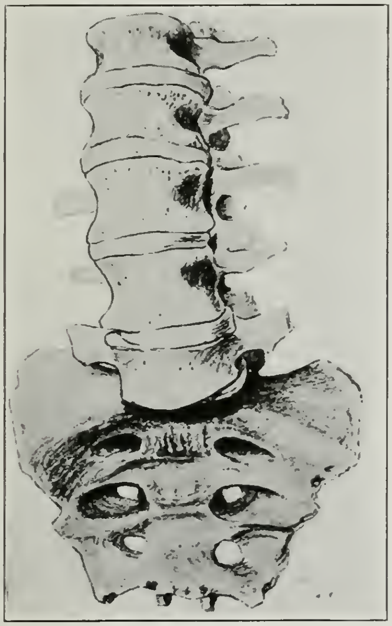

Fig. 6. Diagrammatic View of the Lumbosacral Region. (Goldthwait.)

Shows a unilateral right-sided dislocation of the first degree.

be carefully noted, and effective measures taken to check it by means of braces, belts or Albee bone-inlay operations bridging across the spinous processes involved.

To get the mechanics of the condition clearly before your mind, there is no clearer description than Goldthwait's. "The lumbosacral joint is capable of considerable motion, fully one half of the motion of the trunk below the lower dorsal region being made in this articulation and the one just above it, the remainder of the motion being distributed between the rest of the lumbar spine and the sacro-iliac joints. In forward bending, since the bodies of the vertebræ are so large, the motion at the lumbosacral joint is made partly by the changes in the intervertebral disk, but chiefly by the articular processes of the fifth lumbar vertebra sliding upward upon the opposing processes on the sacrum (Fig. 1). Naturally, if the motion is carried too far, the articular processes will be separated (posteriorly) and the vertebra can then slip forward upon the sacrum. If this is continued, the last lumbar vertebra may slip entirely off the vertebral articulation of the sacrum (as is shown in Figs. 2, 3, 4 and 5) and a true dislocation or spondylolisthesis results. In such a displacement, since the articular processes of the fifth lumbar extend below the lower surface of the body of the bone, the body of the fifth is raised so much above the superior surface of the sacrum that there is practically always a space for the cauda equina—this, together with the fact that the change takes place slowly, makes gradual readjustment possible and explains the fact that paralysis under such conditions does not result.

"If, now, the displacement of the fifth lumbar or the separation of the articular processes takes place only upon one side, a much more serious condition at once results. The displaced articulation slides forward and to the outside (Figs. 6 and 7), with the result that the whole spine with the body of the fifth lumbar vertebra

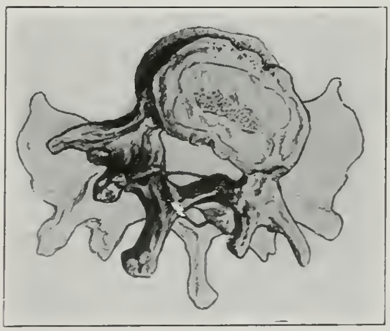

Fig. 7. Diagrammatic View of a Unilateral Dislocation. (Goldthwait.)

Shows the dislocated articulation on one side only, sliding forward on this side, the other side holding. The entire cauda equina is compressed causing partial or complete paralysis below.

is rotated forward on the side of the displacement (Figs. 6 and 7). With this rotation and with the moving forward of the

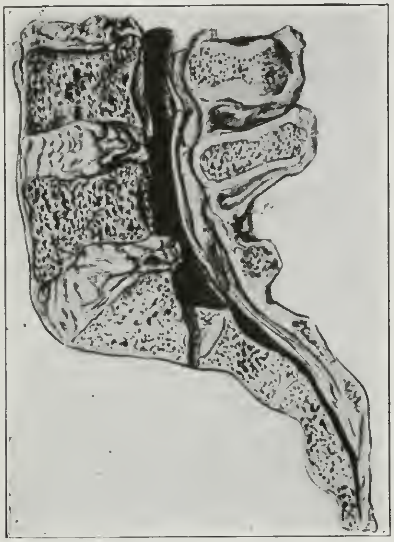

Fig. 8. Another Factor Which Would Produce Gradual Paralysis.

Diagrammatic representation of the projection of the intervertebral disk into the canal (Goldthwait). In this position the posterior portion is separated.

displaced articular process, the other process is drawn nearer to the center of the body (Figs. 6 and 7), at the same time necessarily being drawn forward with the result that the spinal canal is narrowed (Fig. 7), and the narrowing may be so marked that the entire cauda equina is compressed, with paralysis, either complete or partial, below this point. Another element, the intervertebral disk, which was not at first appreciated, but which is undoubtedly of much importance as a direct cause of the paralysis, consists in the separation and possible displacement of the intervertebral disk, lying between the body of the vertebra and the sacrum. Because of the structure of the disk, if such separation occurred, the projection of the disk and the possible paralysis would be gradual in development, since the dense annular portion must be stretched by the central portion and would require some hours or possibly days for the full extent of the displacement to develop.

"The projection of the disk into the canal when the posterior part is separated, is shown in Fig. 8."

(1) In the roentgen stereoscopic examination, the following details are to be carefully noted: spine as a whole; five lumbar vertebræ, whether of normal shape, in proper order above the sacrum, each body normal, with a space for the inter-

Fig. 9. Roentgenogram of Normal Spine.

Shows the usual appearance from 2nd lumbar to the upper border of the sacrum. Note the clear space for the intervertebral disk between each body.

Fig. 10. Roentgenogram of Normal Spine (Lumbosacral Region).

Shows the 5th lumbar as a whole (its body and transverse processes) well above the body of the sacrum, the intervertebral disk showing clearly between.

vertebral disk; fifth lumbar as a whole, its position and the relation of its body and transverse processes, whether clearly above the sacrum or overlapping its upper border (Figs. 9 and 10). Note the spinal foramen, lamina and spinous process; posterior facets, whether fractured or not; finally the degree of dislocation.

(2) In differential diagnosis of spondylolisthesis, uncomplicated, there is no evidence of present or past bone disease. A compression fracture higher up involving the upper lumbar vertebrae is usually evident. The age of the patient at the time of the injury is indicated, for in recent cases the fourth and fifth vertebrae and transverse processes are not stunted but are similar in size and shape to those above; or the fourth vertebra and transverse processes are rudimentary and underdeveloped, relatively proportional to the age at which the dislocation occurred. In no case was a definite fracture of pedicle, lamina or facet made out.

The following five cases which have come under my observation are based on the clinical diagnosis made by the staff of the Ruptured and Crippled Hospital from the roentgen diagnosis and corresponding clinical symptoms and physical examinations. All are apparently those of bilateral spondylolitheses. One is of early childhood or congenital in a female now 15 years old; one is in a male, taking place at the age of 9 years, not diagnosed until 27 years later; three are recent cases in adults, two males and one female.

Case I. Hospital for the Ruptured and Crippled Service of Dr. Royal Whitman, under the care of Dr. Armitage Whitman.

T. M., Age 15, Female.—The patient seemed all right up to 11 years, but until 13 she sat in the house a good deal. At 12 years she only complained of a pain in the calves of her legs. She was not as active as other children, could not walk as well and complained. Her condition did not improve and at 13 years she began to have pains in her back any time during the day, particularly when she was asked to do something. At this time her mother noticed a lump in her back. Her physician said "it was nothing," but her mother watched the lump and found it became more pointed. From 13 to 16 years she grew steadily worse, would

Fig. 11. Case I, T. M., Age 15.

Shows moderately the characteristics of lumbar lordosis with the free ribs low over the crests of the ilia and a prominent sacrum with depression above.

walk a block and come home crying with pain. The patient has been better since wearing a brace.

Physical.—Body in standing is inclined forward above the sacrum, and the spinous process at the lower extremity of incurvation is very prominent, evidently marked displacement forward of vertebra above this point (Fig. 11).

Roentgen Examination.—Examination shows only three normal lumbar vertebrae. The fourth is seen clearly, but has rudimentary transverse processes (Fig. 12).

FIG. 12. CASE I, T. M.—COMPLETE SPONDYLOLISTHESIS.

Note the first three lumbar vertebræ are normal. The fourth is obscured by the fifth which is dislocated forward and downward until its upper aspect faces directly forward. The prominent body of the 5th and the transverse processes are well below the upper border of the sacrum.

FIG. 13. CASE I, T. M., AGE 15. (Compare with Figs. 4 and 5.)

A clearer plate of the lumbosacral region confirming Fig. 12. The rudimentary appearance of the 4th lumbar especially its transverse process, failing any recent history, suggests that the original dislocation was congenital or of early childhood.

This vertebra seems to articulate with the sacrum. The fifth lumbar is dislocated forward and downward on the sacrum until its entire upper aspect, including that of the lamina and spinous processes, faces directly forward (Fig. 13). The posterior articular facets of the sacrum seem to be underdeveloped. As the history gives no evidence of injury, the whole condition would seem to be that of early childhood or even congenital. The lateral view (too indistinct for reproduction) shows faintly the wedge-shaped body of the sacrum. In front of the upper part of the sacrum, the dislocated body of the fifth lumbar faces forward and upward. The fourth lumbar is apparently articulating with the sacrum. The bodies of the fourth, third, second and first lumbars are in their usual position. It is therefore evident what a tortuous course the cauda equina must take in passing from the lower part of the fourth directly forward beneath the arch and spine of the fifth lumbar, and then backward over the upper surface of the body of the sacrum.

CASE II. PATIENT OF DR. B. H. WHITBECK.

E. H., AGE 35, FEMALE.—Patient fell while getting off a street car. The car had stopped but started again, throwing her suddenly on her back. She walked home, then began to have severe pain in her back, and went to bed for a day or so. No nervous symptoms except a numbness which cleared up after a week.

Physical.—Three weeks after injury, examination showed considerable deformity. Patient was bent forward, leaning to the left side. No wrinkles were visible in the flanks. The most comfortable position was with the trunk flexed, with legs doubled under her. Her back was strapped at this time, and brace applied, which gradually helped her, straightening her up somewhat. Pain down the back and legs continued, which was more or less subjective. There was no disturbance in the knee jerk.

Roentgen Examination. — Examination showed to a moderate degree, stereoscopically, an abnormal amount of angulation between the lower lumbar spine and sacrum, with a forward dislocation of the

FIG. 14. CASE II, E. H., AGE 35, FEMALE. (Compare with Fig. 6.)

Roentgenogram shows moderate dislocation suggesting the unilateral type. The body overlaps the upper border of the sacrum. The transverse processes are low, the one on the right overlapping slightly the border of the sacrum. The foramen seems to be viewed from above.

fifth lumbar on the sacrum. The body and transverse processes of the fifth lumbar are slightly below the level of the sacrum (Fig. 14). The spinal foramen with the upper aspect of the body of the lamina and spinous process are more in evidence than normal, and face forward.

Diagnosis.—A moderate amount of spondylolithesis with possible sacro-iliac dislocation on the left.

Within a year after the date of the injury, and after her suit had been settled, the patient had straightened up and resumed her normal position, and up to date, there has been no recurrence of symptoms.

CASE III. SERVICE OF DR. ROYAL WHITMAN, CARE OF DR. ARMITAGE WHITMAN.

H. C., AGE 38, MALE, WEIGHT 230 LBS.—MOTORMAN.—*Previous History*.—At nine years of age, the patient was butted in the small of the back by another boy's head. He felt faint at the time and laid down for a few minutes. The patient states that he had no severe symptoms for 24 years. But he always has had a pain of some character in the leg and back, but never a pain else-

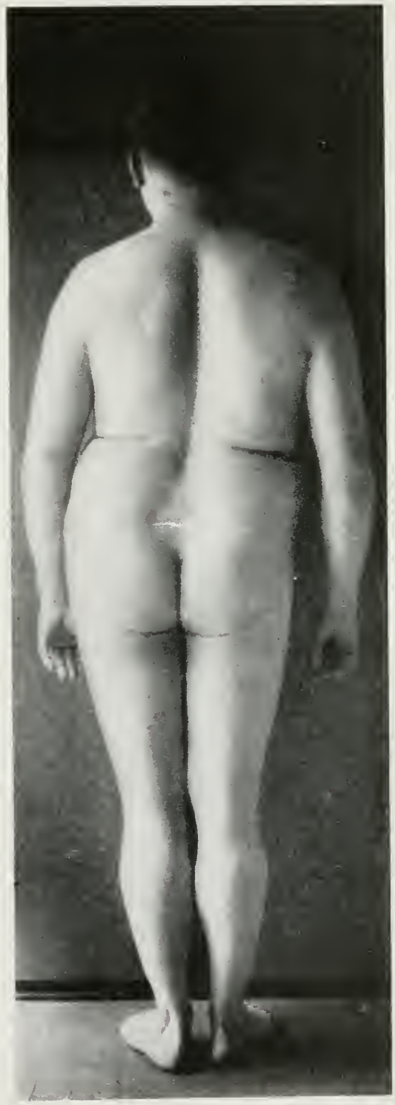

FIG. 15. CASE III, H. C., AGE 38, WEIGHT 230 POUNDS.

Patient was "butted" in the back at the age of 9. Shows the characteristic lordosis in the stout man, short-waisted effect, with wrinkles in the lumbar region. Prominent sacrum with depression just above.

where of any consequence. Pain prevented him from concentrating his mind as a student. For the past two years he has had numbness in the right foot and leg up to above the hip, following short walks; he has had no "weakness" in back, but pain in lumbosacral region, which is worse in the morning when beginning to walk.

Physical Examination.—The examination showed the characteristic posture of spondylolithesis in a heavy man weighing 230 lbs. (Fig. 15).

FIG. 16. CASE III, H. C., AGE 38. (Compare with Figs. 4 and 5.)

The 3rd lumbar is well formed as were the other two above. The 4th is somewhat obscured, its transverse processes are clearly rudimentary. The body of the 5th is completely dislocated forward and downward in front of the sacrum, its transverse process well below the upper border.

Roengten Examination. — Examination showed three well-formed lumbar vertebræ in lumbar region, the fourth rudimentary (as shown by the rudimentary transverse processes) and the body of the fifth dislocated forward in front of the sacrum, with its upper surface and spinal foramen facing forward and upward. The first, second and third vertebræ appear to be small bones for a man of his stature, but are fully developed, as compared with the rudimentary fourth. This undevelopment would seem to fix the date of origin as stated (Fig. 16).

CASE IV. SERVICE OF DR. CHARLTON WALLACE, CARE OF DR. W. L. SNEED.

J. J., MALE, AGE 45 (Fig. 17).—This case well illustrates the misleading sensations at the time of injury and the insidious development of disability and nerve pressure symptoms in a few months or even years. This freedom from pain and lack of symptoms cannot be overemphasized, for in medicolegal cases the absence of symptoms at the time of the injury which would tend to prove the diagnosis prevents the recovery

FIG. 17. CASE IV, J. J. M., AGE 45.

Shows complete spondylolisthesis of recent origin. Characteristics of lumbosacral dislocation are unusually well shown, posture, lordosis, short-waisted effect, wrinkles in the flanks; sacrum is prominent with depression just above. There is noticeable atrophy of the right thigh muscles and calf of the leg.

of damages in proportion to the actual injuries received.

As the patient's description is one of unusual intelligence and shows accurate observation, I give his own words. His testimony from a medico-legal standpoint is peculiarly interesting since his truthfulness and accuracy almost proved his undoing in his trial for damages before a jury who were confused by the absence of symptoms at the time of injury and could not seem to realize that they developed later.

"I am 45 years old and a railway mail clerk. Three months ago in a collision where a motor hit my car a terrific blow I happened to be bending over with my back toward the motor and as I was bent down to the floor with my buttock against the cross table and my left hip wedged in the angle formed by the side table I received a severe shock and concussion, as my body would not give with the impact of the motor. In order to save striking my head against the sharp edges of the letter case at the same moment I swung around sharply. With the concussion I had the feeling as if something gave way in the region between my hips, but I felt no pain there and dismissed it from my mind until called to account for the condition in which my spine was found when examined by different physicians. I believed that severe injury must be accompanied by severe pain and gave no thought to this occurrence, attributing this feeling of dizziness from which I suffered to fright.

Fig. 19. Case IV, J. J. M., Age 45. (Compare with Figs. 4 and 5.)

Shows four normal vertebræ in proper order. The 5th is displaced forward and downward, the body showing clearly below the upper border of the sacrum, its upper aspect faces forward. The transverse processes are very low.

Fig. 18. Case IV, J. J. M., Age 45.

Lumbosacral region showing details of condition indicated in Fig. 19.

"After a six-day lay-off at home I returned to work, and as the work was light I suffered but little inconvenience. Two weeks after the accident while shaving myself one morning my leg became somewhat numb, this feeling extending down to the calf (left leg). This feeling of numbness recurred in the street the same day. This numbness was repeated so frequently and so severely that the following week I reported for examination, which was a superficial one, made without the removal of my clothing or underclothes. The diagnosis of 'contusion of the hip' was made, but as the condition continued without relief, I went to my own surgeon who made the diagnosis of 'inflammation of the sciatic nerve'; but he made no examination of the spine. At this time I was unable to bend over without a good deal of difficulty. I continued my work for two and a half months, during which time I was taking electric massages, etc. When I became convinced that I had some severer injury than a bruised sciatic nerve, I went to the railway surgeon for an examination. He diagnosed my case as 'slight strain of the spine' and advised me to lay off, and obtain leave of absence for 30 days.

"Whether or not my spine was dislocated to the extent that it now is, I am unable to say. I do know though that not one man in a thousand would have kept at work as I did were they in the similar condition. *Time and again I was obliged to sit down, but I found that by twisting my body at the hips I could relieve what appeared to be a pressure on the sciatic nerve, and then get up and walk again.* By continuing on my run, subject to the sudden jerks of the car and the lifting incident to my position, I no doubt exaggerated my injuries, and if there is any condition that might be considered 'postural,' it has come from the injury received in March, and is not of prior origin."

Stereoscopic Roentgen Examination.—The first roentgen examination was made by Dr. Austin L. Hobbs. This and my own subsequent examinations showed that the spinous processes of the lower lumbar vertebrae and sacrum were not in line (Fig. 18). There was a marked angulation between the fourth and fifth lumbar vertebræ and the sacrum. The fifth lumbar was dislocated downward and tilted forward on the sacrum until its whole upper aspect, showing the body, transverse processes, spinal foramen, lamina and spinous processes, faced directly forward and only slightly upward. The transverse processes of the fifth lumbar were plainly much lower than their usual position. On the left the transverse process was well below the uppermost border of the body of the sacrum.

The plane of the fourth lumbar was shown to be well forward, but its lower articulating surface was on a level with the posterior facets of the sacrum, and occupied the usual position of the fifth (Fig. 19).

There was no evidence of old disease.

The uniformly normal development of all the transverse processes and of all the lower lumbar vertebræ was such that the

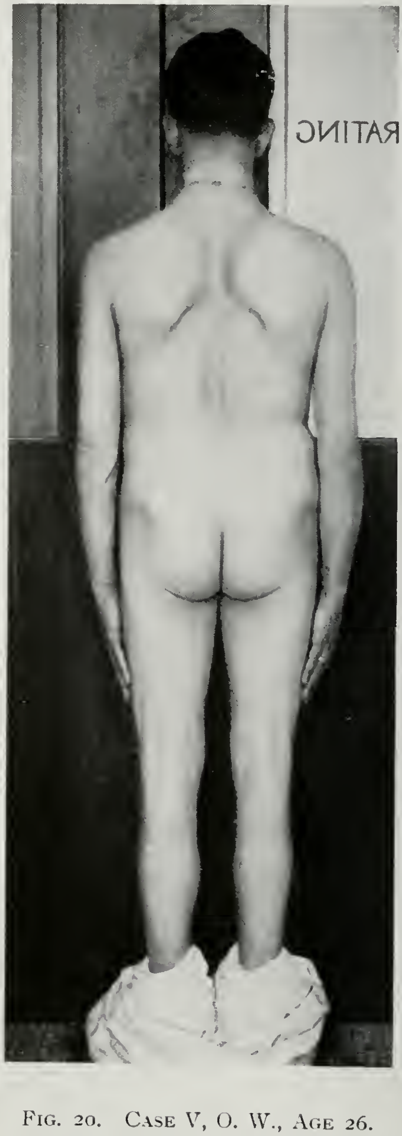

FIG. 20. CASE V, O. W., AGE 26.

Injury occurred 10 years previous. Shows lordosis, short-waisted effect, prominent sacrum with depression just above. Note that deformity is less marked in this case due to constant supervision with medical treatment when needed during a period of ten years.

condition could not have been congenital or of early childhood, but only after their full adult development.

Case V. Patient of Dr. Virgil P. Gibney

The history and treatment of this case extended over a period of ten years. Dr. Gibney then made the diagnosis of spondylolisthesis which was confirmed by roentgen examination ten years later.

Physical Examination.—This shows the characteristic posture of spondylolisthesis.

Roentgen Examination.—This shows definite dislocation of the whole of the fifth lumbar, forward and downward on the sacrum (Fig. 21).

Dr. Gibney's clinical notes covering the period of ten years show the favorable results which may be expected from proper medical treatment.

February 27th, 1907

O. W., Age 17 Years; Male (Fig. 20).—Eight months ago while jumping, he felt a snap in lower part of back and had some pain, but this seemed to trouble him very little until last October. Since then it has been getting worse, pain running down left thigh. At first it pained at night only on walking.

The patient found it very difficult to lie on his back and extend his limbs; he could flex perfectly when hips were sharply flexed, lordosis was overcome and he was free from pain; both sacro-iliac joints were prominent. Tenderness was noted over the sacrum; sensitiveness over lumbosacral region; extreme lordosis and sensitiveness (Fig. 20) along the course of the sciatic nerve.

March 1st, 1907

A solid plaster-of-Paris jacket was applied in the swing with as much extension being made as possible.

June 25th, 1907

Parts were still slightly sensitive over the sacrum and sacro-iliac joint; lordosis was not so marked.

Patient was very comfortable all summer.

January 7th, 1908

The patient had no pain now, but was a little lame and favored the left limb; lumbar lordosis was much increased and lumbosacral kyphosis marked; bore most of weight on right limb as he stood, but two sides of pelvis were about equal. When lying on back the patient preferred to keep left thigh flexed, but could make all movements fully; adductors on right side presented a little more fullness than on left, but both were tense; limbs were equal in length.

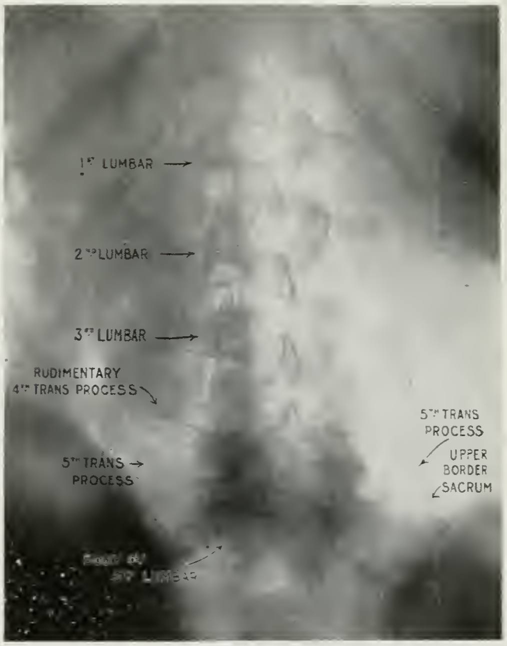

Fig. 21. Case V, O. W., Age 26.

Shows four normal lumbar vertebrae with the 5th dislocated downward and forward as diagrammed in Figs. 4 and 5.

May 9, 1911

The patient had been employed at clerical work for the last seven years. For the last ten days he had complained of pain in right leg; had grown to be a good height; still had sharp lordosis, but as he had grown so much, it was impossible to compare tracings, so these were not recorded. His free ribs hung over the ilium a little, and there was a transverse crease running from one ilium to the other at the line of the umbilicus. The lower limbs were well developed; hip functions were perfect, but if the left thigh, for instance, was flexed rather sharply, he felt pain in the right thigh. Up to ten days prior to the above date he was perfectly well. Plaster jacket was advised.

May 29, 1913

The patient had a little discomfort with the jacket for a few days but since that time had worn the jacket well and had gotten entire relief from the pelvic and hip symptoms.

January 6, 1915

The patient began to complain again on the day preceding, for some unknown cause. He had sagged down again, so I suspended him and put him in plaster.

December 12, 1916

For the past two weeks he had been complaining again of pain; was to have another jacket.

Summary

1.—Violence is the direct cause of spondylolithesis although certain anatomical variations may favor the establishment of the condition. Fracture of the articular processes, though possible, cannot be proven.

Disease, if ever present, is an independent factor. The dislocation may occur in early childhood or even before birth.

2.—I emphasize the gradual onset of symptoms. The symptoms at the time of the injury may be so mild as to be ignored by the patient, and as the condition is rare the diagnosis in no case was made until months or years later when pain and paralysis and incapacity demanded attention and diagnosis.

3.—In medico-legal cases the jury is confused by the apparent absence of sensations and paralysis at the time of the injury, when so great a dislocation of the spine is claimed by the medical testimony for the patient.

4.—The prognosis is good with medical attention and support when indicated as symptoms develop, but a cure or replacement has never been reported.

5.—The condition is not uncommon and should always be considered in injuries of the lower spine. When stripped the patient shows the characteristic posture.

6.—The *x*-ray diagnosis must show only four whole lumbar vertebræ above the upper border of the sacrum. The fifth must not only overlap the upper part of the sacrum but the body must be well below and in front of the sacrum with the transverse process showing below the upper border of the sacrum, or, at least, much lower than their usual position. The upper aspect of the vertebræ as a whole should face forward presenting the picture of this surface of the body, the lamina and the spine foramen. The ray should be centered directly over this region and not higher. The back of the patient should be flattened on the plate, thighs flexed. Stereoscopic plates have an added value in showing forward displacement and the lateral view, difficult and often unattainable, if clear is of great value.

7.—Mistakes in *x*-ray diagnosis and technique can be made where there is a marked lumbosacral lordosis and the ray is directed obliquely from above downward on too large a plate. The plates should show good detail.

DISCUSSION ON THE PAPERS OF DR. GROOVER AND DR. DARLING

DR. ARIAL W. GEORGE, Boston, Mass. —At the January, 1917, meeting of the Society at Atlantic City, I presented what I considered several new observations on the changes which take place about the fifth lumbar vertebra, when this body is dislocated forward (spondylolisthesis). My attention was first called to this condition previously by Dr. Darling. Since that time I have tried to work out one or two diagnostic signs which can be made, with or without stereoscopic plates, on the anteroposterior view of the fifth lumbar vertebra; and in the lantern slides which I am about to show, I shall try to demonstrate these signs. Aside from the anteroposterior view, either singly or stereoscopically, it is absolutely essential that one make a lateral view of this area. Contrary perhaps to what Dr. Groover has just said, I believe that the lateral view of the sacrum, at least for purposes of diagnosis, is a great deal more simple than we have hitherto thought, and is as easy and almost as satisfactory as a lateral view of the dorsal region, especially if one uses an intensifying screen.

One important fact in the technique of the lateral view is that the greater the distance the tube is from the plate, at the same time using a small diaphragm, the better and sharper the detail of the lateral view.

In the anteroposterior view I have noted that when the transverse process laps over the sacrum (see Fig. 1) this is indicative of one of two things (I am not now speaking of the sacralized transverse process, but of the average normal in size and shape), either that the fifth lumbar is slipped forward upon the sacrum to an appreciable degree, or that there is a greater angle between the fifth lumbar vertebra and the sacrum. (See Fig. 3.)

One other effect in the anteroposterior view, which is consistent with the above, is a change in the angle of the lamina and of the spinous process. (See Fig. 1.)

In a study of the lateral view, aside from the actual slipping forward of the fifth on the sacrum, I believe the most important consideration is the acute angle

FIG. 1.

1. Shows the inferior portion of the fifth lumbar vertebra. 2. The change in angle and position of the spinous process as compared with the fourth. Note difference between the third and fourth. 3. Overlapping of the fifth right transverse process on the sacrum (a unilateral case). 4. Change in the angle of the lamina.

of the neural canal (see Fig. 3), and I have been of the opinion that symptoms arise from this latter fact rather than from any special disturbance of the forward displacement of the fifth. What gives rise to symptoms in a traumatically displaced sacrum is simply that the angle is too acute, and the same chain of symptoms appear as when the body is actually forward.

In our series of approximately thirteen cases, the problem arises whether this

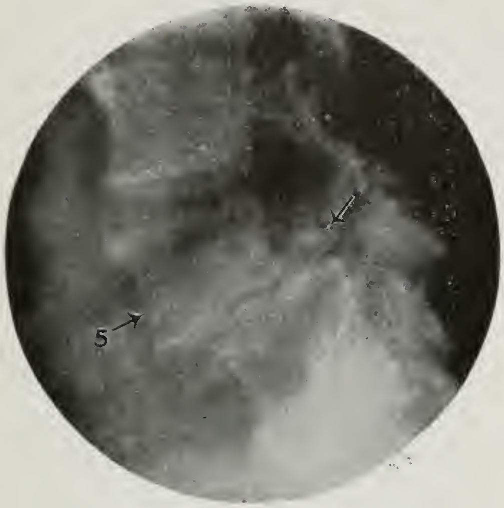

FIG. 2. SHOWS FORWARD DISPLACEMENT OF THE FIFTH ON THE SACRUM.

Note the acute angle of the neural canal.

displacement forward of the body of the sacrum occurs spontaneously at the time of the injury or whether it is a developmental condition later.

I have been of the opinion that most changes, such as increased bone density,

FIG. 3. SHOWS NO DISPLACEMENT OF THE FIFTH.

A very marked angulation of the sacrum in its relation to the normal and to the fifth vetebra is indicated.

etc., which appear in and about the inferior portion of the fifth lumbar, associated with displacement, represent a progressive condition. This process goes on to a certain point, when by the increasing bone density, the body becomes anchored.

MR. H. W. DACHTLER, Toledo, Ohio.—I would like to ask Dr. Groover if he has had any experience in making a differential diagnosis between an old tuberculosis of the spine and a compression fracture of a vertebra. I have had a case in which the patient claimed to have been injured when an automobile body was allowed to slip upon his shoulders but he gave a history suggesting an old tuberculosis of the spine. There was a marked lesion present and I expressed the opinion that it was an old tuberculosis because the edges of the body, in a lateral view, were not smooth but were roughened and showed erosion. In all of my compression fractures the edges of the bodies have been smooth and the intervertebral space well defined. This is not the case in tuberculosis.

I would like to ask his experience in such cases.

DR. KENNON DUNHAM, Cincinnati, Ohio.—I wish to ask two questions. First, what does Dr. Groover consider the normal comparative size of the transverse processes of the third and fourth lumbar vertebrae? Second, I would like the doctor to make clear for me the differences between his method of taking and reading lumbar plates, which he has just described, and the previous work of Dr. Hickey.

These questions are in no way a criticism of this most valuable work of Dr. Groover. I am sure that the work is real and the report valuable, but I am anxious to find out if this is an addition to, a confirmation of, or a refutation of, the previous work of Dr. Hickey.

DR. E. H. SKINNER, Kansas City.—We find a great many spinae bifidae and other transitional and congenital defects at the lumbosacral junction. It is very interesting in any study of these cases of changes at the lumbosacral junction, to be able to have a picture of your entire lumbosacral spine, because in cases in which you have the sacralization of your fifth lumbar vertebra you will almost invariably find a rudimentary twelfth rib. One can have a vertebralization of the first sacral segment or a sacralization of the fifth lumbar segment, so it is best to have your entire spine to count. One will find, in looking over a number of plates of the genito-urinary tract, sacralization of the fifth lumbar vertebra. The spina bifida occulta is another very frequent finding and probably should be noted, but not emphasized. We find it so frequently that it seems to be an old story; but we have known of medico-legal cases where such congenital defects have been misinterpreted, and made to imply a bony injury, whereas a spina bifida occulta is congenital and of little moment.

Dr. Thomas A. Groover, Washington, D. C.—I have had just the difficulty that Dr. Dachtler mentions. I don't think we are likely to have that difficulty if we see the patient immediately after the accident; but if he comes under observation some time later, it may be difficult to decide, and the clinical history will have to be relied upon in making the differential diagnosis. It might present a very perplexing medico-legal problem.

Dr. Byron C. Darling, New York, N. Y.—Just a few words on the size of the transverse processes of the fourth lumbar. If any of you remember to observe this from time to time, you will find that from above downward they become larger to the fourth; then the fourth, for some reason or other, often in what seem to be normal spines, is smaller; so that this observation of mine, about telling the date of the injury by the size of the stunted transverse processes, must be taken with a certain allowance.

Superiority of Roentgen Therapy in Mycosis Fungoides

At a meeting of the New York Academy of Medicine on March 2, 1917, Dr. Arthur F. Holding presented a patient who had been ill for nine years whose disease in the pre-tumor stage had been variously diagnosed by dermatologists of international repute as eczema, psoriasis or syphilis, and treated accordingly without results. The case then progressed to the tumor stage. We abstract the following, from Dr. Holding's report in the *Medical Record*, August 4, 1917 (p. 215).

The tumor formation was very extensive over the forehead, eyelids, cheeks, and back of the neck. Being so extensive, various methods of treatment were applied over areas of the lesion: Excision and skin grafting on the right forehead; roentgen rays on the left forehead; radium on the cheeks and fulguration for the eyelids. The results of excision and skin grafting were good at first, but later the flap broke down and sloughed, exposing the skull. The results of the roentgen rays and radium were clinically and cosmetically much better than those of attempted surgical treatment, and in the fulgurated areas the disease recurred. All of the lesions, however, disappeared within three months after the treatment was instituted. Two months later the patient returned with a general erythematous eruption over the entire body and it was decided to treat the recurrent areas with radium and roentgen rays. After various experiments to determine the best technic, it was found that the roentgen technic was better; there were no subsequent irregularities of pigmentation in the skin treated; it was quicker; the larger areas of skin could be treated; the areas treated through a filter of 1 mm aluminum responded quicker and better than areas treated without filters or with thick filters. The eruption disappeared; there had been occasional relapses of the erythematous dermatoses which always yielded to roentgen treatment.

THE CAUSE OF CONSTITUTIONAL SYMPTOMS FOLLOWING DEEP ROENTGENOTHERAPY

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and

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BATTLE CREEK, MICHIGAN

An interesting discussion has arisen within recent years among roentgenologists respecting the cause of certain symptoms following deep roentgenotherapy. Are these symptoms due to acidosis resulting from the specific action of the x-rays or to the inhalation of noxious gases produced by the high tension currents and inhaled by the patient, or are they due to some other cause?

To find if possible an answer to this question was the purpose of the studies upon which this paper is based. The observations were made in the laboratories of the Battle Creek Sanitarium. The authors are indebted to Dr. James T. Case, Chief of the Roentgen Department, for valuable suggestions concerning the experimental work on acidosis and for roentgenologic material.

FROM THE VIEWPOINT OF THE ROENTGENOLOGIST

By Dr. Jones

The constitutional symptoms following or accompanying the deep application of roentgen rays, which form the subject of the present paper, consist principally in a feeling of nausea. A detailed description of these symptoms does not enter into the scope of this paper; nor indeed is it necessary to dwell upon them at length, as every roentgenologist is, much to his dismay, acquainted with the unpleasant manifestations from his personal observations in actual practice.

The task of the physician is to alleviate the physical sufferings of mankind, and if this applies with full force to the sufferings that human flesh is heir to in the ordinary course of events, it applies with even greater force to sufferings which, so to speak, are of his own creation—the consequence of the treatment he applies in the form of roentgen rays. Furthermore, it requires neither argument nor discussion to establish the fact that, in order to remedy an evil, the causative factor must be known; otherwise no specific antidote or preventive can be applied. In the absence of any positive knowledge as to the cause of a pathological condition all remedies applied are necessarily empiric and tentative, and we are more or less groping in the dark.

Several authors, including Pfahler and Lange, have discussed the unpleasant symptoms following deep roentgenotherapy, setting forth two main theories to explain their cause and origin. Pfahler takes the stand that nausea results from the gases produced by the high tension current, and that indeed is a very plausible assumption. But if these gases were the actual causative factor, the problem of dealing with the nuisance—for it would amount to nothing but a nuisance in that case—would be delightfully simple. A properly and scientifically arranged ventilation of the room would, to a large extent at least, carry off the obnoxious gases and substitute fresh, wholesome air. But, unfortunately, the theory does not hold good. If it did, how explain the fact that the roentgenologist administering the treatment, the nurses, attendants and

*In the absence of Dr. James T. Case, Major Medical Reserve Corps, now in France.

friends who may be present in the room at the time of treatment, are not similarly affected? It is undoubtedly a fact that they all experience the sensation of the air being impregnated with ozone, but it is equally true that they do not experience that peculiar sensation of nausea that characterizes the complaints of patients upon whom the rays are therapeutically directed.

On the other hand, it must readily be admitted that a patient who experiences physical discomfort in the shape of nausea from whatever cause would receive an additional shock from the presence of obnoxious gases in the air; to that extent the high tension current must be adjudged guilty. Since patients have not, and can not have, any other explanation of their sensation, they would naturally look upon the air they breathe as the source of the trouble. But by logical inference it is clearly not the only, and certainly not the exciting cause of the phenomenon, and we are therefore not justified in stopping our researches and attempts at relief with the problem of improved ventilation. The odor in the room is only an associated cause.

As soon as the attention of roentgenologists was directed to the possibility of the odor being the actual source of the trouble, improved ventilation was resorted to. The effect on the patients, however, was only temporary and to all appearances more psychic than real, especially in the case of patients who had strong convictions that an improvement of the circumambient air would allay their complaints. After a little time, however, when the psychic effect had passed away, they experienced the same manifestations as before.

The theory advanced by Lange is along different lines. Lange attributes these symptoms largely to acidosis, and this theory is likewise plausible. It is fortunate that we have in the Battle Creek Sanitarium the facilities and means at our disposal to put this theory to a scientific test. Accordingly Dr. Paul Roth, of the physiological staff, has given considerable time and study to the problem under discussion, and he has summarized his investigations in the second part of this paper.

FROM THE VIEWPOINT OF THE EXPERIMENTAL PHYSIOLOGIST

By Dr. Roth

Acidosis indicates a failure in the delicate function of a special mechanism by which a proper equilibrium in the acid and base content of the blood is maintained. Variations in the acid-base contents of the blood are allowable only within decidedly small limits, and a step beyond these, particularly in the direction of hypo-alkalinity, is of just as much significance as is a departure from the normal limits of body temperature as indicated by various degrees of fever.

The importance of the use of the clinical thermometer is undisputed and, like the counting of the pulse, is universally resorted to as much because it is easily done as because its value is recognized.

Acidosis is of frequent occurrence and if its detection and the estimation of its intensity were as easily performed as the taking of the temperature or the pulse, the chances are that a clinical search for this departure from the normal would be as often performed. The maintenance of a proper equilibrium in the acid-base content of the blood is done chiefly by the kidneys and by the elimination of CO_2 from the lungs. Until quite recently, a diagnosis of acidosis was usually based upon the interpretation of one or more of such urinary findings as the reaction of ammonia, betaoxybutyric acid, diacetic acid and acetone. Knowing, however, that renal elimination is not always quantitatively proportional to the blood content, it is to be expected that acidosis has been reported at times where it did not actually exist, and that it has not always been recognized where it did occur. Severe grades of acidosis can at times be present without markedly affecting one or more of the urinary findings above mentioned.

There are now several methods by which acidosis can be accurately and readily determined. Observations upon the blood directly are, or would be expected to be, the most accurate. These methods consist in determining either the hydrogen concentration of the blood as in Marriott's method or the CO_2 combining power of the blood plasma as advocated by Van Slyke. The estimation of CO_2 tension in alveolar air has proven to be most reliable in determining acidosis in any degree of intensity. Space would not allow discussion of the various methods recommended for this purpose. They are based upon the fact that the CO_2 content of the blood as also of the alveolar air is inversely proportioned to the degree of acidosis; the lower the CO_2 tension in alveolar air the more severe is the acidosis. The analysis of the samples of expired air obtained in these various methods is identical, but it is in the manner of collecting these samples that the methods vary.

In our work we have adopted the method I have worked out, which is a modification of both the Haldane and Plesch-Higgins methods. This method commends itself for its simplicity and universal adaptation to all sorts of conditions and for its reliability in obtaining samples for analysis. For a brief description of the method see my paper on the "Estimation of CO_2 Content in Alveolar Air," published in the *Journal of the A.M.A.*, July 31, 1915, LXV, pp. 413–18.

In connection with the work herein reported, great care was taken to secure samples of alveolar air from the patient before and after the roentgen treatment under identical conditions. The patient in all cases was required to sit slightly reclined in a comfortable chair for at least five minutes before the sample was secured. In most cases, the samples were taken in duplicate. It is evident that the results obtained do not indicate the occurrence of acidosis as the result of the roentgen treatment. Even in those cases which showed some degree of acidosis before the treatment, this condition was not increased by the treatment.

Conclusions from Technical Observations

Having satisfied myself that neither ozone-laden air nor acidosis is the real causative factor of the nausea in deep roentgen treatment, I paid special attention to ascertaining whether the roentgen rays produced an effect differing with the part of the human anatomy upon which they were directed. These suspicions were amply confirmed.

In our treatment of deep-seated lesions we were able to give large doses of roentgen rays without arousing any of the unpleasant symptoms until we arrived at the gastric region. It was usually only in that region that the deep application of *x*-rays resulted in nausea and vomiting. In cases such as Hodgkin's disease, where large doses were applied to the axilla, cervical glands and upper mediastinal region, the patients were free from this distressing form of the complaint, but as soon as the lower chest was treated, nausea and sick stomach resulted. This observation was made in a number of patients, and indeed patients realized that it was the treatment over the gastric region that made them sick and would request me not to continue the application there.

I recall a case of splenic leukemia which was given large doses over all the long bones, where the patient experienced no inconvenience whatever. This set in, however, when I proceeded to treat two areas by the crossfire method over the stomach to reach the spleen. The results were quite definite in this case, but no more so than in many others, although special attention was given in this instance to the manifestations for the purposes of the observations I had undertaken.

So much for application of deep rays over the gastric region.

In treating mouth and throat troubles,

I found that patients complained of dry mouth due apparently to an arrest of salivary secretions. One patient with Hodgkin's disease, whose cervical glands had been roentgenized, drank two quarts of water during the night and found it necessary to keep sipping water to keep his mouth and throat moist.

When the region around the salivary glands was treated patients complained of the secretion being changed and of the presence of a brassy taste in the mouth, altering the flavor of food. Thus, one patient who was treated for cancer of the upper maxilla lost all taste for tobacco, while another stated that all food tasted very salty to him after the treatment.

Turning to the treatment of breast cases, I have found that patients complained of loss of appetite. This may have been associated with some vague apprehension of nausea, but there certainly were not the marked symptoms that characterize the treatment over the gastric region.

Considering the fact that in all these observations the technique of the high tension current with its attendant production of ozone was the same, it seems to me perfectly plain that the deep roentgen rays affect different anatomical parts in different ways and accordingly produce different constitutional by-effects.

Thus, in the application of the rays in breast cases I have been led to conclude that it is the irritation of the vagus nerve to which the untoward by-effects should be attributed. A similar observation has been made by Dr. James Ewing, judging by his statement in the *Journal of the American Medical Association* for April 27, 1917, p. 1245, to the effect that "prolonged radiation of the stomach or the vagus nerve is commonly followed by nausea or vomiting," the only difference being that Ewing did not discriminate between the effects of the application of the rays over the stomach on the one hand and over the vagus nerve on the other.

The feeling of dryness in the mouth, excessive thirst, the presence of a brassy taste, the disappearance of the appreciation of taste for otherwise strong substances like tobacco, and the change in the flavor of foods, clearly indicate that the salivary and other glands in the region referred to are strongly affected, causing them to undergo changes of function.

Under these circumstances is it not reasonable to suppose that the gastric glands undergo a similar change from the effects of deep roentgen treatment over the gastric region, resulting in nausea?

From my observations such in all probability is the case, and while a recognition of the facts does not bring us appreciably nearer a solution as to how to obviate the evil, it will at least pave the way to further investigations in a more logical direction than that of gases and acidosis. We have convinced ourselves that the latter are merely contributing factors under adverse circumstances and that even their total elimination would not remedy the evil. It seems natural, therefore, to assume that only improved technique might eventually be able to overcome these undesirable by-effects, and it is to the desirability of such achievement that I wished to call your attention.

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REPORT OF A CASE OF DILATATION OF ESOPHAGUS FROM CARDIOSPASM*

BY ALBERTUS COTTON, A.M., M.D.

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BALTIMORE, MD.

THIS case has been reported in a paper entitled, "A Case of Huge Dilatation of the Esophagus," by Dr. Julius Friedenwald, Dr. A. C. Harrison, and myself which was read by Dr. Friedenwald before the American Gastro-Enterological Society last spring, and will appear in the September number of the *Journal of the Southern Medical Association.*

My report to this Society will be a brief summary of the history of the case with clinical and roentgenological examinations, treatment, and autopsy findings.

History of Case

B. F. C., age 40 years; occupation brakeman; was referred to me by Dr. Z. K. Wiley in December, 1916, for gastro-intestinal roentgenological examination for suspected pyloric stenosis. The very unusual condition shown by *x*-ray examination induced Dr. Wiley to call in consultation Dr. Julius Friedenwald, who assumed supervision of the examination and treatment of the patient.

The essential points in the history of the case are as follows:

Family History........Negative

Previous History.......Negative

History of present condition—Patient was well until twenty-two years of age. He dates the onset of his trouble from an acute attack of indigestion experienced at this time.

The symptoms complained of were:

(*a*) Eructations and regurgitation of food, both voluntary and involuntary, by mouthful after eating, and continuing from two to ten hours.

(*b*) Nausea often experienced; bad taste frequent.

(*c*) Vomiting when not relieved by regurgitation. No hematemesis.

(*d*) Occasional pain relieved by regurgitation or vomiting.

(*e*) Epigastric fullness and discomfort after eating occurred often.

(*f*) Appetite good and rarely satiated. Patient could eat at one time two-thirds of a loaf of bread, two eggs, two glasses of water and two cups of coffee.

(*g*) Bowels constipated.

(*h*) Headaches.

(*i*) Periods of remission of symptoms of one to two months. For past six months symptoms constant and patient complained of great weakness, with loss in weight of forty pounds.

Physical Examination

(*a*) Pallor and emaciation.

(*b*) Chest.—Lungs normal. Heart displaced downward and to right, with apex beat beneath ensiform cartilage.

(*c*) Abdomen—No palpable tumor, veins enlarged, liver and spleen not enlarged, no tender areas; both external abdominal rings enlarged with small hernias (from strain of vomiting).

(*d*) Urine practically negative.

(*e*) Blood examination: 3,540,000 reds; 7,300 whites; hemoglobin 65%; Wassermann negative. Examination of contents of esophagus after Ewald test-breakfast, 530 c.c. obtained; white, total acidity 25, absence HCl with mucus and lactic acid; microscopically, starch granules—yeast cells—and Opper-Boas bacilli; twelve hours retention of 650 c.c. obtained during life.

Roentgen Examination

Both roentgenoscope and plates were used in the roentgen examination. Most

*Read at the Eighteenth Annual Meeting of the American Roentgen Ray Society, New York, Sept., 1917.

Fig. 1. Residue in Dilated Esophagus.
Note small residue in stomach which is situated in left iliac fossa.

of the work was done with plates, twenty of which were taken. The roentgenoscope served to confirm the findings of the plates.

A large barium shadow, conical, but shaped below at base of cone like a reversed stomach, was shown above the diaphragm. After repeated attempts, a plate was obtained showing thin stream of barium extending from large mass above diaphragm to smaller residue in left iliac region. Similar small residues were shown in left iliac region on two other plates, and a shot attached to silk string and swallowed, was shown in same location forty-eight hours after being swallowed. Very marked 12, some 24, and slight 48-hour retention of barium mass above diaphragm was shown by plates.

The roentgenological diagnosis was dilatation of esophagus; partial obstruction at cardia, stomach ptotic in left iliac region. Possible causes of esophageal dilatation considered at the time were: congenital diverticulum; ulcer of cardia with stricture; carcinoma (malignant degeneration of old ulcer of cardia); cardiospasm.

On account of the shape of the barium mass above the diaphragm (reversed stomach), the diagnosis of diaphragmatic hernia of stomach was considered, but quickly dismissed after obtaining evidence of stomach in left iliac region. Attempts were made to treat obstruction at cardia. First, by passage of Einhorn duodenal tube, which failed to pass cardia. Second, by introducing silk thread to be used as a guide for passage of olive bougies. The string reached stomach but failed to pass through pylorus, due to pylorospasm, and this method of treatment was abandoned.

On December 15th a gastrotomy was done by Dr. A. C. Harrison for the purpose of dilating cardia from below. The cardia and upper abdomen were examined for evidence of tumor mass or callous ulcer with negative result. On opening stomach the previously swallowed silk string was found, by means of which graduated bougies up to the largest size were easily passed through cardia from below.

On account of the ease with which the

Fig. 2. A Lateral Oblique View of the Chest.
The barium is shown in the dilated esophagus.

Fig. 3. An Anteroposterior View of the Lower Chest and Upper Abdomen.

This shows the twenty-four-hour residue in the dilated esophageal sac.

Fig. 4. Small Forty-eight-hour Residue in the Esophageal Sac.

Note shot which had been swallowed forty-eight hours previously, in the stomach in the left iliac fossa.

cardia was dilated and the danger of infection from doing gastrostomy at this time, the opening in the stomach was closed.

The patient could swallow and was free from vomiting for a few days, after which he was unable to retain any food and his condition became worse. On December 23rd a gastrostomy was done under local anesthesia. He was fed through the gastrostomy opening but continued to grow weaker, and died on December 25th.

Autopsy Findings

Chest:—Left thorax normal. Behind right lung lay the greatly dilated esophagus. It was fusiform in shape, its small end extending to the cricoid cartilage in neck. The sac when removed was found to hold 1,750 c.c. of water. The stomach was normal in size (750 c.c. capacity); position to left with some ptosis. Examination of the dilated esophageal sac and its relation to the cardia showed that the obstruction to the passage of barium mass through

Fig. 5. Residue in the Dilated Esophagus with Thin Stream of Bismuth Extending to the Residue in the Stomach in the Left Iliac Fossa.

Small diaphragm used inadvertently in this plate.

cardia was mechanical and due to a trap valve at cardiac opening of the stomach caused by the weight of contents at bottom of sac.

The conclusion reached after studying data obtained from clinical and roentgenological examination, exploratory, operative, and autopsy findings, was that this was a case of cardiospasm originally, followed by dilatation of the esophagus.

PRESENT CONDITION OF A CASE OF CONGENITAL DISLOCATION OF THE HIP, REDUCED BY DR. LORENZ IN 1902 *

BY FRANCES C. TURLEY, M.D.

LOS ANGELES, CAL.

FIRST a brief general statement of some facts gleaned from an interesting paper by Dr. P. Le Damany:[1] Hip luxations are thirteen times more frequent than harelip and ten times more frequent than clubfoot, occur about five times in woman to once in man, with greater frequency in the white race than in the oriental or negro, with less frequency in cities than in the country. Congenital hip luxations are unknown in animals. The cause in man is the extreme flexion of an elongated femur within an ovoid uterus. The hyperflexed femur becomes a lever of the first class, the anterior superior iliac spine is the fulcrum; the pressure of the uterine wall upon the flexed fetal knee, the power; and the fixed head in the cotyloid cavity, the weight. The femoral head is thus lifted from the cotyloid cavity, resulting in a leveling of the acetabulum and a torsion of the femoral neck at the superior diaphyseal line. Luxation occurring at birth is by extension.

The case in point, together with five others, was operated upon in the fall of 1902 in the amphitheater of the University of Southern California Medical School, located at Los Angeles.

Dr. C. G. Toland, now a member of our office staff, was present at the operation. He also made the recent physical examination upon which this report is based.

The clinical diagnosis of congenital dislocation of the right hip was confirmed by a roentgen examination made by Dr. Albert Soiland of Los Angeles.

The child was nearly six years of age. The usual bloodless method was employed and the first cast applied.

Dr. P. C. H. Pahl carried out the regulation after treatment, as advised by Dr. Lorenz in these cases, the entire course requiring one year.

Fig. 1. Roentgenogram Showing Condition of Hip Dislocation When Observed by Dr. Soiland.

The child attended kindergarten during the cast period; she entered public school at the age of nine and graduated from High School at the age of eighteen. During this period she ran and played as other children. She climbed trees, rode horseback, and swam. She entered a Training School for Nurses in October, 1916, and is able to perform the regular duties of a nurse in training.

Examination at the present time, August 22, 1917:

[1] Le Damany, P., *Amer. Jour. Orthop. Surg.*, Apr. 1914, vol. xi, No. 4.

* Read before the Eighteenth Annual Meeting of the American Roentgen Ray Society, New York, Sept. 20, 1917.

Family History—no sisters, two brothers, and father living and well. Mother living, aged 53 years, has high blood pressure and has had slight paralytic symptoms.

Personal History—unimportant.

Physical Examination—Age, 20 years;

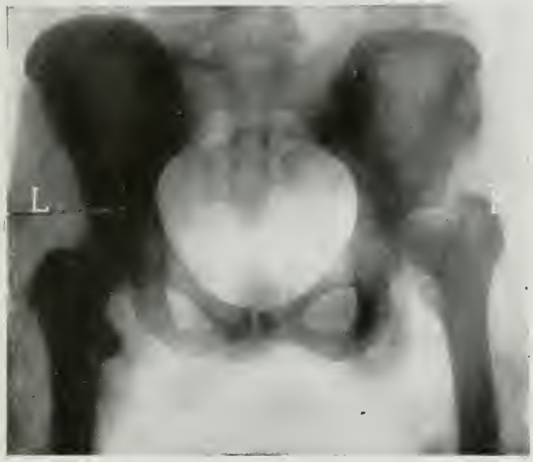

Fig. 2. Roentgenogram Showing Present Condition.

height, 5 ft. 7 in.; weight, 170 lbs.; general appearance, robust; walks without a limp. The right gluteal region is flatter and the right thigh and leg lesser in circumference than the left. The spine is straight. There is no perceptible pelvic tilt; there is but a slight difference in length of the lower limbs, flexion, extension, adduction and abduction are not limited.

Roentgen Examination—the development of the right femur below the neck is the same as the left. The head of the right femur is deformed, being somewhat mushroomed, and there is a slight coxa vara.

This is the only one of the six cases operated upon known to have a perfect functional result.

Dr. Ridlon,[2] in twenty-nine hips reduced by Dr. Lorenz, and subsequently examined by him, found a perfect functional result in only one-tenth of the cases. Possibly this is due to the after treatment carried out without his personal supervision, for he reports a general good functional result in about 50 per cent. of his operations performed on all cases, at home. American operators claim from 50 to 90 per cent. of good functional results.

From the above we may conclude that congenital dislocation of the hip is a not uncommon occurrence, that the bloodless operation of Lorenz is well worth trying and that the roentgenological field of investigation is large.

[2] Ridlon, J. The Ultimate Results of the Replacement of Congenitally Dislocated Hips. *Jour. A. M. A.*, April 16 and 23, 1904, pp. 1011, 1063.

ROENTGEN EXAMINATION IN PEPTIC ULCER

At a meeting of the Medical Society of the State of New York, held at Utica from April 24 to 26, 1917, Dr. L. G. Cole stated, according to a report in the *Medical Record* for July 28, 1917, he had long felt that the ascending portion of the duodenum had characteristics altogether of stomach and not of duodenum. Osler's observations corroborated this. He therefore referred to peptic ulcers as being prepyloric or postpyloric, the latter being beyond the sphincter. Morphologically the disease was surrounded by an area of induration and might go down to the muscular coat or farther. That region of the stomach was rendered less pliable as a result, and cicatricial contractions or adhesions might be associated with it. He believed that a small early ulcer could be diagnosed as accurately by serial roentgenology as a fracture of the long bones could be discovered by a single roentgenogram. He showed slides showing the deformity of the cap of the duodenum, cicatricial contraction, burrowing ulcer, and small healed ulcer.

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"INSTRUCTIVE MISTAKES"

Under this title, the *British Journal of Surgery* conducts a department for case notes which appears to us helpful and instructive. Rare and interesting cases are always of profit, and should be published more frequently than is the case at present.

The particular instance reported in the October, 1917, issue of the journal mentioned is extremely interesting from the *x*-ray point of view. The patient, a shipwright, age 29, reported sick, complaining of pain in the left gluteal region. After twelve days' treatment he returned to full duty. Later, at several intervals, he was returned to the hospital for varying periods of treatment. Finally his case was submitted to the *x*-rays for study, on the strength of which he was reported to have a fracture of the ilium. On the receipt of this report and a history of an alleged previous fall, his case was taken up legally and application made for compensation. Some questions arising, the Admiralty referred him for exhaustive investigation.

X-ray examination revealed that the line of fissure seen in the ilium was not a fracture, but an abnormally large canal for a nutrient artery. There was no evidence of sacro-iliac disease. There was lateral curvature of the lumbar vertebræ to the right, but no evidence of caries of the spine, though there were slight signs of osteo-arthritis of the vertebræ in that region. Clinically, this curvature was detected, and it was noted that there was also marked rigidity of the lumbar spine. The further past history was elicited that at the age of ten years he had an attack of typhoid fever, and this was followed by "trouble in his back," and subsequently by the formation of an abscess, which was opened; the scar of this can still be seen. The case was, therefore, probably one of post-typhoid "rigid-spine" and his pain was due to a sciatica in combination with the lumbar curvature and rigidity.

The interest raised by this case caused the author to examine others. In two or three cases the markings were as noticeable as in the original case.

The most common marking is that of a V-shaped appearance, situated on the body of the ilium close to the sacro-iliac synchondrosis, and this is practically the only one that is apparent in the ilia *x*-rayed in the living subject. The V-shaped mark represents the canals for the nutrient arteries and their veins. The more central of the arms of the V is found to belong to the canal which gives ingress on the anterior or internal surface of the ilium to the nutrient artery derived from the iliolumbar artery, while the outer arm of the V represents that leading from the foramen on the posterior or external surface of the ilium which is supplied by the nutrient branch of the inferior gluteal artery. At the apex of the V these two separate arteries anastomose, and from that common point send off small branches to nourish the surrounding bone. This common point is situated in the thickest part of the ilium, just above the acetabulum, and above the sciatic notch, and it is reasonable to suppose that this is the true primary center of the ossification of the ilium. The point of junction is practically constant.

On the other hand, the position and number of the foramina for the entrance of the nutrient arteries show a wide diversity. On the internal surface of the ilium, the commonest situation for the foramen appears to be at the lower part of the internal iliac fossa, close to the auricular portion of the ilium which articulates with the sacrum. This foramen is the only one of any size in about 50 per cent. of the cases, but it may be double or multiple, in which case the canals may be too small to be demonstrated by the *x*-rays or by the passing of a bristle. Another position in which an additional or alternative foramen is found is just below the iliopectineal line, above the upper border of the great sacrosciatic notch. This also invariably leads to the common point of anastomosis.

This article is of exceeding interest in demonstrating that it is possible to mistake an unusually large nutrient artery in the ilium for a fracture of that bone; further, it brings out the fact that the nutrient arteries of the ilium, whatever their point of entry, invariably converge to a common meeting-point, which may be considered the true primary center of ossification of that bone.

J. T. C.

Roentgen Ray Technicians, "Manipulators"

The United States Army is in need of several hundred roentgen ray technicians. The editors recognize that this term is a misnomer and prefer the term "manipulator" which is employed by the French to designate the lay assistants to roentgenologists. The Surgeon General's Office has already started a class for roentgen ray manipulators and some of them are on their way to France.

A much larger number will be trained in this work as soon as arrangements can be made for enlarging the present school or establishing other schools elsewhere. These "manipulators" not only receive very useful training but in the routine discharge of their duties they come in contact with more varied phases of war work than falls to the lot of the average employee of the army medical service.

The training consists of instruction in the physics and mechanics of roentgen ray apparatus, the care of roentgen ray machines and apparatus, various photographic dark room work and instruction in tube manipulation for routine roentgenographic work.

The editor is authorized to request the readers of this journal to send to the Surgeon General's Office, *X*-Ray Division, Washington, D. C., the names of young men they can recommend for this service.

It will be necessary for all of these men to enlist if they have not already enlisted. There are doubtless already in the enlisted service many young men who would be suitable for this work.

Young men of draft age who are not likely to be called up for immediate service will still be permitted to enlist if they will secure from their local draft board a certification that their number or classification is not liable to early call. The Surgeon General's Office, if addressed as above specified, will be glad to answer any queries regarding this type of medical help.

J. T. C.

TRANSLATIONS & ABSTRACTS

HESS, JULIUS H. The Diagnosis of the Age of the Fetus by the Use of Roentgenograms, *Am. Jour. Dis. of Children*, Vol. 14, No. 6, December, 1917, page 397.

This is an extremely interesting and instructive article which evidently represents a great deal of work. It is often of considerable practical importance to determine the age of the fetus. On the age of the fetus and on its development are based the chief factors that are to be considered before giving prognosis as to the possibility of saving the life of the prematurely born infant. The method of treatment, and especially that of feeding, depends primarily on the age of such infant. In medicolegal cases the question of the age of the fetus may occasionally be of paramount importance, and when only portions of the fetus are available for examination, the roentgenographic method offers the best means for arriving at a diagnosis of the age of such fetus.

Fig. 1 represents a diagram which it would be well to enlarge and place upon the walls of every *x*-ray diagnostic laboratory. This diagram is reproduced herewith. A valuable amount of data has been incorporated in this single plate.

This study is based upon the investigation of fifty-five normal cases which have been determined from the history of menstruation and pregnancy and from other measurements. A number of valuable tables accompany the article. These have been condensed as follows:

TIME OF APPEARANCE OF CENTERS OF OSSIFICATION

Head

Mandible	7th	week
Occipital bone (squamous portion)	8th	"
(lateral and basilar p.)	9th–10th	"
Superior maxilla	8th	"
Temporal bone (petrous, mastoid and zygoma)	9th	"
Sphenoid (inner lamella of pterygoid process)	9th	"
(great wings)	10th	"
(lesser wings)	13th	"
(anterior body)	13th–14th	"
Nasal bone	10th	"
Frontal bone	9th–10th	"
Bony labyrinth	17th–20th	"
Milk teeth (rudiments)	17th–28th	"
Hyoid bone (greater cornua)	29th–32d	"

Shoulder Girdle

Clavicle (diaphysis)	7th	week
Scapula	8th–9th	"

Upper Extremity

Humerus (diaphysis)	8th	week
Radius (diaphysis)	8th	"
Ulna (diaphysis)	8th	"
Phalanges, terminal	9th	"
basal 2d and 3d	9th	"
basal 4th and 1st	10th	"
basal 5th	11th–12th	"
middle 3d, 4th, 2d	12th	"
middle 5th	13th–16th	"
Metacarpals, 2d and 3d	9th	"
4th, 5th, 1st	10th–12th	"

Vertebræ

Arches, all cervical and upper 1st and 2d dorsal	9th	week
all dorsal and 1st or 2d lumbar	10th	"
lower lumbar	11th	"
upper sacral	12th	"
4th sacral	19th–25th	"
Bodies from 2d dorsal to last lumbar	10th	"
from lower cervical to upper sacral	11th	"
from upper cervical to lower sacral	12th	"
5th sacral	13th–28th	"
1st coccygeal	37th–40th	"
structural arrangement	13th–16th	"
odontoid process of axis	17th–20th	"
Costal processes, 6th and 7th cervical	21st–33d	"
5th cervical	33d–36th	"
4th, 3d, 2d cervical	37th–40th	"
Transverse processes, cervical and dorsal	21st–24th	"
lumbar	25th–28th	"

Ribs and Sternum

Ribs, 5th, 6th, 7th	8th–9th	week
2d, 3d, 4th, 8th, 9th, 10th, 11th	9th	"
1st	10th	"
12th (very irregular)	10th	"

Sternum

Sternum	21st–24th	week

Pelvic Girdle

Ilium	9th	week
Ischium (descending ramus)	16th–17th	"
Os pubis (horizontal ramus)	21st–28th	"

Lower Extremity

Femur (diaphysis)	8th–9th	week
(distal diaphysis)	35th–40th	"
Tibia (diaphysis)	8th–9th	"
(proximal epiphysis)	40th	"
Fibula	9th	"
Os calcis	21st–29th	"
Astragalus	24th–32d	"
Cuboid	40th	"
Metatarsal, 2d and 3d	9th	"
4th, 5th, and 1st	10th–12th	"
Phalanges, terminal 1st	9th	"
terminal 2d, 3d, 4th	10th–12th	"
terminal 5th	13th–14th	"
nasal 1st, 2d, 3d, 4th, 5th	13th–14th	"
middle 2d	20th–25th	"
middle 3d	21st–26th	"
middle 4th	29th–32d	"
middle 5th	33d–36th	"

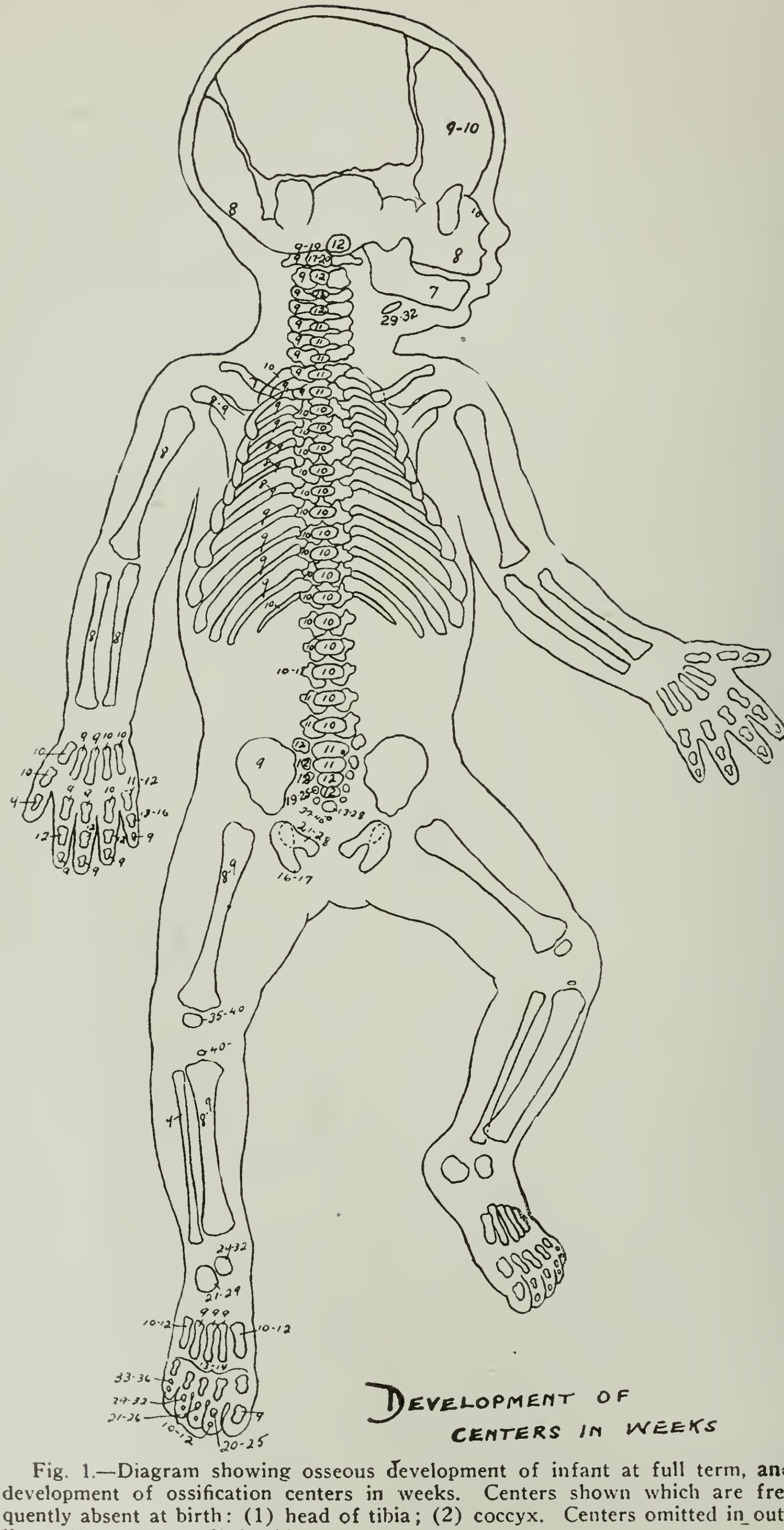

Fig. 1.—Diagram showing osseous development of infant at full term, and development of ossification centers in weeks. Centers shown which are frequently absent at birth: (1) head of tibia; (2) coccyx. Centers omitted in outline: (1) sternum; (2) hyoid.

There are, as might be expected, some variations in the normal process of ossification, and it is also influenced by pathologic conditions of the mother and of the fetus (for example, syphilis, rickets, osteogenesis imperfecta, etc.). In general, these pathologic processes may well be diagnosed in the roentgenograms so that an error may easily be prevented. In some portions of the skeleton the ossification is less regular than in others, and as a general rule the more caudad the portions of the skeleton are, the more they are subject to variations in the process of ossification; and the centers which develop at a later period of fetal life are also more variable. Thus, there are considerable variations in the time of appearance of centers of ossification in the sacral vertebræ. The foot, as a general rule, is unreliable as an indicator of the age of the fetus. The ossification of the sternum is also irregular in the time of appearance, size and arrangements of the centers of ossification.

The author refers to the several roentgenographic studies of the fetus by Alexander, Bade, Hasselwander and Lambertz. Reference is also made to the classical work of Mall.

The estimation of the age of the fetus can be made with greater accuracy in the first half because many more new centers appear duiing the first months, also because the appearance of the new centers is more constant. The peculiar advantage of the roentgen method for determining the age of the fetus lies in the fact that many centers of ossification are the factors taken into consideration for arriving at definite conclusions. In studying the roentgenograms, the author recommends the use of a reading glass about four inches in diameter.

Funk, Elmer H. Osteitis Deformans, *Medical Clinics of North America*, Vol. 1, No. 2, September, 1917, p. 451.

The author states that since the first case described by Sir James Paget in 1876, there have been reported up to June 1, 1917, only 232 authentic cases of osteitis deformans. Only three cases of this disease were recognized in thirty-eight thousand admissions to the new Jefferson Hospital in a period of seven years. Hurwitz reported only three cases in thirty thousand admissions to the Johns Hopkins Hospital.

The present article deals with an early case which is reported in full with roentgenologic studies by Dr. W. F. Manges. The disease was of particular interest because it was apparently confined to one bone. The author is under the impression that this case of monoosteitic involvement together with a case reported by Bowlby and Hurwitz are the only ones on record in which the disease is limited to the femur.

The reviewer feels that it is unfortunate that so many interesting cases of rare pathology go unreported for he has recently been shown two similar cases while visiting various roentgenologists in this country. He would take this opportunity of urging upon our readers that they should submit for publication in this journal reports of interesting cases which occur in their practice. A brief survey of the literature will add much to the interest of each reported case.

Barling, Gilbert. Peptic Ulcer Opening into the Transverse Colon, *Brit. Jour. of Surg.*, Vol. 5, No. 18, October, 1917, p. 343.

This case is reported on account of its rarity and because the symptoms were more or less obscure until the roentgenographic examination was made. Three years previously, the patient had been operated upon, a gastrojejunostomy being done for duodenal ulcer. A large cicatrized ulcer of the duodenum was found just beyond the pylorus. A no-loop transmesocolic jejunostomy was done, thread being employed for the outer row of sutures.

The patient was well for a year and a half after which he began to suffer a good deal of discomfort after eating, loss of weight, vomiting and diarrhea. At times he was free from these symptoms. Wasting was rather extreme and there was a curious edema about the legs and abdominal wall. At this time roentgenographic examination showed food passing direct from the stomach through the gastrojejunostomy opening without any delay. The course of the meal was then difficult to follow. Part of it appeared to travel downwards on the left side in the line of the descending colon. It was not possible to say whether it was actually in the colon, or whether it was in the dilated small intestine. Another part of the meal travelled to the right, apparently along the line of the transverse colon towards the hepatic flexure, and within ten minutes of eating the cecum was seen to be filled.

The patient finally died without the surgeon having an opportunity to re-operate. At post-mortem, there was found on the mesenteric border of the jejunum immediately opposite the gastrojejunostomy opening an ulcer about five-eighths of an inch in diameter, but not very deep in most of its extent. The ulceration spreading from this had opened into the transverse colon, where there was a communication about half an inch in diameter between the jejunum and the colon. The margins of this opening were perfectly healed and smooth.

Case, James T. The Value of *X*-ray in Cholelithiasis, *Annals of Surgery*, Vol. LXVI, No. 1, July, 1917, p. 69.

Case refers to the element of doubt which exists in nearly every clinical diagnosis of gallstones unless the gallstones have been shown on the roentgenographic plate. It is a well known fact that many surgeons no longer make a definite diagnosis of gallstones, preferring to state the diagnosis in a somewhat less definite manner such as gallbladder disease or gallbladder infection. The author recognizes that the negative roentgen findings do not for a moment negative the diagnosis. A number of statistics are cited, both from the author's experience and from the literature, which in his opinion warrant the conclusion that it is definitely possible to show gallstones in approximately 50 per cent. of positive cases, and to show evidence of gallbladder disease in 85 per cent. of positive cases.

O'Reilly, J. J. A. Railway Spine's Little Sister, *Inter. Jour. Surgery*, Vol. 30, No. 11, November, 1917, p. 369.

This article, written by a medical member of the New York bar, is an exceedingly interesting commentary upon the misuse of *x*-ray plates. The article is as follows:

"Traumatic Hystero-Neurasthenia (Neurosis) recently played a successful engagement in the New York Supreme Court (theater). The nominal receipts to the pitiable lady who enacted the title rôle and spoke her lines from a cot carried into Court was $25,000, but an unsympathetic Appellate Court reduced the actual receipts to $10,000. Quite enough, say you? More than enough, say I, in the light of the physical and medical facts in the case, which were evidently not appreciated by the defendant's doctors or attorneys, since no medical evidence was introduced by them to inform the jury that the allegations were utterly at variance with facts of physical and medical science which are so patent as to be almost axiomatic.

"A young woman, age 19, claimed to have fallen into a hole 5 ft. deep and to have landed on both feet and in such a position that her knees were driven up against her stomach. The immediate effect of this force was alleged to have caused some inconsequential cuts, bruises and a sprain, and to have so disarranged her abdominal organs that the stomach was displaced four inches downward and the transverse colon bent into a V shape with the point of the V in the true pelvis (a downward displacement of six inches or more); that the left kidney was displaced downward (distance not stated); that the womb was retroflexed and displaced downward, but what degree of prolapse the testimony did not show; and that the left ovary was displaced downward and backward behind the uterus.

"The hole was near a railroad track, and prior to the accident the woman saw a train several blocks away and, while in the hole, was conscious of this as a recollection. She decided to remain there until the train passed, after which she raised herself by her hands and emerged from the hole, walked several hundred feet, took a train for a distance of several miles to a terminal and reported the accident. She then descended a high stairway to the street and ascended a high stairway to the other side, took an elevated train to a station near her home, got off and had some conversation, reboarded the train and left it at her home station, walked several blocks to her home and went to bed. Next day she walked to the scene of the accident (about five blocks), returned home, went to bed, and when a doctor reached her at four o'clock the next day, 45 hours after the accident, he found her 'nervous and trembling,' and in what he called 'profound shock.' He treated her local injuries and did not know at that time that she had this visceroptosis, but discovered it three weeks later, after three weeks she returned to business and four months later took to her bed and remained there until her dramatic entry into court and thereafter until the following May, nearly fifteen months, during which time she was on a liquid diet and became steadily emaciated, had constant abdominal pain with acute paroxysmal exacerbations, during which, while constantly losing strength, she was able to pull her 220 pound doctor off his chair, although she was unable to bear the delicate and erudite touch of that doctor's examining hand on the abdomen.

"After the verdict was secured she began to improve so that a few days before her majority, seven months later, she was able to rise from her bed and five months after she ceased to be bed-ridden she presented the appearance of the average healthy girl. She moved at ordinary strolling speed and sat naturally in a chair, crossing her legs, and when changing her position raised her hips from the chair perhaps three inches, sat down with a 'jolt' and recrossed her legs, occasionally bending forward and clasping her knees and generally assuming natural and unstrained positions. For a few moments, while describing the period of taking to bed, she twitched the corners of her mouth from side to side (choreiformly), perhaps five times, but during the time preceding and succeeding this, covering several hours, she did not exhibit this motion.

"The only treatment which this girl received during the nineteen months following her accident was hypodermic injections of morphin twice (and sometimes thrice) a day for most of the days in that period, with occasional use of other sedatives to take the place of the morphin, and toward the end of the bed-ridden stage a surgical corset—and 'she was never constipated in her life.'

"Some x-rays were taken of this woman's abdomen, and the visceroptosis referred to was alleged to have been found, but the possibly favorable physical conditions under which that was taken, i. e., holding the breath, full stomach, unevacuated bowels, etc., do not appear.

"A 'nerve-specialist' saw this case, and with the keenness of Sherlock Holmes discovered that this visceroptosis was leading a double life, and in the higher walks of 'Kultured' medicine was a 'Traumatic Neurosis, Hystero-Neurasthenia.'

"Curtain.

"Intermezzo. Business of transferring the case from a lower to a higher court with jurisdiction over larger claims for damages.

"Act II, the Court: Victim on a cot, testifying, medical experts and radiographists in the wings; some characters are missing but the play must go on without them. There is no one to show the jury that the stomach, transverse colon and kidney are anchored in their normal positions by ligaments of white fibrous tissue, which are so delicate that coarse print may be read through them; that a four-inch or six-inch sudden stretch means rupture of some fibers, and, at least, capillary hemorrhage, and that this means foreign matter, free blood, in the folds or upon the surface of the peritoneum and a peritonitis; that the drag of those dropped organs on the remains of their ligaments would mean pain so excruciating that the most stoical would lie in that home and shriek for help instead of clambering out after 'chinning' a car rail at the edge of the hole; that during the trip to and from the railroad terminal she would have been a public spectacle of agony, if not an unconscious passenger in an ambulance; that once in bed she would stay there and not 'view' the scene of the accident the next day; that once down those organs would stay down unless a major operation restored or an abdominal supporter sustained them; that she would not go down into a subway and climb stairs from the subway twice a day on her way to business for four months, and that the very least of her troubles would be constipation and auto-intoxication, even with a liquid diet of cereals. There was no one to explain to the jury that the violence to that kidney would probably strip its capsule, with the attendant pressure symptoms without, and congestive and hemorrhagic conditions within. There was no one to say what the sensitive diaphragm would be expected to do when this pull of the ligaments attached to it sought to drag it, too, downward toward the pelvis, or why that diaphragm did not seek to protect itself from the tug, tug, tug, of these loose organs during her peregrinations and register its protest by a distressing and continuous hiccough. There was no one to ask why this pain should be so agonizing that, emaciated as she was, she possessed the strength to move her ponderous physician from his chair, or why a sensitive abdomen, which could not bear the pressure of her physician's examining hand, could withstand the force of rigid recti-muscles, reinforced by the back, flank and thigh muscles as a brace, so that the pull of her arms might be effective in moving her doctor to his feet, if not to tears. There was no one to show the malign influence of suggestion upon the mind of this pleader for a portion of another's wealth; there was no one to show that even a V-shaped transverse colon, while anomalous, may be normal for the one who possesses it, or that its displacement may be the result of consistently continuous pressure of distended intestinal organs in the anemic and constipated girl, during her pubescent and adolescent years. There was no one to show that if she fell as she said, in the position she described, and with a force sufficient to displace those organs in the degree alleged, she could not possibly have retained the contents of her rectum, since two things cannot occupy the same place at the same time, and her clothing would be soiled not only by the dirt among which she fell but by the fecal matter within her rectum, since the force was exerted clear down into the true pelvis.

"There will be no return engagement as the incident is closed and the judgment recorded. A revival of such a situation should be impossible in the work of the readers of this column when 'Railway Spine' forms part of the issues of the case."

The moral of this is that in some way, the medical profession must educate its own members and the bench and bar, so that the rule of evidence which will only admit a photograph for "so much as it is worth" as a "representation" or circumstance from which an inference may be drawn, looking to the identity of something, should apply an even stricter rule to the *x*-ray plate and skiagraph, since, in order to make any inference whatever from it, the untrained mind of a juryman must speculate upon the known tissues and contour with which he is familiar, and his judgment is the result of an inference based upon a speculative conclusion which is itself based upon an inferential circumstance, and this is stretching evidence of an expert character much farther than the law intends or human society should tolerate.

Rogers, Mark H., and Foley, Thomas M. An Analysis of 75 Cases of Tuberculosis of the Spine in the Adult. (*Am. Jour. Orth. Surg.*, March, 1917, XV, 208.)

Tuberculosis of the spine in adults is more common than has been supposed, and differs materially from the disease in childhood. The diagnosis in adults is difficult and in this series an average of two years and two months elapsed before an accurate diagnosis was made. The first evidence of the disease in six cases was paraplegia, in five cases abscess. Previous diagnoses had been back-strain, lumbago, sciatica. Four cases had been considered gastro-intestinal, one had been operated upon for gallstones, one for appendicitis, one for perinephritic abscess, and one had had a nephropexy. Paraplegia was most common in the dorsal group, and abscess in the lumbar group. *X*-ray findings of the dorsal group in cases with no clinical evidence often show circumscribed abscess formation which does not spread. Most cases can be demonstrated roentgenologically to have some evidence of abscess. The kyphos is seldom large and produces but slight deformity. End-result was determined in 20 of these cases and showed 75% of good results. The principle of treatment is the same as with children,—rest in recumbency during the acute stage, fixation and protection for the duration of the disease. Bone grafting is advised in the dorsal region for the greater fixation and shortening of the time of treatment. It is especially adaptable for adults.

Hetzel, W. B. Isolated Disease of the Scaphoid Bone of the Foot (Köhler's Disease.) (*Am. Jour. Orth. Surg.*, March, 1917, XV, 214.)

General discussion and report of one case. Roentgen ray showed scaphoid smaller than normal, irregular in outline, no distinction between cortex and spongy portion, and much increased in density. Foot was immobilized in plaster of Paris. After three months the scaphoid had increased in size and decreased in density toward normal. According to Köhler the scaphoid shows changes in four ways: 1. One-half to one-quarter smaller than normal. 2. Form entirely irregular. 3. Architecture impossible to recognize, cortex and spongy portion running together. 4. Density increased two- to four-fold. This disease is a clinical entity, probably inflammatory, of an osteochondritic nature with typical radiographic picture and of good prognosis

Percy, James F. The End-Result of the Treatment of Inoperable Uterine Carcinoma by Heat. (*Med. Rec.*, June 16, 1917, p. 1063.)

In his paper on the above subject, read before the Annual Meeting of the American Medial Association, Percy claimed that, although is method of applying low heat to the uterus r inoperable cancer was only palliative, it as well worth while if only for the fact that he patient was relieved of the offensive discharge. In the discussion the consensus of pinion was by no means altogether in favor of he Percy method, and Dr. Bailey, of New ork, stated that he had used the method with adium treatment following, but had only the ame number of cures as when he had used adium without an abdominal operation. He hought the roentgen ray might be utilized to ind out just the line of demarcation where inluence of the heat ended.

Steiger. Arrest of a Malignant Intracranial Tumor by the Roentgen Rays. (*Correspondenzbl. f. Schweizer Aerzte*, March 10, 1917. Ref., *Med. Rec.*, May 26, 1917, p. 904.)

At a session last fall of the Berne Medico-Pharmaceutical Society Steiger presented a woman, aged 31, who had recently successfully undergone roentgen treatment for the following condition: Less than five months before she presented right exophthalmos and lockjaw, and the latter symptom greatly interfered with nutrition. The sight of the right eye began to fail, and ptosis and ophthalmoplegia developed. There was a painful swelling above the right zygomatic arch. A roentgenogram showed an enlarged sella and the diagnosis lay between tumor of the hypophysis and sarcoma of the base of the skull—probably the latter.

The tumor was rayed in all directions concentrically. Very hard filtered rays were used. In all there were 12 fields, 3 of which were used in a session of thirty minutes, daily sessions at first, after that somewhat irregularly, 1, 2, or 3 days of intermission. A roentgen dermatitis developed, but in the meantime considerable improvement had taken place. After an unavoidable absence of the patient for a month, radiation was resumed in three fields only. The exophthalmos was completely gone, and the eye was almost normal in all respects save vision, which had not returned. The jaws could be opened voluntarily to the extent of three centimeters without forcing. The patient looked and felt well.

Nordentoft, S. Roentgen Treatment of Brain Tumors. (*Ugeskrift for Læger*, May 17, 1917. Ref. *Jour. Am. Med. Assoc.*, July 14, 1917, p. 160.)

Nordentoft has now a record of twelve cases of brain tumors in which roentgen treatment has been applied and he reports complete success in three instances. The improvement was most marked in the better vision. Rapidly developing tumors are more liable to give good results than the more slowly growing. Symptoms from stasis and compression subside as the cause is removed. The loss of hair over the region was not permanent in any instance. The cure has persisted to date, the longest interval being a year and a half. Choked disk retrogressed in some of the cases, in one after it had lasted for three years. He advises a tentative course of treatment as for syphilis before beginning the roentgen treatment, and urges that the latter should always be tried before attempting an operation. Gulstad reports the details of the twelve cases with the findings on which the diagnosis of a brain tumor was based. Two of the twelve patients proved refractory; necropsy in one showed a very old fibrous tumor. In eight the roentgen treatment gave favorable results; in three cases earning capacity was restored. It is emphasized that these experiences seem to prove that the roentgen rays can be applied to the skull without injury to the brain and that the tumors can be modified through the skull wall.

Radium Treatment in Manchester (England). (*Lancet*, CXCII, April 7, 1917, p. 547.)

The report for 1916 of the Manchester and District Radium Institute, as furnished by Dr. Arthur Burrows, the radiologist of the Institute, contains amongst others, the following particulars:

The year under review saw the completion of the first thousand cases presenting themselves for radium treatment during the two years' existence of the Institute. Included in the report is a list of all the malignant cases except rodent ulcer which were well at the end of 1916. This list states the time during which the patients have remained free from symptoms or signs of disease. No case of carcinoma of the breast was reported as being apparently well at the end of 1915 and, therefore, in this particular instance, twelve months is the maximum period during which a patient previously suffering from this disease can have been free from symptoms. During the year the Institute has limited itself to the purely clinical side.

A series of cases illustrating interesting points in relationship to radium treatment is given, among which those dealing with carcinoma of the breast and with tumors of the abdominal muscles deserve special mention.

The best results in mammary carcinoma followed the implantation of emanation tubes, as many as twelve having been buried at one time. In tumors firmly fixed to the chest, the results are not so good and implantation may produce an intractable ulcer, unless extreme caution is observed. In such cases mere external application of plates may be preferable to the insertion of tubes. The opportunities for local repair should always be considered. An exaggerated growth of the breast is best removed, and radium applied at the site of removal and along the lymphatic tract. Inoperable or small, scattered glands of the neck, small secondary skin nodules are also usefully treated with radium.

As to tumors of abdominal muscles, the report contains the clinical histories of three cases which are interesting from the point of view of diagnosis and radium treatment. The first case is one of true sarcoma of the left rectus, and the other two are examples of fibrosis of the abdominal muscles and chronic interstitial myositis, respectively. The case of sarcoma yielded very slowly, while the other two cleared up extremely rapidly.

Radium Treatment in Edinburgh (Scotland). (*Lancet*, CXCII, April 7, 1917, p. 546.)

Dr. Dawson Turner, who is in charge of the Radium Department at the Royal Infirmary of Edinburgh, has forwarded a report covering the year 1916 to the *Lancet*, from which the following interesting particulars are abstracted.

Out of a total of 520 patients, 66 were treated with radium, as against 64 in the preceding year. The complaints were distributed as follows: Rodent ulcer 28, malignant disease of the vagina and cervix 7, malignant disease of other parts 18, exophthalmic goitre 7, nevi 4. Sarcoma proved more amenable to radium than carcinoma and sometimes disappeared in a remarkably short time. Rapidity of growth is no contraindication to the use of radium, as rapidly proliferating cells readily yield to it. This leads Dr. Turner to ask the question whether all sarcomas are equally amenable to radium treatment and, if not, what conditions determine the sensitiveness, but he fails to supply the answer.

The difficulty in treating malignant disease of the vagina and cervix with radium lies chiefly in the comparative inaccessibility of these parts, and this difficulty is enhanced in recurrences which are usually located in more inaccessible parts yet. A further difficulty in this respect is that the surviving cancer cells are more refractory to radium than those that were destroyed by the first application. But even so, the intermediate cure always greatly benefits the patient by the removal of pain, cessation of discharges and general gain in health and strength.

The beneficial action of radium on rodent ulcer is generally admitted, and superficial uncomplicated cases invariably do well if the available amount of radium is sufficient. In the cured cases there is scarcely any contraction of the skin, but when situated on mucous membrane, the affection is less amenable, and Dr. Turner prefers to divide the necessary dose into two or three, administered at three or four days' intervals. To prevent recurrences, the deeper parts should receive as adequate treatment as the superficial ones.

Of the seven cases of exophthalmic goitre, one died of hyperthyroidism in less than a month after treatment, while the others were benefited.

The report concludes with the clinical history of ten of the more important cases other than rodent ulcer, in which radium treatment had favorable effects in varying degrees.

Clark, John G. Results Obtained by the Use of Radium in the Treatment of Cancer of the Uterus. (*Ann. Surg.*, Nov., 1916, Vol. LXIV, p. 602.)

Clark bases his article upon the results obtained by the use of radium in the treatment of cancer at the University of Pennsylvania Hospital at Philadelphia. He first refers to the limitations of the applicability of the surgical treatment of cancer. Approximately 80 per cent. of the cases of cancer of the uterus received for examination at the University of Pennsylvania Hospital were inoperable, only 20 per cent. of the cases being considered within radical operative limits. This statement was based upon the fact that within the last two years 49 cases of inoperable cancer of the uterus were treated with radium, and during the same period only 12 cases were considered as suitable for radical operation.

The results of the radical operation have proved conclusively that, with very rare exceptions, the hopeless cases are those of the metastatic type. In carcinoma of the fundus the statistics of various surgeons do not differ to any marked degree, because extirpation of the uterus generally suffices to give good results. So long as the growth is confined to the fundus, recurrence does not take place in more than 50 per cent. of cases, provided even simple hysterectomy is performed. We are all fairly well satisfied with the results of operation in cancer of the fundus, whereas no one regards the operative treatment of cancer of the cervix with any great degree of optimism. To attain a higher measure of success, some more efficient means than the scalpel must be employed. This remedy has not as yet been discovered. Notwithstanding the remarkably good results that have followed the use of radium, the author still adheres to the dictum that the uterus and all possible adjacent tissue, if the growth is very limited in its extent, must be extirpated. Beyond this point, however, he has grown quite conservative.

The crux of the situation, therefore, as our experience has taught, is to attempt surgical measures only in the clearly operable cases, leaving the large remainder to secure relief from therapeutic efforts, which give as good or, as we now believe, even far better results from the use of radium.

In the inoperable cases, Clark believes, the Percy cautery holds out a distinct hope; nevertheless, he does not share the great degree of optimism shown by the inventor of this method as regards the cases of widespread extension. His experience at the University of Pennsylvania Hospital convinces him that radium offers the most helpful outlook of any remedy thus far presented in the palliative and occasionally the curative treatment of the borderline and inoperable cases. Of 69 cases reported treated up to September, 1915, the malignancies involving the uterus, vagina and urethra, practically all of these would, according to our past standards, have been classed as inoperable and, therefore, would inevitably have been doomed. Of these 69 cases, 13 died during the first twelve months following treatment. Ten were not traced. Of the remaining 46, two were alive at twenty-two months; three at eighteen months; seven at twelve months; and seventeen at six months.

Radium, as is shown in our series of cases, is by no means a universal panacea for cancer, even when the growth is strictly localized. There is no way of determining which cases will be benefited by its use. There is beyond doubt a certain percentage—how small or how great we cannot tell from our experience—in which cancerous growths are not retarded by radiotherapy; indeed, occasionally it would appear that there is a positive acceleration of growth.

Clark quotes Schauta's experience. In Schauta's first series he used radium in too large amounts and too often, with most disastrous results. One patient died of pyonephrosis; eight patients showed steady loss of weight, with diarrhea, tenesmus, fever, vomiting, headache, and reduction in blood count. The autopsy findings showed severe necrosis and fistulæ with diphtheritic and purulent inflammations of the rectum and bladder, sigmoiditis, and ulcerative processes in the pelvic coils of the ileum. *One striking point, however, noted at the autopsies was that in not a single instance was a trace of local carcinoma found.* In the method of its application, however, the remedy proved far worse than the disease, but this investigator established beyond question that radium emanations were absolutely destructive to cancer cells. The more moderate dosages employed in his later series of cases gave eight apparent cures out of eleven patients treated, and in no instance were fistulæ or necrosis produced, and the weight and general condition of the patient showed marked improvement.

Schauta's later technic is as follows: From 30 to 50 mg of radium, filtered through 1.1 mm of gold, 1 mm of platinum, and 0.75 mm of brass, are applied in from 5 to 8 exposures of 12 hours each, at intervals of from one to several days; an interval of rest of three to four weeks is then allowed to elapse, followed by a second but shorter exposure, and in some cases, after another interval of two to three weeks, a third series of applications is employed.

As an evidence of the widespread skepticism concerning these newer remedies, and in spite of this very favorable personal experience, Schauta declares that, although he will use radium in advanced cases, he will still continue to employ Schuchart's radical method of performing vaginal hysterectomy in the clearly operable cases, reserving radium as a post-operative prophylactic agent. It would also appear to be a self-evident fact that the post-operative effects of the Percy method must fall far short of those of the radium cases.

Clark concludes with the following important observations: "Removal of the uterus in cases of cancer of the fundus has yielded such good results that I do not feel we are justified in taking any chances with radium, not even in the borderline cases. *Our attitude toward the cervical and fundal growths is diametrically opposite. In borderline cases of cancer of the cervix we invariably employ radium. In advanced cases of cancer of the fundus we invariably perform a hysterectomy.*"

Holding, A. F. and Brown, S. The Treatment of Hodgkin's Disease. (*Jour. Am. Med. Assn.*, Mar. 3, 1917, Vol. LXVIII, p. 701.)

In the past three years these authors have had under observation eighteen cases of Hodgkin's disease. The diagnosis in each case was verified by microscopic study. Seven of the patients were males and eleven females. The ages varied from six to fifty-six years.

The following is a summary of the authors' conclusions:

1. Microscopic examination of the tissues in all cases of enlarged nodes, especially in the neck, is to be recommended.

2. Attention should be called to the fact that cases of persistent idiopathic pruritus may be due to Hodgkin's disease.

3. The treatment of Hodgkin's disease is unsatisfactory. No efficient treatment is known. The treatment recommended is that in vogue for malignant tumors and occult infections. The results to be expected are temporary ameliorations.

4. Recoveries are rare. Of the thousands of patients treated there are only two authentic cases in which the patients are reported symptom-free after five years.

5. The roentgen ray and radium are the only new agents found beneficial in this disease, and should be used in treating it, at least after operation.

6. A roentgen examination of the chest is indicated in all cases before an extensive surgical removal is considered. This will save many patients from a needless operation.

Ewing, James. Radium Therapy in Cancer. (*Jour. Am. Med. Assoc.*, LXVIII, No. 17, Apr. 28, 1917, p. 1238.)

In a dispassionate article dealing with the present status of radium as a curative agent, Ewing reviews the successes and failures of this therapy and, based upon his observations and experience, ventures upon a prophecy as to the therapeutic employment of radium in the future.

While the chief value of the article lies in its logical inferences and should therefore be followed in its details, an abstract of some of the more important statements may be read with profit and interest. Thus, Ewing is responsible for the statement that the action of radium on cellular tumor tissue is selective and specific in the sense that tumor tissues are from 4 to 7 times as sensitive as most normal tissue. The uncertainty of progress is due to the fact that little is definitely known of the mode of action of radium. That its action is electrical may be conceived, but is not demonstrated. The appearance of the cell cytoplasm suggests hydrolytic cleavage of cell protein, and this seems to excite leucocytic emigration. The growth of capillaries may be explained as a regenerative process, following a loss of tissue equilibrium or it may involve a direct stimulating action of the radium on endothelium and fibroblasts. In any event, the process is very complex, and in many cases there are very strong hints at a restoration of normal resistance of the connective tissue against lawlessly proliferating tumor cells.

Reviewing the practical achievements, Ewing has not found any exaggerated statements of its value in recent accredited medical literature, whilst warnings against the use of radium regularly come from persons who have had little experience in the use of it. To inform the public that radium has failed in the treatment of cancer is to misstate the facts.

The condition laid down by surgical opinion that radium must be tried out on inoperable cancer has generally been accepted and on the whole is a wise restriction. The effects of radium are confined to a limited territory and have no influence on disseminated tumors. The attempt to control a large territory leads to the use of excessive doses with serious results. The limitations of radium should be recognized, but its failures in this class of cases should not prejudice its claims elsewhere. Only palliative efforts should be attempted, when there is no possibility of reaching all the invading tissues.

Ewing lays down the following indications for the use of radium in inoperable cancer, when considerable quantities of the agent are available in the hands of an experienced operator.

Radium should not be withheld from rapidly growing, deep-seated and bulky tumors, for the cellular structure of many such tumors is just that much susceptible to the action of large amounts of radium at a distance from the skin and over long periods. Radium should be employed in combination with a limited operation in those forms of cancer where operation alone yields particularly unfavorable results, as in cervix of the uterus, prostate, tongue, pharynx, antrum, and in lymphosarcoma. In very advanced cases, only cautious, palliative treatment is allowed. Much of the distrust against radium has arisen from the untoward effect of overtreatment of inoperable cases and not from its proper use in suitable conditions.

The capacity of radium to eradicate cutaneous carcinoma is now a routine experience. In certain derivatives of basal cell carcinoma, as in mixed tumors of the salivary glands, radium has had notable success and should usually be employed in preference to operation. Among the refractory cases are recurrences after operations, carcinoma following lupus, invasion of bones, location near eye or nasal sinuses, in thin skin or bony prominences, and after repeated ineffectual exposures.

Ewing cites a number of authors who have reported highly favorable results in radium treatment of carcinoma of the cervix and body of the uterus, the details and figures of which need not be repeated here. Our present knowledge of the favorable results in cancer of the rectum, mouth and tongue is likewise summarized. The author further calls the attention of radium workers to osteogenic sarcoma, inasmuch as roentgen rays have had a favorable effect upon this distressing form of malignant disease, and surgery has proved extremely unsatisfactory. In mammary carcinoma favorable results have been attained, while in esophageal carcinoma, where the difficulties of application are great, at least palliative results have been reported.

The author demands a closer study into the limitations of radium therapy and a standardization of methods as well as concentration of the work as far as possible in large clinics thoroughly equipped with radium, technicians and trained medical specialists. The mechanical difficulties are still very great, and the various expedients to protect the normal tissues are still far from uniformly effective. Incidentally the author states that he has never observed any initial stimulation of tumor growth either under radium or roentgen treatment.

A serious objection to the use of radium in advanced cases is the failure of long inflamed granulation tissue to heal after the tumor cells have been destroyed. It appears to be necessary to attack the tumor before it has laid down much dense connective tissue, as otherwise the normal reaction by cellular granulation tissue fails to occur while the tumor cells resist the direct effect of the rays. He has also found that the susceptibility of normal tissue to repeated applications of radium seems to increase, while the sensibility of tumor cells seems to diminish after several exposures. Hence the best effects in advanced lesions often follow a single massive dose.

Recurrences after radium treatment have been rather frequent, but it should be recalled that they have been observed with few exceptions in advanced inoperable cases and that there is no means of comparing their frequency with those following operation in less advanced cases. But in view of the many practical limitations to the use of radium, the author considers it unwise to spread among the general public the impression that radium is ready to supplant surgical treatment of operable cancer. On the other hand, these precautions should not be permitted to stand in the way of the legitimate extension of radium treatment.

As to the probable future of radium therapy in cancer, the author sees no indications that the intravascular injection of radium will have a favorable effect, preliminary reports to the contrary notwithstanding. But he believes that by increasing the quantity, the length of exposure and the distance from the skin many deep and locally extensive tumors may be inhibited or destroyed. He also touches upon the propriety in future treatment of employing radium in operable malignant tumors and seems to be ultimately in favor of it. Starting with demonstrating the capacity of radium to control superficial cutaneous tumors, he would also give it a trial in all accessible and strictly localized carcinomas, but he would select cases in which there was some contraindication to operation. His next step in the argument is that, as a rule, the same conditions that are favorable for operation are also favorable for radium, and inasmuch as radium treatment of the future should be more than a mere palliative, he thinks that certain forms of early and strictly operable cancer may on the whole be more satisfactorily treated with radium than by surgery. However, he does not advocate this "at the present moment," but he believes it to be a consideration that can not be ignored in estimating the value of radium therapy.

Steiger. Newest Problems of Roentgenological Treatment of Cancer. (*Cor.-Bl. f. schweiz. Aerzte*, Dec. 9, 1916. Ref.: *Med. Rec.*, Jan. 20, 1917, p. 120.)

Steiger has now treated 200 cases of uterine and other genital affections with roentgen rays. In regard to operable cancer he has not yet come to substitute the latter for the knife, but he irradiates all cases after operation. Not to do so would be inexcusable, for while recurrences can not be suppressed altogether by this means, their number can be greatly reduced. In roentgenizing inoperable cases the possibility of cure is always present, although as a rule the disease is only held in check and its distressing symptoms mitigated. An inoperable growth is not necessarily a neglected growth, for it may also mean a cancer of unusual malignancy. If the rays can prevail over such cases, they ought to be efficacious in the technically operable cases, in addition to doing away with operative mortality. But at present the knife achieves a good share of actual cures, when figured on a basis of five years' freedom from relapse. The rays can not as yet make a similar showing. Deep roentgen treatment hardly goes back as far.

The author has thus far treated 26 inoperable cancers of the uterus. In three of these he obtained a clinical cure and in four others a favorable result. Eleven of the women are dead. The entire number of malignant inoperable cases treated were 50, of which 15 have been improved. This includes all localities and all forms of malignancy.

An entirely different series is that of 34 cases of prophylactic roentgenization after operation. Of this number 14 were situated in the uterus. All the patients have been under control. There has been but one recurrence, now under treatment, as are also six others which are still free from symptoms. The other 5 return periodically for inspection and are still sound. The author has roentgenized 17 cases of cancer of the breast after operation. One is dead of cachexia and two have local recurrence; five have disappeared and three are still under treatment.

Mercier, M. Roentgen Therapy in Muscular Sclerosis Following Contracture. (*Paris Médical*, Dec. 2, 1916; Ref.: *N. Y. Med. Jour.*, Jan. 20, 1917, p. 131.)

Mercier points out that in military practice sclerotic muscular conditions following persistent contracture or myositis have given considerable trouble. Four cases presenting retraction of the biceps, the result of wounds of this muscle or of its tendon by shell fragments, were recently treated by roentgen rays with promising results. None of these patients had been able to extend the forearm more than 90 degrees. Converging rays to the extent of two H units were used upon the muscle tissue of the biceps, first on one side and then on the other. A filter of 1 to 1.5 mm of aluminum was used, and weekly treatments were given. After eight or ten sittings all these patients were able to extend the forearm up to 150 and even 160 degrees—a gain of 60 to 70 degrees.

Goetjes, H. The Etiology of True Loose Knee Joints. (Tenth Anniversary of the Cologne Medical Academy. Ref. *Zentralbl. f. Roentgenstr.*, 1916, Nos. 5 and 6, p. 154.)

If, according to the author, in a loose joint near the insertion of the cross ligaments of the femur and of the tibia, there is a cartilaginous defect from which the loose joint originates, the latter is of traumatic origin and not due to osteochondritis desiccans, even in cases where the anamnesis is traumatically negative. This statement is based on anatomical examinations and roentgen findings which were later confirmed at operation. In three cases out of four he found that there was a tear at the tibial end of the lig. cruc. post., and in the fourth case there was a tear at the femoral end of the same ligament. The tension of the cross ligaments or their fascia does not occur all at once, but runs a course according to prevailing anatomical conditions in such a way that the extreme fibers undergo tension first, followed later by that of the others, as the movement progresses. The most important complicating factor is the motor mechanism, and in the latter it is the inward rotation of the lower leg which is principally responsible for the state of affairs.

Green, A. A. Russell. A Record of Sixty-one Cases of Neoplasmata of the Skin Treated by X-rays or Radium. (*Lancet*, CXCII, April 7, 1917, p. 544.)

The results of roentgen and radium treatment in sixty-one cases of malignant neoplasm of the skin, which were admitted to the Birmingham (Eng.) Skin Hospital during the past four years, seem to be capable of division into good, bad and indifferent according to the details furnished by the author. Besides, twenty of these cases failed to reply to a circular note asking for information about their present condition. The treatment seems to have been tentative and adapted to the peculiarities of each case rather than modeled on a fixed principle admitting of comparison, and the condition of the patients is not sufficiently described to admit of any thorough-going conclusions as to the effect of the treatment adopted. However, the author describes his "method of dosage" as follows:

"The radium in use is pure radium bromide, and is certified as such by the Curie Laboratory. It is spread on metal plates in the proportion of 5 mg to each square cm. of surface. The roentgen rays were employed as full or fractional Sabouraud doses, this being the quantity of roentgen rays required to bring about the fall of the hair of the scalp without visible reaction, or permanent injury to the hair follicles, and is a sharply defined dose."

Besides this, the author has found two methods of supplementary treatment useful, consisting in electrolysis and autogenous vaccines. Electrolysis for the small nodules that are sometimes left at the periphery of the scar and which are liable to become centres of subsequent relapse, has proved much more useful to him than the application of carbonic acid snow. In one of his cases, concurrently with the first exhibition of radium, he transfixed the base of the epithelioma with an electric needle in some half dozen places. In cases that have been obstinately septic, he has found autogenous vaccines of great value.

Of all cases that could be traced, sixty-six per cent. were healed and have remained healed for the following periods:

Between 3 and 4 years	7
" 2 " 3 "	4
" 1 " 2 "	9
Under 1 year	4
Relapsed	2

Of those treated by radium 70 per cent. were healed, of roentgen-treated patients 43, and of those who had radium and roentgen treatment 66 per cent. The author admits that the results from so small a number of cases are misleading, but he believes they go to demonstrate the following conclusions:

(1) The administration of radium in less than one hour doses of the strength specified is likely to prove unsatisfactory, although small doses of roentgen rays and radium will sometimes bring about healing.

(2) Radium will heal when roentgen rays have failed.

(3) In most superficial cases screening is not necessary.

(4) Cases that are going to do well will do so within six months, and if they have not done so within that period, a drastic revision of the treatment is imperative.

(5) Electrolysis and autogenous vaccines are useful as supplementary methods of treatment.

(6) Caustics are contraindicated.

THERSTAPPEN. Traumatic Malacia of the Os Naviculare and Os Lunatum. (Tenth Anniversary of the Cologne Medical Academy. Ref. *Zentralbl. f. Roentgenstr.*, 1916, Nos. 5 and 6, p. 156.)

This is a description of two roentgen exposures of traumatic malacia of the os naviculare and of three of the os lunatum. The injuries were caused by overstretching the wrist. The author contradicts Preiser who attributes these changes to tearing of the ligament. He rather holds nutritive disturbances responsible for the cause of the affection. The author also describes the roentgenological and microscopic findings of several artificially produced injuries and circulatory disturbances of the calcaneus of a rabbit.

BELOT, J., AND FRAUDET, H. Localization of Foreign Body in the Eye. (*Jour. Radiol. and Electrol.*, Paris, Vol. II, No. 7, Jan., 1917. Ref. *Jour. Amer. Med. Assoc.*, June 9, 1917, p. 1786.)

Belot and Fraudet emphasize the advantages of rapid roentgenoscopy and of roentgenography in five positions according to a geometric system they have devised and here describe with twenty illustrations and a large plate. With this system they were able to locate minute scraps even of aluminum, stone or glass, which are relatively transparent for the roentgen rays. In one instance Belot thus localized a fragment from a test tube; the particle of glass was 1 mm long by ½ mm wide and thick. They say localization with the stereoscopic technic is possible only when the eye is incapable of any movement. The preliminary roentgenoscopic examination, after the patient has sat for twenty minutes in an absolutely dark room, serves to locate the foreign body in one quarter of the orbit and may locate it with sufficient precision. If not, they proceed to roentgenography. As the eyeball revolves on its transverse or vertical axis, if the foreign body changes its place proportionally to the displacement of the periphery of the eyeball, then the foreign body must be in the eyeball itself or the muscles in contact with it. If the foreign body is in the parts outside the eyeball, its displacement with different movements of the eyeball occurs according to geometric principles. Study of the type of displacement shows at once the muscle involved. In twenty-five cases in which this technic has been applied the foreign body was found exactly at the point in the operative cases. An error of a few millimeters in localization would be negligible elsewhere, but the eye is unable to stand any groping. Even with intermittent screen control, compasses, etc., we have no guarantee of success, but the system here described is incapable of failing, it is asserted, provided the eyeball is movable and vision is not lost in the other eye. All that is required is to outline a curve, drawing the outline on transparent paper placed over the five radiographs in turn. The tracing thus obtained locates the foreign body with precision.

KEELER, J. CLARENCE. Fracture of the Tympanic Plate of the Temporal Bone. (*Laryngoscope*, Vol. XXVII, No. 3, March 1917, p. 192.)

Fractures of the tympanic plate of the temporal bone are so rare that many of the leading textbooks either on surgery or on otology fail to mention the condition. Dr. Keeler recently presented at the Philadelphia Laryngological Society a patient, a girl of 17, who had sustained considerable injuries to her head by being thrown from a motor cycle. The roentgenograms showed the fracture at the symphysis, the broken teeth, a fracture of the left condyle of the mandible and a fracture of the tympanic plate of the temporal bone with upward displacement.

The Introduction of Roentgenograms as Evidence. (Medicolegal Notes, *Med. Rec.*, Feb. 17, 1917.)

In an action for permanent injury caused by being struck by an automobile, roentgenograms of the broken bones of the plaintiff's leg were permitted to be exhibited to the jury, although they were calculated to shock a layman and might create an impression of much graver injury than a surgeon would understand existed from a consideration of them and so result in much increasing the size of the verdict.—Berg vs. Mitchell, 196 Ill. App., 509.

BOOK REVIEWS

Le Traitement des Plaies Infectees. (Treatment of Infected Wounds.) By A. Carrel and G. Dehelly. 177 pages, with 78 text illustrations and 4 plates. Paper cover, price 4 francs. Masson & Cie., Publishers, Paris.

As the title of this excellent little book implies, its contents are not of primary interest to the roentgenologist. The treatment of infected wounds only calls for the aid of the latter, when it is desirable, among other contingencies, to control the progress of the healing of compound fractures, and it is in this connection that the authors reproduce a number of roentgenograms illustrating the satisfactory progress which badly infected wounds of war origin have made under the special treatment they advocate. This treatment consists in the systematic application of the Carrel-Dakin method which has of late aroused the favorable attention of surgeons and internists alike. The authors give precise instructions for the preparation and application of the Dakin disinfecting fluid and call attention to the extreme importance of thoroughly understanding these details before applying the method. In fact, they attribute failures in the hands of others solely to the want of adequate mastery of the technic. This "apprenticeship" requires at least several weeks even for an experienced surgeon, but the time is well spent as the results are sure to be satisfactory even in cases where older methods are useless.

Although the book is written in French, the terminology employed is so simple that a physician acquainted with the fundamentals of the language will be able to understand it. The book may be obtained in this country from the publisher of this journal.

Medicine and Surgery, June, 1917. Annual Subscription $3.00; single copies 30 cents. Published by Medicine and Surgery Publishing Co., St. Louis, Mo.

The June number of this recently created magazine is almost entirely devoted to roentgenological diagnosis and treatment and contains a number of articles which, while not going as deeply into technical matters as journals would that are exclusively devoted to this specialty, furnish matter of value and interest to the roentgenologist.

Dr. Emil G. Beck contributes a paper on the advantages of the stereoscopic method and incorporates therein a summary of his early as well as most recent experiences in the use of roentgenographic stereoscopy. He recommends the universal adoption of this method for all cases with a very few exceptions, such as making lateral roentgenograms of the spine to show defects in the bodies of the vertebræ or in cases where we have simply to prove the presence of a foreign body and not its location. Otherwise, he holds, the stereoscopic roentgenogram is indispensable.

A. Hyman, in writing on the difficulties of interpretation of renal and ureteral roentgen shadows, thinks that the roentgen method is the most valuable at our disposal in the detection of renal and ureteral calculi, provided it is used in conjunction with the other established methods. In order to avoid errors of interpretation in these regions, special precautions must be used. Corroborative evidence furnished by stereoscopy, the shadowgraph catheter, pyelography, and ureterography (the latter preferably combined with stereoscopy) are absolutely indicated in all doubtful cases.

Maximilian J. Hubeny deals with the roentgen examination of the chest, pointing out the advantages derived from its employment in a number of thoracic affections and irregularities. In this way he deals with the esophagus, drop heart (asthenic heart), angina pectoris, aneurysm of the thoracic aorta, pericardial effusions, miliary tuberculosis, fibrosis with consequent displacement of the trachea, chronic indurated fibroid phthisis of the lung with compensatory emphysema of the opposite side, metastatic carcinomatosis, sarcomatous infiltration secondary to sarcoma of head of humerus, mediastinal tumor (endothelioma), hydropneumothorax, and pleurisy with effusion — all of which are illustrated by roentgenograms.

Roentgenotherapy in malignant tumor of the parotid salivary gland forms the subject of Chas. A. Pfender's contribution. The literature does not abound with case reports of malignant tumors of the salivary parotid gland treated either by radium or roentgen rays, for the simple reason that few men have had opportunity to employ radium on account of its expense, while roentgenotherapy until quite recently had not perfected a technic which enabled the operator to destroy the tumor mass without injury to the patient. The author recalls what was probably the first case of sarcoma of the parotid treated by roentgen rays in 1908 by Bataille and Méret, of Rouen, France. The course of this case was interesting. The first operation was followed in 15 days by recurrence. Then roentgenization appeared to check the progress of the sarcoma but did not destroy the tumor cells, as the microscopic study showed karyokinetic figures in the sections. The second operation was not complete either but was immediately followed by roentgenization with complete recovery in two weeks. At the time of the report, eight months had elapsed with no sign of recurrence.

In conclusion the author reports three inoperable cases treated by roentgen rays. In the first case the patient died from multiple metastases; the second patient was entirely well six months after treatment and the prognosis of the third case was unfavorable due to low general vitality. Death was due to exhaustion.

A. C. Christie writes on the diagnosis of bone tumors, taking as a basis the classification as given in Bryant and Buck's "Practice of Surgery," combined with Bloodgood's classification of secondary cysts. The differential diagnosis of bone tumors is summed as follows: Exostoses may be accurately diagnosed by their roentgen appearance. Chondroma when growing laterally from the epiphysis gives a typical roentgen picture, and multiple enchondromata are readily recognized. Single chondroma occurring centrally may be mistaken for benign cyst or giant-celled sarcoma, but the treatment is practically identical for all three. Periosteal sarcoma may be confused with tuberculosis, osteomyelitis, syphilis or Charcot's joint, and the greatest care is necessary to differentiate them. Multiple myeloma and endothelioma are rare. The former can usually be recognized, but the latter can not be distinguished clinically from sarcoma. Benign cysts are likely to be confused only with chondroma or giant-celled sarcoma. Carcinoma of bone may be confused with tubercular disease, especially in the spine, but if care is taken in examining for areas of regeneration and to discover the primary cancer, a mistake is usually avoided.

Syphilitic pleurisy with effusion is either an unusual lesion or one that escapes identification, according to P. G. Skillern, who presents a roentgenogram of right side of thorax, showing columnar area of syphilitic thickening of pleura. A dark area extends along the lateral wall of the thorax from axilla to diaphragm and helped to clear up the diagnosis.

Samuel B. Childs reports a case of a gallstone in the ampulla of Vater and reproduces a roentgenogram intending to show the common duct and the right and left hepatic ducts after bismuth injection, with the gallstone at the lower end of the duct, but it is unfortunate that the illustration could not have been reproduced more clearly.

In an article on the treatment of malignancy by radium, Russell H. Boggs arrives at the following conclusions:

Operable growths should be operated, except certain types of epithelioma, and then have after-treatment by roentgen rays or radium. Leading surgeons are beginning to recognize radium as a legitimate means of treatment. One of the most striking results of radium treatment is the disappearance of offensive secretions in almost every case. Every advanced or inoperable case should be treated with radium, for palliation at least. In the past, the treatment of hopeless carcinoma cases has been morphine; to-day it should be radiotherapy.

The "X-ray and Radium Treatment of Leukemia and Hodgkin's Disease" is the subject of a paper by Isaac Levin. A great many attempts have been made to show that these diseases are of an infectious origin and caused specific microörganisms, but there is no definite evidence, according to this author, that any of this class of diseases are caused by an infectious agent and it seems more plausible, for the present at least, to maintain that they are closely related to malignant neoplasms. Levin's paper intends to show that the results of roentgen and radium therapy bear out this contention.

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LOCALIZATION OF FOREIGN BODIES

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PHILADELPHIA, PA.

IN no aspect of *x*-ray practice has individuality been so pronounced as in the localization of foreign bodies, and the very multiplicity of methods advanced is, of itself, proof of the limitation of all of them. As each operator advances in experience, he will, doubtless, find himself favoring a practice depending much upon the principles here given but differing, perhaps even more, in detail.

Accurate Determination of the Vertical Ray

The essence of localization is accuracy. Before any attempt is made in the use of localizing devices the location of the focus point must be determined. Upon this location and the ability to determine it rest most of the methods to be described. For this the device shown in Fig. 1 is recommended.

This may be adapted to any standard tubestand with cone attachments, using the cone fitting of that particular stand as a base. In the diagram (Fig. 1) let (*A*) be such cone base; (*B*) a brass or other metal tube with ¼ in. bore except at the extreme upper end where it is reduced to ⅛ in.; (*C*) is a pointer rod, and (*D*) a set screw to hold it in place. It is, therefore, not only a device to accurately center the focus but it serves as well, by means of the pointer, to indicate the point which the central ray will strike. Substituting the attachment (*P*) for the pointer rod we have a plumb

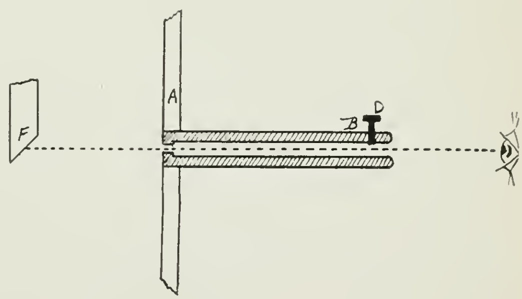

Fig. 1. Diagram of the Author's Tube Centering Device, Pointer Omitted.

line with which to discover the course of the vertical ray. (Fig. 2.)

The *vertical ray*, hereafter often referred to, is that ray proceeding from the focus which is perpendicular to the plate or screen. For casual examination, it may be permissible to think of a "central" ray proceeding from the focus to the center of the plate, but for localization this will not do. Even should the focus be so badly centered that no ray from it is perpendicular to the plate, the vertical ray is still the ray perpendicular to the *plane* of the plate. In any of the following methods which consider the vertical ray as centered upon the center of the plate, it is at once manifest that any degree of failure to meet that requirement must detract just that degree from the accuracy of the result. In fluoroscopy where the tube is confined in a leaded box with a movable diaphragm no less care is needed. A convenient device for this purpose is Fig. 3 made from a piece of brass pipe, 2″ or 3″ in length, set in the center of a wood block 3″ square and 1″ thick. The under side is cut away or rabbeted ½ in. on all sides leaving a shelf by which the device rests on the shutter which is opened to fit it (2 in. square). If the focus is accurately centered the tube will cast a circular shadow on the screen, otherwise the shadow will be oval.

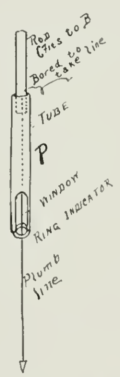

Fig. 2. Plumb-Line Attachment for Centering Device.

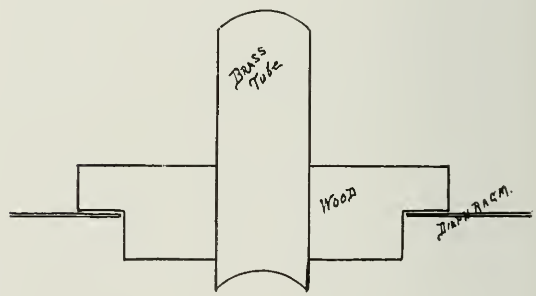

Fig. 3. Diagram of Centering Device Applicable to Rectangular Opening Diaphragms. (Cross Section.)

In all stereoscopic localization the vertical ray or the focus is in the median position, the two exposures being made with rays equally oblique to this perpendicular.

Localization by Means of Plates

Cross-thread Method.—It may be said that all plate methods of localization and many of the fluoroscopic methods depend upon a simple problem of triangulation, which for our purpose may be visualized by means of cross threads, or determined by pre-arranged scales of measurement or measured by rule.

One of the earliest of the graphic methods was that described by Mackenzie Davidson[1] and since known by his name or as the cross-thread method. It consists primarily of a frame by which the two separate positions of the focus and the focus plate distance can be accurately relocated. There are provided also small pointed weights ("mice") to the points of which are fastened threads. In practice two exposures are made upon the same plate from separate positions of the focus, both of which are carefully recorded. The resulting plate bears a double image of all shadows cast by the subject, including a double image of the shadow of the foreign body. The plate is dried and, by the aid of shadows cast upon its margin by an indicator, is placed in the frame in a position exactly corresponding to its position relative to the focus during the exposures. The threaded points are now placed upon the two shadows of the foreign body and the threads are carried to points accurately replacing the two focus positions. If the work has been accurately done the threads will be found to barely touch at a point of crossing and this point shows the distance of the foreign body from the plate.

Slight modifications of the original model are said to be in active service in British military hospitals to-day. The original and all American derivatives are, however, open to one serious objection for military use. This is, that a localization having been made, the whole apparatus is tied up until that particular foreign body has been removed. This has been quite overcome by Marion[2] in his localizer which is now popular with several operators in French bases. This consists of (Fig. 4) a table (*b*) upon which is a photographic plate (*p*) on which the region of the wound is laid; a graduated column (*t*) vertically fixed on one side of the table; a horizontal semicircular support (*s*) adjustable up and down the column (*t*) and supporting adjustable scales and indicators; another and similar support (*s'*) adjustable in the same way upon column (*t*) but below (*s*), and carrying scales (*r-r'*), vertical indicators (*CC*), and a pointing rod (*g*) adjustable in any direction. The latest models have two of these pointers and a caliper (*h*) for measurements.

Use.—The region to be examined is placed upon the table in the operating position. The foreign body, approximated by previous examination, is placed as nearly as possible in the line of the direct ray. At a few centimeters distance to one side is placed a lead indicator, as a square with an opening at its center. The location of this marker is permanently marked upon the skin. Vertically above this marker and at a measured distance from the plate the focus is centered and the first exposure is made. The lead marker is then placed an equal distance to the other side. The focus is again centered above it and the second exposure is made.

The distance of each position of the skin marker above the plate is then ascertained with the caliper and recorded.

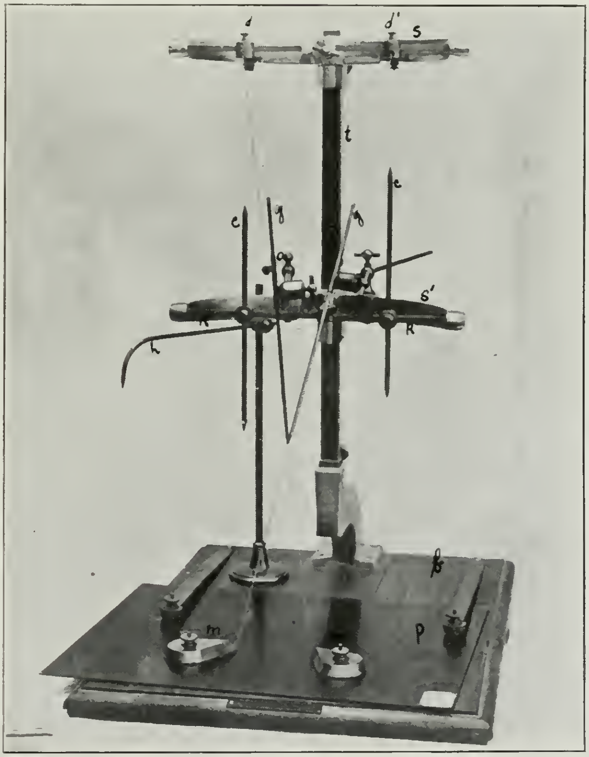

Fig. 4. Late Model Marion Localizer, Showing Two Pointers and Table Caliper.

The negative having been developed and dried we have a plate showing two shadows of the foreign body and one shadow of the lead skin marker in each position. Remember also that in each position this marker was vertically beneath the focus during the exposure, but that the column (*t*) with its attachments was removed.

Reassembling the Apparatus for Operation. — The negative is replaced upon the base in exactly its position during the exposures. Column (*t*) is replaced and the two indicators (*d* and *d'*) made to occupy exactly the positions of the two focal centers during the exposures. The pointed weights (*m* and *m'*) are placed upon the centers of the foreign body shadows and the threads run to (*d* and *d'*). The point of contact marks the altitude of the foreign body. The support (*s'*) is now adjusted and the indicating rods (*C* and *C'*) are made to coincide with the path of the vertical ray for each exposure. These rods will then if projected upward touch, the centers of (*d*) and (d') and if projected downward will touch the centers of the two skin marker shadows. With the aid of the caliper the lower points of (c and c') are set to the height above the plate of the skin markers as previously recorded. The pointer (g) is now set so that its lower end touches the point of contact of the threads and the rider (1) is set close to the sleeve (o). In later models, two pointers are both so adjusted.

The threads, pointed weights, plate, and, if so desired, the upper support (s) are now removed. The pointer (g) (or both pointers if there are two) is pulled well up into the sleeve (o) taking care that the sleeve is not moved, and the patient so adjusted under the points (c and c') that these points are in exact contact with the permanent skin marks. The pointer (g) (or two) is now lowered until it touches the patient's skin. It then gives the direction in which the foreign body lies and the distance between the lower border of the rider (1) and the upper border of the sleeve (o) is the distance of the foreign body below the skin *in that direction.*

Sources of Error.—Of these the most difficult to eliminate is the question of the exact location of the focus points.

With this localizer, when several localizations are to be made before any of them are operated it is most essential that the various measurements and adjustments be accurately recorded.

HIRTZ COMPASS.—Another graphic method using a widely different application of the triangulation process is the compass of Hirtz [2b].

In Fig. 5 let (R) be the sensitized plate. Upon its envelope is placed a lead marker (V') and upon this is accurately centered the direct ray from focus point (V). The projectile is (P). (A, B and C) are three metal markers at conveniently chosen points on the skin. If the focus is displaced to (F) and to (F'), (Fig. 6), and an exposure made at each point, there will result upon the plate two shadows each of (A, B, C and P).

Knowing the distances (VV') and (FF') we are able, by measuring the displacement in each pair of shadows, to set forth all the data needed for the primary problem.

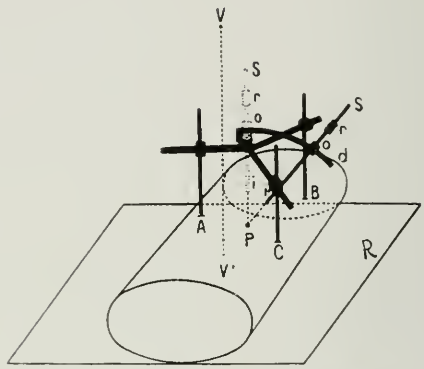

FIG. 5. DIAGRAM OF THE HIRTZ COMPASS.

Making the Plate.—(1) The approximate position of foreign body should first be determined by one of the fluoroscopic methods.

(2) Upon the center of a plate of proper size place a marker, say a lead triangle (V'). Center the focus accurately above this point.

(3) Being careful not to change position of either tube or plate, place the patient so that, as well as can be judged, the shadow of the projectile will fall a little to one side of the center (V'). The position should also be one desirable for operation.

(4) Choose and mark with lead indicators three convenient skin points to form a triangle, of which the normal ray (VV') shall be the approximate center; not too near together lest they embarrass the operative incision; not too far apart lest their shadows, one or both, be projected outside the plate. It is well to have these markers perforated in the center.

(5) Fix the focus at a chosen altitude (uniform for all cases). Co-efficient tables for 50 cm. and for 60 cm. altitude are supplied with the instrument.

(6) Two points (F and F') are chosen at this altitude which are equidistant from the central line (VV'). This displacement should also be uniform and in most cases is 6 cm.

(7) Two exposures, one at (F) and one at (F'), are now made upon one plate. After development we find a single shadow of (V') and two shadows of each, the foreign body and the three skin markers. These latter should be indelibly marked upon the skin; tattooing, thermocautery, etc., etc.

Graphical Construction.—(*a*) When the plate is dry mark by a point of ink the centers of the shadows of each of the lead markers and of the foreign body.

(*b*) Place a tracing paper over the plate and mark these ink points, as they are seen through, upon it.

(*c*) It will be found that imaginary lines between each pair of shadows will be parallel to each other. Through the point (V') draw a line parallel to these. (Fig. 6.)

(*d*) Upon this line fix the points (FF') by a measurement, exactly the same as the two displacements of the tube. (Another way would be to determine these points before the exposure and to fix opaque markers upon the plate vertically beneath each focus position, exactly as the point (V') was determined in step (2), above.)

(*e*) Mark upon the chart each separate shadow, as for instance (a) for the right hand shadow of skin mark (a and a') for its left hand shadow. Similarly (F and F') represent respectively right and left positions of the focus.

(*f*) Reciprocally, join by pencil and ruler (a to F'), (b to F'), (c to F') and (P to F') and likewise, (a' to F), (b' to F), (c' to F) and (P' to F).

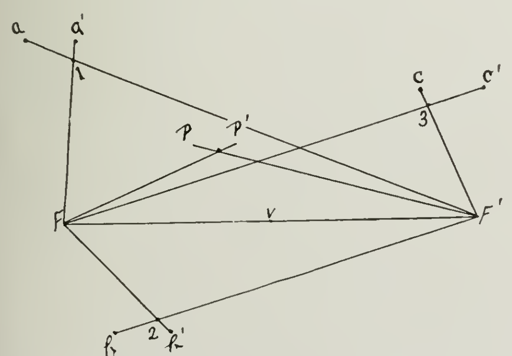

Fig. 6. Typical Chart for Use with the Hirtz Compass.

(*g*) At intersection of lines from (a-a') mark a point (1), from (b-b') (2) and from (c-c') (3), and at the intersection of (P-P') a dot.

(*h*) Measure with a rule the distances (pp'), (aa'), (bb') and (cc') which correspond to the spreading of the images and read on a previously calculated table, which accompanies the apparatus, the numbers corresponding to the heights of the different points (P, 1, 2 and 3) above the horizontal plane of the plate. There is a table calcu-

Table I

Focus Plate Distance 600 mm.
Tube Shift 60 mm.

Spreading	Height	Spreading	Height
1	10	26	181.5
1.5	14.5	26.5	184
2	19.5	27	186
2.5	24	27.5	188.5
3	28.5	28	191
3.5	33	28.5	193
4	37.5	29	195.5
4.5	42	29.5	198
5	46	30	200
5.5	50.5	30.5	202
6	54.5	31	204.5
6.5	58.5	31.5	206.5
7	62.5	32	208.5
7.5	66.5	32.5	211
8	70.5	33	213
8.5	74.5	33.5	215
9	78.5	34	217
9.5	82	34.5	219
10	85.5	35	221
10.5	89.5	35.5	223
11	93	36	225
11.5	96.5	36.5	227
12	100	37	229
12.5	103.5	37.5	230.5
13	107	38	232.5
13.5	110	38.5	234.5
14	113.5	39	236.5
14.5	117	39.5	238
15	120	40	240
15.5	123	40.5	242
16	126.5	41	243.5
16.5	129.5	41.5	245.5
17	132.5	42	247
17.5	135.5	42.5	249
18	138.5	43	250.5
18.5	141.5	43.5	252
19	144.5	44	254
19.5	147	44.5	255.5
20	150	45	257
20.5	153	45.5	258.5
21	155.5	46	260.5
21.5	158.5	46.5	262
22	161	47	263.5
22.5	163.5	47.5	265
23	166.5	48	266.5
23.5	169	48.5	268
24	171.5	49	269.5
24.5	174	49.5	271
25	176.5	50	272.5
25.5	179		

TABLE II

Focus Plate Distance 600 mm.
Tube Shift 50 mm.

Spreading	Height	Spreading	Height
1	8	26	151
1.5	12	26.5	153
2	16	27	155
2.5	20	27.5	157
3	24	28	159
3.5	27.5	28.5	161
4	31	29	163
4.5	35	29.5	165
5	38.5	30	166.5
5.5	42	30.5	168.5
6	45.5	31	170.5
6.5	49	31.5	172
7	52	32	174
7.5	55.5	32.5	175.5
8	59	33	177.5
8.5	62	33.5	179
9	65	34	181
9.5	68.5	34.5	182.5
10	71.5	35	184
10.5	74.5	35.5	186
11	77.5	36	187.5
11.5	80.5	36.5	189
12	83.5	37	190.5
12.5	86	37.5	192.5
13	89	38	194
13.5	92	38.5	195.5
14	94.5	39	197
14.5	97.5	39.5	198.5
15	100	40	200
15.5	102.5	40.5	201.5
16	105	41	203
16.5	108	41.5	204.5
17	110.5	42	206
17.5	113	42.5	207.5
18	115.5	43	208.5
18.5	118	43.5	210
19	120	44	211.5
19.5	122.5	44.5	213
20	125	45	214.5
20.5	127.5	45.5	215.5
21	129.5	46	217
21.5	132	46.5	218.5
22	134	47	219.5
22.5	136.5	47.5	221
23	138.5	48	222
23.5	140.5	48.5	223.5
24	143	49	224.5
24.5	145	49.5	226
25	147	50	227.5
25.5	149		

lated for a focus height of 60 cm. and one for 50 cm. There is also made a direct reading rule or scale which answers the same purpose.

(i) Subtract successively the number expressing the height of (P) from those which correspond to the points (1, 2 and 3). These differences are noted and later used in setting the compass for depth. The compass, schematically shown in Fig. 5, has three arms (1, 2 and 3), revolving around a common axis (O) through an opening in which there moves, with light friction, a rod (S) bearing an indicator (r) with set screw. On each arm, in an adjustable rider, and moving perpendicular to the plane of the three branches, there slides a rod having millimeter graduations. A winged nut under the axis of the compass serves to set the branches in a desired position.

Setting the Compass.—(a) Place the rod (S) in the median position, set the graduation of each of the other rods at zero and loosen the winged screw.

(b) Place the transparent paper chart on a small drawing board with the point of the rod (S) on the horizontal projection of the foreign body. Place the ends of the other rods on points (1, 2 and 3).

(c) Shorten the rods or lengthen them until they stand at the number of mm. found as the difference in distance, from the plate, between each skin marker and the projectile. (Fig. 7.)

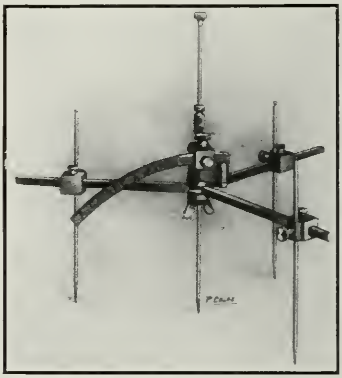

FIG. 7. HIRTZ COMPASS SET READY FOR APPLICATION TO THE PATIENT.

The compass is now ready for use. The patient is removed to the operating table and placed in the position in which the x-ray examination was made. This requirement is not too rigid. It is only needed that the rod points shall coincide with three skin marks (Fig. 8). When this condition is fulfilled, the localizing rod (S) is lowered to touch the skin. It now indicates the direction in which the foreign body lies and its depth is told by the distance between the lower border of the indicator (r)

and the upper margin of the canal in which the localizing rod moves. By means of an arc almost any desired adjustment of the localizing rod may be obtained without resetting the compass. The method is interesting in that the localizing instrument plays no part in the production of the plate, but is set entirely from the plate findings.

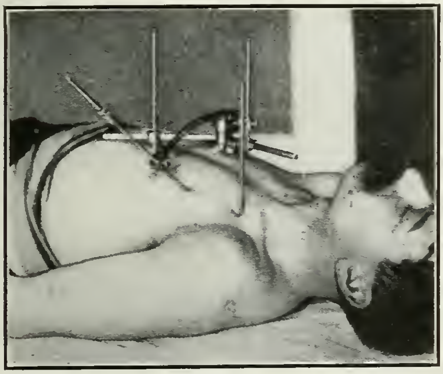

Fig. 8. Hirtz Compass Applied to the Patient.

It must be kept in mind that when two exposures are made on one plate, each exposure should be just one half of the actual exposure time. If two full exposures are made the plate will be too dense for easy reading.

LOCALIZATION BY THE STEREOSCOPE

This is often most satisfactory, the more so if there is real coöperation between x-ray specialist and surgeon. It is most important that sufficient opaque landmarks be provided to produce the stereoscopic effect from the skin surface. For instance the writer has used, for some years past, a paste of lead oxide and vaselin to fill the normal skin markings of the hand and thus utilize the entire palm as a foreground by which needles, etc., may be localized. In larger parts a circle or cross of fuse wire at wound of entrance, a T of the same over a tender point, etc., will add materially to the efficiency. Again, if the foreign body is in close relation to some well-known surgical landmark, e. g., in the glenoid fossa, the stereoscope would give the best information.

Whatever we may concede as against plates for localization they still hold first place, easily, in the *discovery* of smaller fragments and more especially when larger fragments are present in the same field. And when infection is present and removal is sought, for that reason the plate is a paramount necessity in order that the last, even if smallest, fragment may be discovered.

LOCALIZATION BY MEANS OF THE FLUOROSCOPE

In this procedure it is vitally important that the focus point of the tube be accurately centered, and for the same reasons as stated under the plate methods.

With the fluoroscope one can learn very promptly the approximate location of the foreign body with relation to the skin or bones, and therefore the probable point of surgical approach.

Fluoroscopic methods may be classified as immediate or mediate according as localization and removal are combined or separate; and as indirect or direct according as the localization is obtained by the displacement of the shadow in the oblique ray as compared with that in the vertical ray, or by various positions of the body in the vertical ray.

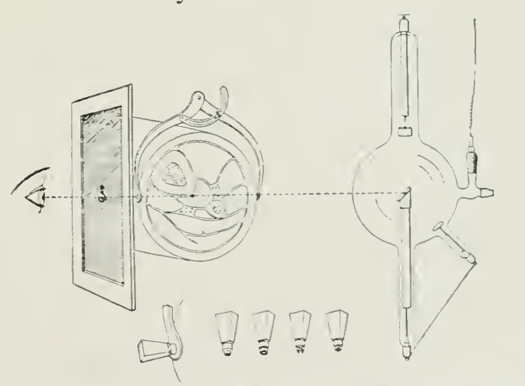

Fig. 9. Diagram Showing the Sutton Cannula and Trochar and the Harpoon, as well as the way they may be used.

The milled wing at the head of the cannula may be engaged with a strong forceps and thus obviate the necessity for getting the hands into the open ray.

IMMEDIATE METHODS

Trochar and Cannula.—Of the immediate methods the most important is that of Sutton.[17, 18] The following description is given by Flint.[15]

"It is extremely convenient in most cases to have a definite guide to facilitate the search for the projectile during the actual operation. Undoubtedly, the most useful instrument of this type is that devised by Sutton, which may also be utilized as a localizer when the projectiles are situated in the muscular portions of the body. Sutton's localizer consists in a trochar and cannula which is introduced under the skin previously anesthetized by novocain. After disinfection, the operator puts on sterile rubber gloves or manipulates the cannula by means of sterile artery forceps. It is plunged beneath the skin and the sharp trochar is removed from the cannula, which is then replaced by a blunt obturator. The field is covered with sterile towel and the fluoroscope employed. Under the direct vision of the operator, the cannula with its obturator is passed down through the tissues until it touches the projectile. At this point, the light is turned on and the obturator removed. In Sutton's original method, it is replaced by a piece of very fine piano wire with a crochet end. This fine wire serves as the surgical guide to the foreign body. We found, however, that when the field of operation was stained with blood, it was difficult to see the wire, which was also too fine to be felt readily as the operation proceeded into the depths. Accordingly, we substituted a small harpoon, about the diameter of the obturator, which is passed through the cannula, where it opens and becomes fixed in the tissues immediately about the foreign body. After the cannula is withdrawn, the projecting portion of the harpoon is bent over parallel to the skin surface and is covered with a sterile dressing. Thereupon the patient is dispatched to the operating room. This larger guide can be seen with great ease and also felt during the operation, as it leads directly to the foreign body. It is quite obvious, however, that this method cannot be employed except in the extremities or in the muscular portions of the body, owing to the possible injury of important structures. Small nerves and vessels are pushed aside as the cannula and obturator are introduced. The localizer, harpoon, and the method of using them is shown schematically in Fig. 9."

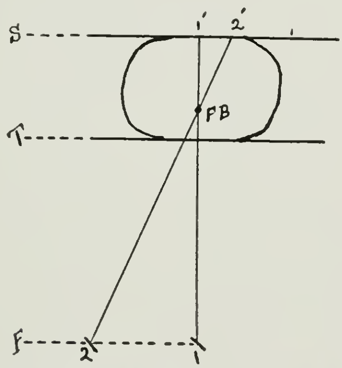

FIG. 10. HARET'S METHOD. DIAGRAM TO SHOW MOVEMENT OF SHADOW WITH TWO POSITIONS OF TUBE.

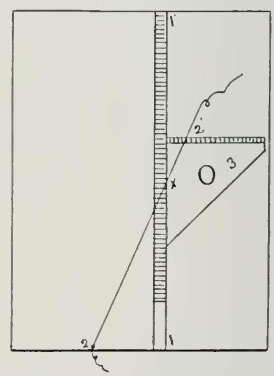

FIG. 11. HARET'S METHOD. THE INTERPRETATION BOARD.

In conversation with the writer, Dr. H. H. M. Lyle states that if at all possible, he undertakes to pass the Sutton localizer in the vertical ray. In this position the head of the instrument hides the point and as soon as the point can be seen it is at once known that the instrument is deviating from the direct course.

Intermittent Control.—Ledoux-Lebard[4] writes enthusiastically of a method which he calls intermittent control. In this the *x*-ray operator wears, during the entire operation, a modification of the familiar hand fluoroscope. This is so arranged that when not in use it can be tipped back over the head, leaving the eyes protected from light by a suitable dark glass.

Working in a light room the patient is placed in suitable position for operation, and the emergence of the vertical ray through the projectile is indicated on the skin. The incision is made and from time to time the surgeon inserts one of several forms of long-handled instruments, depending upon the distance and position away from direct rays, for his protection. A fluoroscopic observation of this position of the instrument with relation to the foreign body is now made and information given the surgeon from which he proceeds in the same direction as before or in a new direction as the case may be. By this intermittent control the two work, the one operating and the other observing until the body is removed. The value of the method will depend entirely upon the skill which any pair of men may acquire for "team-work."

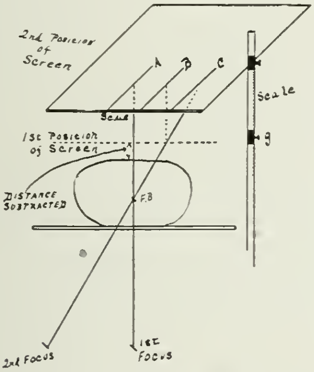

Fig. 12. Carver's Method.

A serious objection to its use is the lack of protection. The author says that the surgeon is able to keep far enough away, as the tube is never excited while the surgeon is over the wound, and that the *x*-ray specialist has learned to take care of himself.

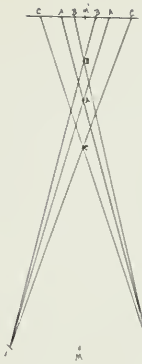

Fig. 13. Showing how Movement of Shadows Varies with Distance from Screen.

INDIRECT METHODS

In the indirect methods one plots the depth of the foreign body from the point on the skin where the vertical ray exits after passing through the foreign body. Many modifications of this principle are described in recent literature.

Simple Tube-shift.—Haret's method[12] also described by Gocht[13] is perhaps the simplest of this class. In Fig. 10 let (*S*) be the screen, (*T*) the table, and (*F*) the focus. The distance (*FT*) and the distance (*TS*) are measured and recorded. Practically (*FT*) is usually fixed, i. e., the same for every case, while (*TS*) is found upon a graduated upright attachable to table, or by actual measurement. The shadow of the foreign body is located in the vertical ray, the entrance and exit of which is marked, as in

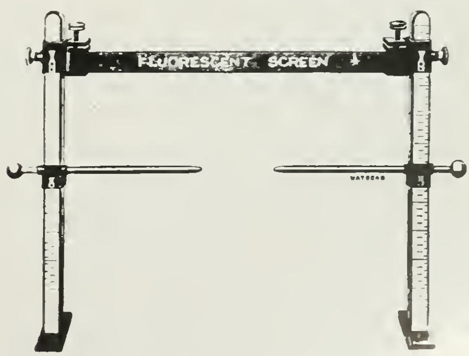

Fig. 14. Jordan's Localizer, End View.

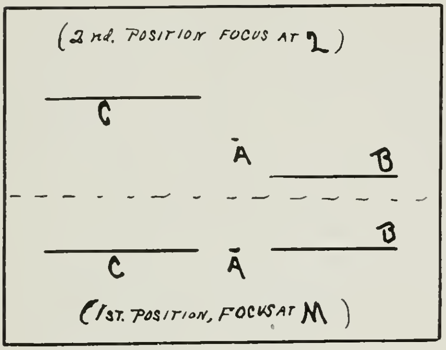

FIG. 15. JORDAN'S METHOD. APPEARANCE OF IMAGE FOR TWO POSITIONS OF THE TUBE WHEN RODS AND FOREIGN BODY ARE AT DIFFERENT LEVELS.

other methods, upon the skin. It is also marked upon the screen, using either the pierced screen or greased pencil. The focus is now shifted from (1) to (2), a measured distance, say 15 cm. The shadow on the screen will, of course, shift also from (1′) to (2′). This distance is measured and noted.

We now have recourse to a drawing board (Fig. 11), or any plane surface of suitable size (the scale may be permanently laid out on one of the walls of the room) in the center of which is a scale with cm.

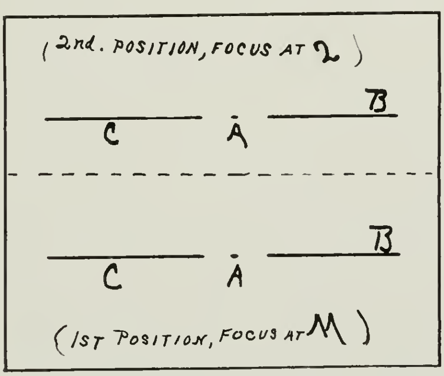

FIG. 16. JORDAN'S METHOD. APPEARANCE OF IMAGE FOR TWO POSITIONS OF TUBE WHEN RODS AND FOREIGN BODY ARE IN SAME LEVEL.

graduations (1-1′), with a straight edge to fit a triangle (3) also graduated in cm. The triangle is now set against the vertical scale at a distance equal to (*FS*) (Fig. 10). A small nail is set in the drawing board at (2) to which is fastened a thread, the distance (1-2) being equal to the focus shift distance (Fig. 10). On the graduated triangle is now read the distance (1′-2′) of the shadow shift as seen on the screen (Fig. 10). The thread is now drawn straight and will cross the vertical scale at a distance, below the corner of the triangle, equal to the distance of the foreign body below the screen. The distance between the screen surface and skin must be deducted, which gives the depth of the foreign body from the skin.

Carver's Method.—The method described by Carver[10] does not require measurement

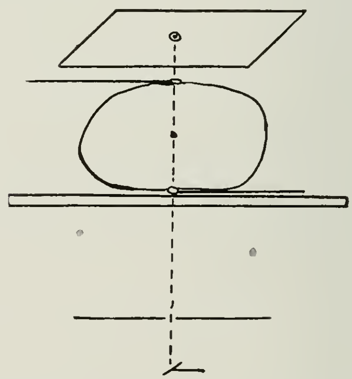

FIG. 17. DIAGRAM TO SHOW USE OF RING POINTER. TWO SUCCESSIVE POSITIONS IN WHICH THE POINTER IS PLACED.

of the focus-screen distance nor that of the focus shift. The screen is fitted to an upright which is graduated and provided (Fig. 12) with a glider (*g*). In the first position the screen is lowered to touch the patient. (If it does not touch the distance from the skin must be recorded and calculated in later.) The glider is raised until it is in contact with the screen holder. Manipulate until the foreign body shadow is in the vertical ray as described above and mark both its entrance and exit upon the skin. Now move pointer (*A*) (attached to screen) along the scale on the screen until it marks the shadow. The focus is now moved any convenient distance and pointer

FIG. 17A. THE RING POINTER.

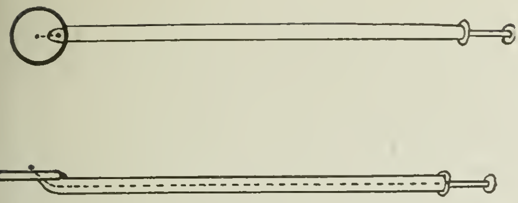

FIG. 18. AUTHOR'S RING POINTER AND MARKER COMBINED.

Front and lateral views. In both the Bowden cable is shown as pushed out to its marking position. At rest it is withdrawn well below the level of the ring.

(*B*) is moved to mark the new position of the shadow. Pointer (*C*) is now set at the same distance from (*B*) that (*B*) is from (*A*). The screen is raised until the shadow is shifted to (*C*). At this point read on the scale of the upright the distance that the screen has been raised above the glider. This equals the distance of the foreign body below the screen in the line of the vertical ray previously marked. If the screen did not rest on the skin at this point the distance between them must be subtracted from the reading.

Equal Shadow-shift.—Jordan's method[11] is based upon the fact that, given a surface (*s*), an object (*o*) and a distant light (*L*) movable in a plane parallel to (*s*):—then, the shadow of (*o*) will move proportional to its distance from (*s*) or inversely as its distance from (*L*). In the diagram Fig. 13 let (*A*), (*B*), and (*C*) represent three bodies in the same vertical plane but in different horizontal planes. With a source of light at (*M*) the shadows (*C*, *A* and *B*) will be cast in a straight line (vertical to the plane of the diagram) at (*M'*). But if the source of light be shifted to (1) or to (2) the shadow of (*C*) will move more and that of (*B*) less than that of (*A*).

Now transfer the same letters with the same significance to Fig. 15, a diagram of a fluorescent screen. (*A*) is now the foreign body, (*C*) is a rod in the same vertical plane but at a lower level, (*B*) is a rod in the same plane vertically but at a higher level. With the light at position (*M*), the vertical ray, (*A*, *B* and *C*) are in line, but in position 2 (the focus having shifted toward the reader) the shadow of (*B*) has moved less than that of (*A*) while that of (*C*) has moved more, therefore (*A*) is farther from the screen than is (*B*) but nearer than (*C*).

In Fig. 16 the rods have been so maintained upon their uprights that in both position (*M*) and position (2) the shadows are all in line, therefore both rods and foreign body are at same distance from the screen. This method should be of value especially with patients so seriously injured that turning is undesirable. It will naturally increase in difficulty with increase in size of the part examined and consequent greater separation of the rods.

Fig. 14 is an end view of Jordan's apparatus.

DIRECT METHODS

All direct methods depend upon some means which mark the point at which the vertical ray passes through the skin both at entrance and exit. The earliest, most simple, and, so the writer thinks, best of these was described by Morize[7] and many

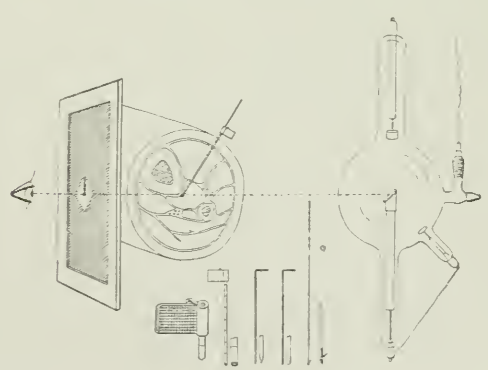

FIG. 19. DIAGRAM SHOWING THE USE OF THE FLUOROSCOPE AND THE RING COMPASS TO OBTAIN THE DIAGONALS PASSING THROUGH THE PROJECTILE AND THE STAMPS TO MARK THEM ON THE SKIN.

others. It may be called the ring pointer (Fig. 17). In use the foreign body shadow is first located on the screen and then the diaphragm opening shut so that a very small zone of lighted screen surrounds this shadow. The ring is then passed beneath the patient and so manipulated that the shadow of the ring surrounds that of the

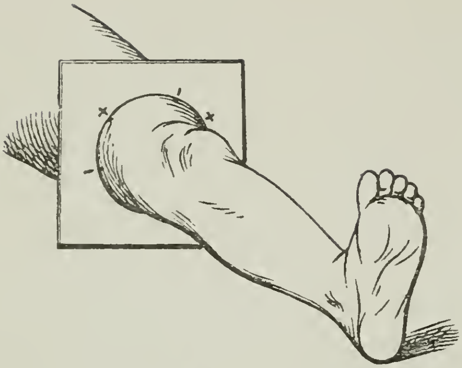

FIG. 20. VERGELY'S METHOD. FORMATION OF CARD.

foreign body. This point is marked and the ring is removed. Without moving tube or patient the same procedure is undertaken with the ring *over* the body and again the point is marked. The patient is now turned, and with tube and diaphragm in the same position a second pair of marks is secured. Three or even four pairs tend to still greater accuracy. By marks either of distinctive color or of distinctive shape each pair should be made easily distinguishable from every other pair. The accurate marking of such points as occur on the under aspect of the patient may offer some difficulty. Following a suggestion[8] the writer has devised an instrument which may perhaps be original to the

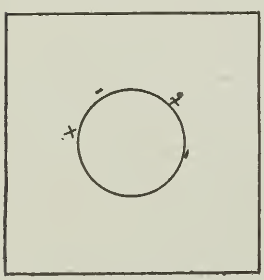

FIG. 21.

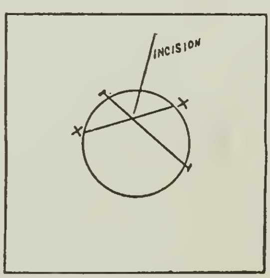

FIG. 22.

FIG. 21. VERGELY'S METHOD. DISTINCTIVE MARKS TRANSFERRED TO CARD.
FIG. 22. VERGELY'S METHOD. COMPLETED CHART.

extent that it combines the ring and the marker. This consists (Fig. 18) of a ring fitted to a tubular handle which carries a Bowden cable. (The original model made use of an ordinary shutter release such as are commonly used on amateur cameras.) This cable carries at its distal end a minute bit of cotton saturated with copying ink, and is so directed that a thumb pressure will project it into the middle of the ring. The marking thus is made accurate and rapid. The writer prefers a set of four, each inked with a distinctive color. It need hardly be said that such marks are most temporary and must be replaced with others more prominent before the patient is even moved from the room. For this purpose Ledoux-Lebard uses either the thermocautery or a tattooing instrument; but unless the removal is to be long delayed

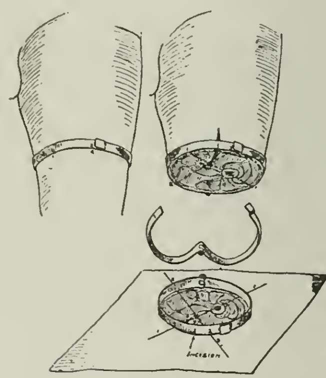

FIG. 23. DIAGRAM SHOWING HOW THE PROFONDOMETER IS EMPLOYED TO MAKE CROSS SECTION CHARTS AND ITS USE IN INDICATING THE EXACT POSITION OF THE INCISIONS.

it seems that solid silver nitrate should be quite sufficient. An elaboration of the ring pointer is found in the ring forceps or calipers described by Belot[9], and modified by Flint. In this instrument (Fig. 19) the upper and lower ring are combined and so manipulated over and under the patient that both ring shadows appear as one about that of the foreign body.

REPORTING TO THE SURGEON

Localizing methods may be ever so clever, but if we fail to transmit their information to the surgeon so that he actually extracts the foreign body from that information, then there is a fault somewhere. It is perhaps as often a failure to translate the findings into a form that the surgeon readily grasps as it is a fault of the method.

In the case of the indirect methods the information gained is that the foreign body is at a definite depth from a spot marked on the skin. The line from the skin mark to the foreign body at the time of localization is a perpendicular, but if the patient is rotated the line will become oblique. It is therefore important that the position of the patient at the time of operation should be the same as at the localization.

Cardboard Cut-outs.—The direct methods may be reported graphically as follows: We have four, six, or eight marks upon the skin grouped in pairs, each pair representing a line passing through the foreign body,

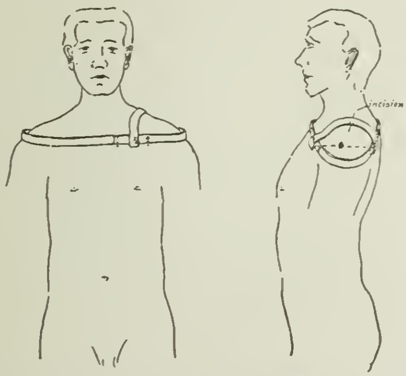

Fig. 24. Use of Two Profondometers at Right Angles to Each Other.

and, if accurately placed, all will be in a regular line encircling the part. The separate marks should be permanently marked, as, for instance, with solid silver nitrate, and the encircling line may be less permanent, as with writing ink. We may now employ the method of Vergely [14] (Fig. 20). In a plain card of suitable size an opening is cut to fit the wounded region at the level of the skin markings. These markings are then transferred to the margin of this opening (Fig. 21) using in this instance distinctive signs, the + and the —. A better method is the use of distinctive colors. The card is now removed and laid upon a sheet of paper on which the margin of the opening is traced as are also the distinctive marks. These marks are now connected

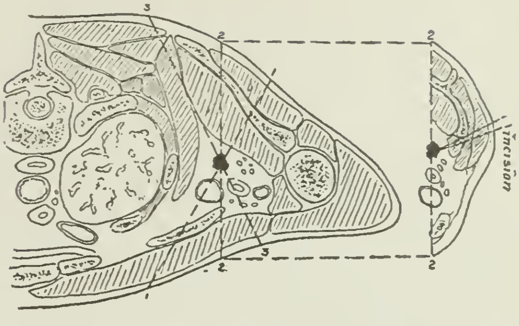

Fig. 25. Horizontal and Vertical Sections Indicated by Fig. 24.

by pencil lines + to + and — to — or red to red and blue to blue, etc. (Fig. 22).

The Profondometer.—Another method is by the use of flexible metal strips. During the present war this has rapidly gained in general favor but was first recorded by Flint [15] and by him credited to Irwin and by them named the profondometer. It may be made of any flexible material which has yet enough stability to retain its shape when carefully handled. The writer prefers block tin from 1/16 to 3/32 in. thick and from ½ to 1 in. in width. Two pieces are hinged end to end and are made of suitable length for the parts to be examined, somewhat more than one half the circumference of the arm, thigh, or torso as the case may be. These are now moulded about the part at the desired level, taking care to place the

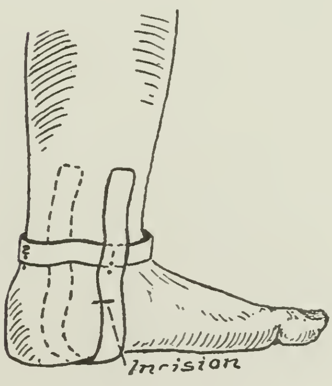

Fig. 26.

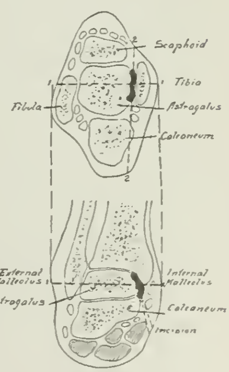

Fig. 27.

Fig. 26. Use of two Profondometers on the Foot.
Fig. 27. Horizontal and Vertical Sections Indicated by Fig. 26.

hinge in a favorable position that the instrument may be removed without disturbing its shape. The point of overlap is marked and the distinctive marks are transferred in exactly the same manner (Fig. 23) as described for Vergely's card, and in a like manner the paper chart is made. The further procedure is described by Flint as follows:

"The profondometer is thereupon removed from the paper and the corresponding points are converted into real diagonals by a ruler, so that we have the exact position of the projectile indicated at the point where the lines intersect. Finally, the important anatomical structures can be sketched into the cross-section, a procedure which is greatly facilitated by the aid of a good cross-section anatomy like that of Eyclesheimer, and Shoemaker, for example. It is now possible with these data to

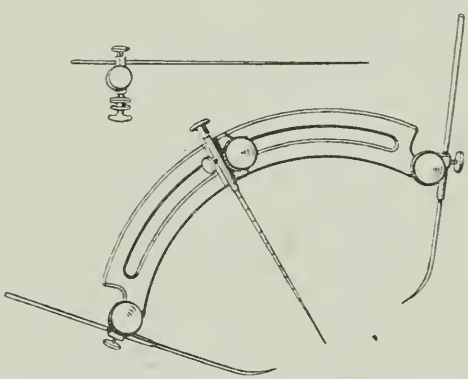

Fig. 28. Debierne's Compass.

plan the operation and select the incision with reference to surgical and anatomical considerations, which is then marked on the tracing. By means of the profondometer, the position of the incision can be transferred to the skin surface of the body by first marking it from the tracing on the instrument and then replacing the latter on the body in its original position and making a corresponding mark on the skin. The tracing may then be used to obtain exact measurements from the incision to the projectile. The various stages of the application of the profondometer and the

Fig. 29. Application of Debierne's Compass.

method of obtaining the tracing are shown in Fig. 23. It is important to remember in obtaining cross-sections of large regions of the body, like the chest or abdomen, where there may be some distortion of the profondometer from the spring in the metal which might lead to a slight error, that it is well to control the anteroposterior and lateral diameters of the section under examination. This is done most easily by checking up these dimensions as the profondometer is placed on the paper. There are certain parts of the body where a simple horizontal localization sometimes does not give the data necessary for extraction, owing to the interposition of bony structures, and in these cases the method must be modified. Such an instance occurs, for example, where a shell fragment lies between the clavicle and the scapula adjacent to the brachial plexus and axillary vessels. As the only operative route lies above the shoulder, this fact necessitates the addition of a right angled or vertical localization, starting

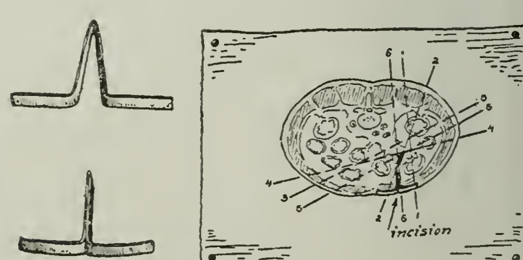

Fig. 30. A Band Guide and its Application to the Abdomen.

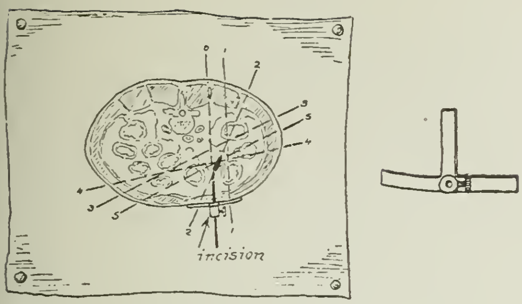

FIG. 31. TRIPOD BAND GUIDE AND CHART TO ACCOMPANY IT.

from one of the original diagonals as a base line. I solved this problem by placing a malleable band of metal similar to the profondometer and moulding it to the shoulder in a position at right angles (Fig. 24) to the ends of one of the diagonals. This diagonal is then projected out to one side of the chart (Fig. 25) and the vertical contour of the

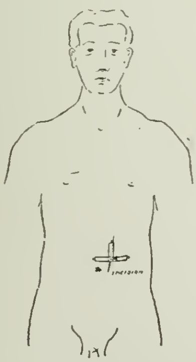

FIG. 32. APPLICATION OF TRIPOD BAND GUIDE TO THE ABDOMEN.

shoulder obtained by a tracing of this second piece of moulded metal. This makes it possible to obtain accurate measurements from above and to select the proper incision from the surgical point of view. Another similar problem is presented by the case where a shell fragment lodged between the internal malleolus and the astragalus. This patient had been operated upon unsuccessfully in another hospital. The horizontal localization shows the interference of the malleolus with the selection of a direct incision, which should of choice be from below. By the use of a secondary band extending below the sole of the foot, as is shown in Fig. 26, not only the incision, but accurate measurements from it to the shell fragment are obtained. The charts with the right angled localization are given in Fig. 27. It can readily be seen that, with similar variations of this method, there is not a part of the body which cannot be rendered accessible and for which data for the extraction of projectiles cannot be obtained."

Guiding Instruments.—Not infrequently the surgeon feels the need of some tangible guide as an added assurance that the chart is being accurately used. Such is the compass of Debierne[16] the use of which is easily understood from Figs. 28 and 29. The bar is an arc and the pointer may be shifted at will without resetting the compass.

A much simpler device for the same purpose is described by Flint as follows:

"To provide an operative guide for abdominal and chest cases or those with projectiles in the neck, where the Sutton localizer would be dangerous, a band guide was devised and used. This is made as follows: A small band of aluminum is bent double. It is then placed on the tracing (Fig. 30) with the bend at the position of the projectile extending in a straight line through the selected incision. At the skin level, the two arms are bent to conform to the skin contour. In this way, after the incision is made, the guide can be slipped into the wound and, when the proper depth is obtained, it should touch the projectile. As there is, however, certain possible inaccuracy in this instrument owing to the fact that the indicator can swing through the arc of a circle, a tripod guide and pointer were devised as an improvement. This is moulded to the skin contour from the chart (Fig. 31) with the socket of the pointer lying in the plane of incision. It is then placed in the corresponding position upon the patient and three marks made upon the skin at the ends of the tripod (Fig. 32). The tripod is then replaced upon the chart and the pointer inserted and adjusted so that it reaches the depth of the projectile, where it is fixed in position by a thumb screw. Obviously, when this is utilized during the operation, the three marks upon the skin will always control the position of the pointer so that it leads directly to the foreign body. While these various guides are very convenient during the actual period of the operation, they are not absolutely essential. As a matter of routine, it has usually been our custom to utilize them, particularly the Sutton cannula and harpoon, in conjunction with the charts, because they facilitate and simplify the operation. Moreover, there is an additional factor of safety in utilizing one method to check the possible errors of another."

[EDITOR'S NOTE.—In the foregoing article we find several instances where the names of authors have been attached to the methods which they have described, even though the authors themselves have disclaimed any intention to hold the methods as original. For instance, Jordan specifically states that the method he has employed was already in use by Shenton. Haret disclaims originality for the method attributed to him. Flint himself calls attention to the fact that malleable bands were used before him by Warluzel and Jollant.

In order to place before our readers, for future reference, a list of articles on foreign body localization, there will be published in the March issue a collective review on the subject, beginning with the earliest publications of March, 1896.—J. T. C.]

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Especially is indebtedness acknowledged to the masterly monograph of Ombredanne and Ledoux-Lebard, and to Dr. Joseph Marshall Flint for very kind permission to make unrestricted use of recent articles.

THE WAR ROENTGENOLOGIST IN HOME TERRITORY

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THE last six months seem like a dream to many physicians. Men who were following the regular duties of civilian medical practice were summoned to army life and the difference is as great as that between a clergyman in a country town and a traffic policeman on Fifth Avenue. What roentgenologist would have imagined that he was to undergo the paring-down process of the training camp, with its hikes, setting-up exercises and early hours? Nevertheless, many have survived these things and look back at them with even some pleasure and satisfaction.

The early summer found many physicians of the Officers' Reserve Corps eyeing telegrams from Washington which ordered them to proceed to a training camp. My surprise at the first enlisted man's salute, the quandary about the parts of the uniform and the proper honors and ceremonies, were probably the experiences of other reserve officers. It has been said that at least one doctor reported at Fort Benjamin Harrison ornamented with a sabre and shortly after inquired for his orderly who was to polish or rather "police" his shoes and run his errands.

A part of the barracks at Fort Benjamin Harrison was erected for a training camp for the medical officers, while the remainder housed several thousand student officers. Each of the four medical companies of about one hundred men was commanded by an officer of the regular medical corps who acted as instructor. Each company was furnished with two sleeping barracks and a mess hall with the kitchen at one end. The only formality of the day which did not require the premonitory whistle of the top sergeant occurred when the colored boys stood by to unlatch the mess-hall doors at meal times.

The companies began the day's work with roll call at half-past five in the morning. This was preceded by as much time as each individual desired. One showed by his calm demeanor and well groomed appearance that he believed in preparedness. Another indicated by his hasty exit into the company street at the last minute that he had not yet become adjusted to his changed habits. After the top sergeant had made his report, the company joined the others in battalion formation for the setting-up exercises. It was an amusing and pathetic sight to see the men of that particular profession which advocates hygiene in its various forms at this drill. It is not necessary to sketch the picture further. The rest of the morning after breakfast was taken up with road work, foot drill, map sketching, tent pitching and ambulance or litter drill. In the afternoon, classroom work filled the hours until five o'clock.

The question has been debated many times as to whether or not the doctor with special medical training and ability should undergo the course of "right face," "litters post" or "pitch shelter tents" of the camp as well as the other requirements of the drill. The answer to this is clearer to the man who has been through the training than to the one who theorizes about it. The new officer has entered into military surroundings and should know what is expected of him as well as what to expect of others. He will be in command of a group of men who in turn have had military training and who know that certain requirements have been established for them. How, then, can he obtain the clean-cut results in his work, unless he knows what to do and what should be done by others?

It may be necessary in an emergency for the officer to take command of troops.

The sense of *de profundis clamavi* would then come home to him in full force in his helplessness. In reality, he is in the way if untrained in army routine. Moreover, let it be slyly mentioned that a little discipline, out-door living, and regular exercise for untrained muscles will benefit him.

The average age of the men at this medical camp was about forty years and seventy per cent. were married. No other branch of the army can show greater patriotism.

For the roentgenological division, men were selected who were fitted for the work by previous training. For further instruction, schools of war roentgenology were established in several cities, as Boston, New York, Kansas City, San Francisco and others. Members of the American Roentgen Ray Society were commissioned by the War Department to act as instructors. At the end of the three months' intensive training in practical work, demonstrations and lectures, the men found suitable were assigned to base hospitals or cantonments. War roentgenology is, in a way, a specialty within a specialty. The classes are drilled in the wiring and mechanics of the machines and the ways of locating and correcting difficulties. In times of stress "over there," the electrician may not be available. The operator must also be conversant with the numerous methods of locating foreign bodies and to this end each school was furnished with wax anatomical parts in which were imbedded bits of metal for localization. Accuracy and speed with the fluoroscope are especially sought for and localization methods which require calculation may be passed by, when twenty-four hundred cases are brought in from the front within sixty hours, as occurred at one base hospital.

Eventually orders arrive for the men at the schools to depart, and each with his goods, chattels and swagger stick sets out for his assignment with more *sang-froid* than when he first donned his uniform. After his respects have been paid to his new commanding officer, he investigates his quarters and laboratory. The standard equipment is found to be the transformer, fluoroscopic table, vertical fluoroscope, vertical plate changer, eye localizer and Coolidge tubes with tube stand. The work is similar to that of a general hospital where fracture and dental work together with chest examinations take the first place.

There is very little social life at the cantonments. On a half holiday there is an exodus of officers from the camps and the enlisted men load down the army trucks even to sitting on the hoods and fenders. The provisional officers are occupied with evening lectures and studies during the week, so that, if they are fortunate enough to be situated near an active town, the occasional hotel fare and moving picture show makes an agreeable break. In the day time, companies are drilling on all available open spaces and from the distant rifle range come the sounds of target practice. In the new buildings under construction, the numerous workmen find opportunity to practice *camouflage* on their own behalf. Everywhere, the spirit of accomplishment is apparent, and all are pressing toward the desired objective.

THE ROENTGEN DIAGNOSIS OF BONE LESIONS

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THE roentgenogram is not a picture of disease. It is a record only of varying resistance to the passage of the ray offered by the parts roentgenographed. For example, the semi-solid liver-like substance in sarcoma, the blood-stained fluid in bone cysts and the pus in bone abscesses often cannot be differentiated by means of the roentgen ray alone, because penetration depends upon specific density which in turn depends upon the atomic weight of the elements of the substance. The interpretation and meaning of various shadows in bone lesions, whether they are caused by pathologic conditions or not, require, on the part of the roentgenographic diagnostician, a full knowledge of the clinical expressions of the various affections and of the various shadows in consequence thereof.

A case of osteomyelitis of six to eight weeks' standing, as the case shown by Fig. 1, presents a characteristic picture. The mottled appearance on the plate, alternating dark and light areas, with rarefaction, indicating bone softening and loss of lime salts extending from the epiphyseal line downwards with no epiphyseal involvement and showing the new bone formation at the periphery, is practically pathognomonic of osteomyelitis. In the case shown by Fig. 2, a more virulent type of infection of only five days' duration, the roentgenogram reveals softening of the cancellous structure of the lesser trochanter shown by the absorption of the lime salts in this area; also the shaft of the bone is darker than that of the opposite femur. This is due to the surrounding pus beneath the periosteum giving a similar effect to the blood found between the periosteum and bone in scurvy. This was confirmed by operation. A culture from the pus obtained was found to be nearly a pure streptococcic strain. In acute osteomyelitis, the infection is at first located in the medulla. When the pyogenic infection is very virulent, rapid and extensive, as case represented by Fig. 2, it causes blockage of the vessels, not only of the medulla, but also of the shaft, producing necrosis. The main nutrient vessels of the bone are thrombosed, but due to separate blood supply of the epiphyseal ends and the periosteum these are not affected. The roentgen ray has its limits in the diagnosis of early cases of osteomyelitis because changes in structure (density) of the bone has not been produced. The diagnosis must be made by means of the clinical signs and symptoms, not relying on the roentgen findings in early cases.

Fig. 3 is a case of osteomyelitis six months after seven inches of the shaft of the bone was removed. As much of the periosteum as possible was left. Fig. 4 is the same case two years after operation. The regeneration of bone by the direct division of osteoblasts is well shown in the upper fragment and ossification proceeded rapidly, due to the favorable condition of the case. The periosteum normally contains few or no osteoblasts, but if certain stimuli be applied to the underlying osseous tissue, we find the osteoblasts are increased in the Haversian canals and are found to accumulate in the subperiosteal areolar tissue surrounding the area of irritated bone. Osseous production ensues to an extent limited by the osteoblastic supply, as shown in this case from the lower fragment extending upward.

Bone abscesses are readily detected on a roentgenogram and are seen to be of a large size (larger than a hazel nut). They have but little density in their center, but

Fig. 1. Osteomyelitis of the Tibia, Six Weeks' Duration.

Showing marked disturbance of the shaft, due to necrosis and new periosteal bone formation. No involvement of the epiphysis.

are surrounded by a wall of considerable density. These abscesses are usually due to an infection in the spongy tissue. When old or of long standing, they may be surrounded by a dense eburnated wall. If of great extent, we may find a network of trabeculæ extending through the entire area. When this occurs, differential diagnosis, with some bone lesions to be later described, is very difficult.

Post-typhoid lesions of bone sometimes occur at long intervals following typhoid fever. The "collar stud abscess" is typical. Here we have an increase of the compact layer of the affected bone with a corresponding narrowing of the medullary canal. In other cases, the periosteum is principally affected and there is a tendency to necrosis of the underlying bone. When it affects the spine, the vertebræ are not well defined, but there is no absorption of the intervertebral discs as in tubercular lesions of the spine.

Fig. 5 is a case of gonorrheal arthritis of one month's duration. The roentgenogram showed the bone normal. The synovial fluid shows a slight cloudiness compared with the normal ankle. Fig. 6 shows a case of longer standing; eight months since the initial lesion. There are marked changes in the articular head of the femur and the acetabular cavity allowing a partial dislocation. Fig. 7 shows a case similar to the last one reported, only of longer duration; eight years since the initial trouble with the joint. It is now in the quiescent stage firmly ankylosed. In the early cases of gonorrheal arthritis, the findings are usually negative.

The typical roentgenogram of tubercular osteitis shows rarefaction of the bone (atrophy), one or more areas of bone destruction and a peculiar hazy appearance simulating a poor slate. The latter helps to differentiate bone atrophy found in atrophic arthritis; bones of the aged atrophy from nonuse and from the absorption of lime salts in tubercular osteitis. Primarily tubercular infection of the shaft of bones rarely occurs except in the phalanges, metacarpal and metatarsal bones.

Fig. 2. Acute Osteomyelitis of the Femur, Duration Five Days.

Shows an area of increased radiability of the lesser trochanter. The cortical layer of the shaft of the bone shows very plainly, due to the pus beneath the detached periosteum.

It occurs most frequently in early life and is often associated with involvement of the joints. When the disease is confined to the synovial membrane and cartilage, the roentgen plate may show bone atrophy and effusion in the joint, but is often negative. There are cases of tubercular osteitis where erosions in the bone outside the joint are shown on the roentgen plate, but nothing in the joint itself. Common examples of this type are found in the olecranon of the ulna, the great trochanter of the femur, and the internal or external condyles of the femur. Removal of the diseased area will usually cure these cases. In others, however, the signs of joint disease persist, although the roentgen plate shows no joint involvement. This is due to pathologic conditions already in the synovial membrane of the joint and does not show on the roentgenogram. In acute tubercular osteitis the hazy appearance is usually well marked, together with rarefaction and atrophy of the bone. This may be all that is shown on the roentgenogram.

Fig. 4. Same Case as Fig. 3; Taken Two Years Later, Showing the Growth of the Bone.

Fig. 3. Case Similar to Fig. 1.

Where surgeon removed seven inches of the shaft of the tibia, leaving as much of the periosteum as possible. This plate was taken six months after operation.

In these cases areas of bone destruction, even with abscesses, often blend with areas of rarefaction, so that the outline of the abscess cavity is ill defined and the extent of the diseased bone cannot be told from the examination of the roentgenogram. The clinical symptoms must be kept in mind and the extent of the operation is indicated by the bone-softening, presence of sequestra or pus. In quiescent cases of tubercular osteitis, the extent of bone destruction or wall of abscess cavity is usually well defined on the roentgenogram, and a general appearance of rarefaction takes the place of the hazy appearance. In tuberculosis of bone, we find no proliferation of bone. We have rarefaction without bone growth. Primarily, it is a joint disease affecting the adjacent cancellous structure and very seldom occurring in cortical bone or the periosteum. As regards the prognosis in tubercular lesions of bone, the roentgen ray is of the utmost value in the study of the progress of cases.

Fig. 5. Gonorrheal Arthritis of the Ankle Joint, of One Month's Duration.

The roentgenogram shows some cloudiness of the synovial fluid, but no bone involvement.

Fig. 6. Gonorrheal Arthritis of the Hip-Joint, Eight Months' Duration.

Entire head of femur roughened and some involvement of upper part of the acetabular cavity allowing a partial dislocation.

Syphilis of bone is very difficult to diagnose due to the different methods of affecting the bony structure. The three chief manifestations of syphilis of bones are epiphysitis, periostitis and gumma. Syphilitic epiphysitis shows on the roentgenogram as an irregular epiphyseal line, thickened epiphyses and periosteal new bone formation on the shaft side of the epiphyseal line. It differs from tuberculosis in that in the latter we find rarefaction. Syphilis affects the epiphyseal side rather than the diaphysis. Occasionally erosions and separation of the epiphysis results from syphilis, also the periosteal thickening may occur on the shaft side of the epiphyseal line in tubercular epiphysitis. In these cases, the diagnosis cannot be made from the roentgenogram alone, but must be reached by weighing all the evidence in the case. The second type or syphilitic periostitis usually presents a typical roentgenogram. We find it affecting the convex surface of long bones, showing a thickened and irregular outline (lace-like) of the periosteal covering due to the condensing osteitis in and on the surface of the bone, and a deposit of new bone under the periosteum chiefly at the expense of the medullary cavity. This sclerosis may either be localized or extend throughout

Fig. 7. Ankylosed Elbow-Joint Showing the Final Result of a Case Similar to Fig. 6, Nine Years Since the Initial Involvement.

FIG. 8. TUBERCULOSIS OF THE RIGHT HIP-JOINT. HISTORY OF TWO MONTHS' DURATION.

The upper rim of acetabular cavity, the head and neck of femur showing involvement.

the length of the bone. In the third type localized gummata are formed in the bone and lead to rarefaction (syphilitic caries)

FIG. 9. "TRAVELING ACETABULUM" IN A WOMAN THIRTY-SIX YEARS OF AGE.

The result of an untreated tubercular lesion when a child. Lesser trochanter in remnants of acetabular cavity. Entire head and neck of femur gone.

FIG. 10. TUBERCULOSIS OF THE SPINE. INVOLVEMENT OF THE BODIES OF THE THIRD AND FOURTH LUMBAR VERTEBRÆ.

with formation of new bone around. Periosteal thickening is also commonly present in the bones beneath syphilitic ulcerations. Chronic osteomyelitis, osteoperiostitis from typhoid infection, and early periosteal sarcoma must be kept in mind in differential diagnosis.

Osteosarcoma can be divided for roentgen study into two classes, the periosteal

FIG. 11. SAME CASE AS FIG. 10; SHOWING BONE GRAFT IN PLACE.

and central. The disease in the first group starts in the bone or the periosteum and may even start from the outside layers of the periosteum involving the soft parts, itself remaining intact between the bone and the growth. Most frequently a new bone is formed beneath the periosteum so that the tumor is encased in a thin bony shell. Perforating this and the periosteum, the tumor invades the soft parts. The roentgen appearance is that of blurred and irregular shadows due to the incomplete ossification that appears to radiate from the center of the growth. In central sarcoma the roentgen appearance depends upon the rate of growth. In the rapidly growing round or spindle-celled sarcoma the tumefaction visible to the eye is accompanied by a more or less complete disappearance of the bony tissue in the roentgenogram, as though the bone had been eaten away or scooped out. In advanced cases the bone may be reduced to a mere shell and is liable to spontaneous fracture. Such a roentgenogram is quite diagnostic and unlike that of any other lesion. In the slower-growing types, the giant cell variety, the roentgenogram reveals a cyst-like appearance in which may be seen irregularly placed trabeculæ of bone. The growth is enclosed in an outer shell composed of a layer representing the periosteum, beneath which is a layer of compact bone. In Fig. 15 the growth is gradual, expanding in all directions, leaving merely a thin bony shell which forms a capsule to the tumor. The expansion of the bony capsule in myeloid sarcoma is more abrupt and circumscribed than in benign cysts. Frequent roentgen examinations should be made in doubtful cases to study the behavior of the growth.

Fig. 12. Marked Case of Scoliosis from Untreated Pott's Disease.

In myeloid tissue, we have two distinct groups of cells. First the osteoblasts and osteoclasts, second, the erythroblasts, megalocytes, myeloblasts and lymphoblasts. The first class mentioned has to do with bone formation. The second class are the mother cells of the red blood cells and leukocytes. These are two groups of cells of widely different function. It has been observed that under certain unknown conditions any or all of these cells may react by growth to some particular stimulus. The osteoblast has as its function the building up of bone, reaching its maturity as a fully developed bone cell. The osteoclast or myeloplax in which we are now interested in the cases under discussion has as its function the destruction of bone and is only secondarily concerned in the growth of bone. Adami feels that the giant cells in these tumors have the characteristics of mature myeloplaxes; therefore, the term sarcoma is not appli-

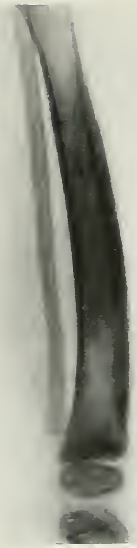

Fig. 13. Syphilitic Periostitis of the Tibia. "Saber Tibia."

Anterior part of shaft more convex than normal, due to the thickening of its cortex at the expense of the medullary canal.

cable; also the non-malignant character of these tumors would bear this out. His description of a giant cell myeloma is as follows: "It grows locally, most often in the marrow of the long bones and the jaw. Its growth is expansile, leading to absorption of the surrounding bone. It is abundantly vascularized. It does not form metastases save in the infrequent cases in which it undergoes sarcomatous modification. It does not recur on complete removal, and as recently shown, to prevent recurrence, it is only necessary to remove the portion immediately involved with very small surrounding zones. Histologically it exhibits a body formed mainly of short spindle-cell elements of fibroplastic type, somewhat irregular in shape, varying from typical spindle to polygonal cells and among these are numerous giant cells of the type described as myeloplaxes."

In some cases, we have the formation of bony spicules and lamellæ in the parts of the tumor where the giant cells are least abundant. This is shown on the roentgenogram of the case represented by Fig. 16. There are many different opinions by different writers leading to numerous, confusing and misleading nomenclatures. It will be necessary for the histopathologist to determine the character of these giant cells, whether they are of the foreign body type, as Barrie contends, or are the true tumor cell derived from a transitional stage of the myeloplax. These lesions involve most frequently the long bones and the lower jaw. They may appear in short bones. The age is generally the mid-period of life. Jones reports one case involving the patella; Prince, two cases of the os calcis. As far as I know the case described in this paper is the third to be reported of the os calcis and the fourth of the short bones. The case reported in this paper was a woman thirty-six years of age, employed as a saleslady. She gave no definite history of trauma. Duration of illness was three or four years. She was treated for flat foot, wore numerous devices and specially made shoes, had a tenotomy on the tendon of Achilles (an Italian operation devised for the treatment of flat foot), was

Fig. 14. Syphilis of the Femur.

The roentgenogram shows much coarse thickening of the irregular areas of sclerosis. The medulla is with difficulty differentiated from the cortex. Also shows a pathologic fracture.

FIG. 15. MEDULLARY SARCOMA OF THE LOWER PART OF THE RADIUS.

considered a neurasthenic, and finally a roentgenogram revealed the true condition. She was operated on, cavity thoroughly curetted, shell of bone broken down and overlying tissue brought together with catgut and skin incision closed. Foot put in a cast and healed without infection. Two years later, with a shoe built to support the heel, she had a perfect recovery as shown by Fig. 17, taken one year after operation.

Osteitis fibrosa or von Recklinghausen's disease, very much similar to the giant cell tumor described in this paper, has many characteristics in common. According to Bloodgood, we cannot differentiate giant cell tumors and bone cysts from osteitis fibrosa by means of the roentgen ray. Clinically, we find in osteitis fibrosa more tendency to fracture. Roentgenographically, we often find a more vascular condition, often showing the openings of the dilated vessels on the peripheral wall of the giant cell tumors. The essential change which occurs in osteitis fibrosa is the replacement of the bony structure by fibrous tissue in the form of longitudinal striæ containing cysts. Like giant cell tumors, it most frequently affects the long bones and is a disease usually found in the mid-period of life, or between the ages of twenty and fifty. The cause of both these lesions is believed to be the same, trauma or some mechanical factor, together with some perverted action of the internal secretions. The case reported in this paper was that of a woman forty years of age, giving a history of a slight injury one year before. Had an injury to arm from getting up from a chair, and the roentgenogram taken shortly afterwards revealed the condition found on Fig. 18. The arm was immobilized and put at rest; nevertheless, we find that the print from roentgenogram as represented by Fig. 19, taken one month later, shows no sign of repair. The diseased bone was then removed and a bone graft was inserted. Fig. 20, taken three months after operation, shows the result.

In differential diagnosis, especially from the last two cases reported, sarcoma must first be excluded. In sarcoma, we find extreme rarefaction, the expansive character, its irregular progression, often the indefinite outlines, its opacity, its early rupture through the periosteum and the involvement of the surrounding soft parts. Clinically, the early appearance of pain, interference with function and the more rapid growth will usually aid in the diagnosis.

FIG. 16. GIANT CELL TUMOR OF THE OS CALCIS.

FIG. 17. SAME CASE AS FIG. 16; TAKEN ONE YEAR AFTER OPERATION.

Carcinoma of bone is usually secondary to a growth elsewhere in the body. The bone is not enlarged to the extent that the clinical examination would suggest and the roentgenogram shows the bone irregularly eaten away. The involvement may be very extensive with few clinical signs. There is as a rule no attempt at new bone formation.

In osteitis deformans, or Paget's disease, we have a rarefying osteitis, progressive in character, which in the early stages may be difficult to differentiate, but later characteristic bowing of the legs and bending of the spine, together with enlargement of the head, helps to differentiate these lesions.

Osteomalacia is a rare disease. We find the roentgenogram shows the shaft of the bones narrow, the cancellous tissue greatly rarefied and the central canal disproportionally wide. This disease may occur at any age and runs a very chronic course. It usually commences in the spine or pelvis, but may extend to the entire skeleton, resulting in deformity from bending or twisting, and frequent fractures.

Osteogenesis imperfecta is a disease of fetal life or early infancy. The chief clinical feature is multiple fractures due to the extreme brittleness of the bones, resulting in deformity and crippling of the limbs. The roentgenogram shows the compact layer of the bones thin and transparent to the ray. The bones are broader than normal and they consist of coarse-meshed cancellous tissue which often presents a cystic appearance in places.

Exostoses or bony spurs are easily recognized on the roentgenogram. The free extremity is usually turned away from the nearest joint, and is in direct continuity with the shaft, and is composed of irregular masses of bone.

Enchondromata usually occur in early life and are found most frequently in the toes and fingers, where they are usually multiple. The roentgen appearance is that of a relatively transparent mass growing within the bone and causing expansion. It is often difficult to differentiate from bone cyst.

FIG. 18. OSTITIS FIBROSA CYSTICA OF THE HUMERUS WITH A PATHOLOGIC FRACTURE.

Fig. 19. Same Case as Fig. 18; Taken one Month Later, Showing no Attempt of Nature to Unite the Fragments.

Scurvy in the acute stage shows on the roentgenogram a light fusiform shadow where the subperiosteal hemorrhage has occurred. Later the hemorrhage gives a darker shadow between the bone and periosteum. The shadow of the bone is darker than that of the unaffected side, because of the hemorrhage surrounding the bone. The periosteum is raised, but smooth, differing in this respect from sarcoma.

Rickets gives a very characteristic appearance on the roentgenogram, the most striking feature being the great change in the epiphyseal area of the bones. The long bones are bowed and the cortex on the concave side is markedly thickened. The epiphyseal ends of the diaphyses are broadened and frequently contain small irregular areas filled with tissue of very little density. The center of ossification of the epiphysis is small and presents a smooth contour towards the joint, and an irregular one towards the epiphyseal line. The epiphyseal cartilage itself is much thicker than normal, and its demarcation from the diaphysis is very indefinite.

CONCLUSIONS

1. The roentgen ray is of the utmost value as an aid in the diagnosis of many bone and joint lesions.

2. The roentgenogram is pathognomonic of some diseases.

3. The roentgenograms are similar in some diseases. We should, therefore, never forget the clinical findings, and carefully weigh the evidence from all points of view.

4. The roentgen ray should not be relied upon in early cases of pathologic bone, because changes in structure (density) are not produced. Particularly is this true in tuberculosis and acute osteomyelitis.

5. The pathologic process may not give us a true picture due to the fact that the roentgenogram does not show difference in the composition of substances of the same density.

6. The roentgenologist must continue with earnest zeal in this comparatively new field of diagnosis, and not feel chagrined in a mistaken diagnosis. Remember that occasionally the pathologists disagree when they have access to the specimen before them.

Fig. 20. Same Case as Fig. 18; Taken Three Months after Bone-Grafting.

ROENTGEN PLEURITIS

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THE fact that roentgen ray exposures may, at times, cause an irritation of the deep tissues such as the nerves, the kidneys, the pleura, the peritoneum and the gastro-intestinal tract, has been reported by several German authorities. These two cases of pleuritis, following roentgenotherapy, are presented as further confirmatory evidence.

CASE I. Mrs. P., age 56, complaint—coryza. Physical examination showed dulness in the upper left chest and roentgen examination, February 14, 1916, showed a smooth-edged tumor-mass extending from the left hilus forward and upward, apparently not involving the pleura. Treatments by a Coolidge tube were administered at a target skin distance of ten inches, through three millimeters of aluminum with a parallel spark gap of eight and one-half inches, as follows:

June 29, 1916—front left chest—50 milliampere minutes.

July 12, 1916—left back—40 milliampere minutes.

July 21, 1916—front left chest—50 milliampere minutes.

Plate taken at this time showed no evidence of effusion.

Aug. 7, 1916—left back—40 milliampere minutes.

Aug. 21, 1916—front left chest—40 milliampere minutes.

Plate this date shows diminution in size of tumor and small effusion left base.

No further treatments.

Plate, Dec. 6, 1916, shows no evidence of fluid, tumor somewhat increased in size.

Conclusion.—Primary lung tumor, mild radiopleuritis.

CASE II. Mr. D., age 31. In February, 1914, he entered the University of California Hospital. Complaint was weakness, hoarseness, loss of weight, masses in the neck greatly increasing over a period of 7 months. Examination showed paralysis of left vocal cord and a large mass extending from above the clavicles to the diaphragm, further to the left than to the right, masking particularly the inner heart shadow. Patient received series of roentgen ray treatments; the masses disappeared; patient gained 30 pounds in weight. In September 20, 1915, he reëntered the hospital with fluid in the left chest, having recently received intensive roentgen ray exposures outside the hospital. At this time he showed a moderate effusion at the left base. The paralysis of the vocal cord, tumor masses in the neck and the mediastinal shadow had entirely disappeared. In November, 1915, he reentered the hospital with pain in the left side of abdomen and an irregular mass in the left flank, which disappeared under intensive treatment. There was no effusion at this time. Since then he has been fairly well under mild, continuous roentgen ray exposures and no recurrence of the effusion.

Conclusion. — Lymphosarcoma. Roentgen pleuritis.

Strasser[1] cites the following case. Patient 68 years—man. For 15 years he has had gout; for 9 years a mild glycosuria, fatty heart and arteriosclerosis; for 4 years bronchial catarrh, twice a small bronchopneumonia in left lower lobe, never a pleurisy. Early in 1910 patient slowly developed stenosis of trachea and esophagus. Fluoroscopy by Holzknecht showed tumor of the mediastinum behind the manubrium extending to the right beyond the sternum, showing a transmitted pulsation, compression of the trachea, displacement of the esophagus to the left. Patient received treatments as follows:

Dose of $3\frac{1}{2}$ H.

June 10.—Front of right chest.

June 17.—Right axilla.

June 28.—Right thorax posterior.

There was a severe skin reaction after the three treatments and attacks of anginal pain. Difficulty in breathing and swallowing rapidly diminished following radiation, but the patient began running a low evening temperature. On July 12th, a slight pleuritic rub was heard on the right side. Two days later a definite effusion occurred, which in a week extended to the angle of the scapula. With rest in bed the fever disappeared in one week and the pleuritic symptoms in four weeks. The patient went to the country and was all right until March, 1911, when he had a slight hemoptysis. The roentgen ray showed no sign of the tumor at that time.

Fellner and Neuman [2] give an account of the radiation of four dogs with high doses. Laparotomy later showed ascites.

Jaksch, [3] Primbram and Rotky [4] called attention to possible direct radio effect on the kidneys with consequent albuminuria and also observed diarrhea and pleuritis following heavy doses.

Quadrone [5] reports that in addition to skin lesions there has been reported a form of ascending neuritis and also that Penzoldt observed phlegmonous gastritis, also nephritis with albuminuria and casts. He reports two cases of lymphatic pseudoleukemia. The first in a girl of 12 who, after fifteen exposures, developed dyspnea and right-sided effusion, of which 1½ liters were removed, of a light, straw-colored fluid containing many corpuscles. The second case in a 28 year old man in the third year of the disease. After thirty exposures he experienced severe gastro-intestinal intoxication and skin reaction. After five further treatments, slight dullness at the base of the left lung. After seven further treatments, chest tap showed thick, yellow exudate, of which a liter was removed. The effusion in both cases had a specific gravity of eleven hundred and twenty-eight to eleven hundred and thirty, thirty-six per cent. albumin, numerous small lymphocytes and red cells, very few polymorphonuclears. In a discussion of the cases Quadrone asks whether they are due to a late complication of pseudoleukemia, to broken down tuberculous glands at the hilus, or obstruction of the vena cava or direct effect on the pleura. He concludes that the latter is the case because the effusion was an exudate without the characteristics of tuberculous processes, without leucocytes; because the pleuritis appeared when the lymphoma was reducing; because it appeared on the site where the radiation was strongest and because it recurred with subsequent treatment.

That lung tumors may extend to the pleura, causing an effusion, and that in lymphosarcoma a pleurisy with effusion is not infrequent, are well known facts and it might be argued that in the two cases here cited, pleuritis may have occurred without the roentgen exposures. However, it should be noted that in our cases, as in those from the German authorities, the effusion disappeared on cessation of the treatments, while the primary condition was greatly improved. In cases of effusion occurring without radiation, the condition is more apt to be progressive.

It would seem, with the high penetration and filtration now in general use, together with cross-firing, that irritation of the deeper structures, particularly the pleura, must occur more frequently than the English literature would seem to indicate.

We wish to record these two cases, not as absolutely proven ones, but to emphasize the possibility of a pleuritis and perhaps stimulate investigation along this line.

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THE ROENTGEN DIAGNOSIS OF TRAUMATIC LESIONS OF THE LOWER BACK

BY ERNEST L. DAVIS, M.D.

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BACK injuries have a bad reputation. In no small measure this is richly deserved, because of the serious difficulty in making a correct diagnosis on the one hand, and on the other because of the ready opportunity for malingering afforded the unscrupulous patient. As a natural consequence surgeons view all trauma of the spine with more or less anxiety and distrust. Even a perfectly honest patient frequently excites suspicion because his symptoms seem all out of proportion to the trivial nature of his injury. That disability, therefore, often seems unduly prolonged is a not unnatural plea; and that it is more often made ever since workmen's compensation acts began to extend pecuniary aid to injured employees, is not at all surprising. It may perhaps be that this financial aspect is the immediate cause of the commendable interest now directed toward back injuries. Be that as it may, one immediate effect of compensation acts is an earnest attempt not only to shorten the period of disability, but what is more to the point, to clear up the whole matter of spinal trauma. With this end in view the aid of the roentgen ray is being invoked, and that no little is being accomplished is due in great measure to the painstaking work of roentgenologists. Thanks to their findings it is universally granted that every case of back injury, however trivial, demands a roentgenogram; for the roentgen ray men are proving time and again that beyond all doubt fracture of a vertebra may exist when clinically it is least expected. Particularly is this true of the lower back.

While the roentgen ray is taking a huge burden from the surgeon's shoulders and relieving him of much responsibility in spine injuries, the roentgenologist finds himself confronted with some very perplexing problems. In the first place the roentgen examination is so often negative that the roentgenologist has to take great pains both in technic and interpretation, lest he overlook an apparently slight lesion which may really be very important. In the next place, while it is usually very easy to show the first four lumbar vertebræ on a plate and to interpret what is shown, it is exceedingly difficult even to show the fifth lumbar, to say nothing of interpreting the image when shown. Furthermore it is under ordinary circumstances not difficult to show the bony pelvis and to show it well, but in the iliosacral region, at least, interpretation may be difficult. Even more perplexing are the adventitious shadows that complicate all plates of the lumbar region. Fecal masses and gas sometimes cast confusing shadows, and finally the lines of the articular processes which are seen many times projected through the vertebral bodies are apt to be mistaken for fractures, especially as it often happens that these lines are seen more distinctly in one vertebral body than in all the others. Many of these back cases get into court, or at least before an arbitration board, and necessitate expert testimony from roentgenologists. Confronted as they are with trying perplexities of interpretation, it is well to be charitable and to regard the conflicting testimony as honestly given, however biased and ridiculous it may appear.

It is well known that not infrequently in making a roentgen examination of the lower back, fractures of vertebræ are discovered in cases where clinically there is little or perhaps no evidence of fracture. Even in cases where fracture is scarcely more than a remote possibility, where no deformity is detectable by ordinary clinical means, and where no sign or symptom pointed to fracture, one is found by the roentgen ray, not in a few but in many instances. It is usually of the compression fracture type, and most often in the upper lumbar region. It is produced by a form of violence causing longitudinal jarring of the spinal column or forcible bending beyond physiological limits, and the degree of violence is often surprisingly slight.

The lumbosacral region presents the greatest difficulties of interpretation. The body of the fifth lumbar vertebra differs in shape from its fellows in that it is wedge-shaped with the narrow end of the wedge directed backward. Its axis points back and up. Moreover the whole bone so lies that the rays fall obliquely upon it and through it, thus projecting upon the plate an image that is more or less ill-defined. On plates taken with the tube parallel with the plate the fifth lumbar vertebra always has the appearance of being crushed, for the upper part of the sacrum obscures the posterior part of its body. It has been suggested that a lateral view be taken of the fifth lumbar in order to show its relation with the sacrum. Personally, I have as yet been unable to get satisfactory plates of the lower part of the fifth lumbar by so doing. On the contrary, with the patient on his back, with the cone just above the pubic arch, and with the tube tilted towards the feet (reversed bladder position), I have been able to show the body of the fifth lumbar more plainly. Yet I have to confess that this maneuver has the disadvantage of throwing the shadow of the fifth somewhat on that of the fourth.

Many times on plates taken of the lumbar spine there appear to be depicted apparent curvatures. If any curvature is seen, it is well to note the shapes of the involved bodies and the intervertebral discs. In temporary curves the discs present definite wedge shapes; the bodies are unaltered. Moreover the spinous processes retain in temporary curvature their medial positions relative to the bodies. In general a localized deviation is pathological, whereas a generalized deviation of the spinous processes to one side is usually due to the position of the tube which was not centered vertically in the median line.

Sacro-iliac strain and sacro-iliac dislocation are perhaps the commonest injuries diagnosed in the class of cases where liability is concerned. In fact, such injuries now constitute the favorite claim of the plaintiff. Unfortunately for him, my experience is that roentgenograms of these alleged injuries make better evidence for the defendant. I say this because after examining a great many plates showing the sacro-iliac joints I have only once seen what I could honestly say was a change in the normal relations of the bones. I exclude, of course, cases showing obvious disease of the bone. Either the roentgen ray does not demonstrate sacro-iliac dislocation, or it is a very rare injury. Sacro-iliac dislocation, even to a degree that allows the irregularities which form the surface of the articulation to catch on opposing irregularities, is rarely shown on roentgenograms. And yet it is heard not infrequently that a roentgen ray plate shows even a relaxed sacro-iliac joint. Unless accustomed to read plates of this region, it is easy to go astray. Careful study of the roentgenogram generally brings out the disquieting fact that the tube was not centered over the sacrum, which accounts for the apparent difference in the joints of the two sides.

Many times in making plates of injured backs evidence is obtained of hypertrophic bone conditions which undoubtedly existed long before the present injury is claimed. Likewise there are occasionally found developmental malformations, some of which simulate fracture of the lamina; sometimes a spinous process or adjacent portion of the neural arch is found absent. In all malformations, however, the free ends of bone are not irregular, but rounded off. Occasionally, however, there is an apparent overlapping of the free ends, which cannot always, therefore, be clearly outlined. As for dislocations, I would say that I have never seen a roentgenogram of a dislocation of a lumbar vertebra without fracture.

It is obvious, therefore, that all back

injuries should be roentgen rayed. While it is true that with present knowledge and technic the roentgen ray does not show bony lesions in a large number of cases claiming disability in the sacro-iliac region, it is certainly most satisfying to physician and patient alike to be assured that no fracture nor dislocation is present. With further advances it may well be shown that sacro-iliac strain is really a forward dislocation of the fifth lumbar vertebra on the sacrum.

SOME ROENTGENOLOGICAL OBSERVATIONS ON THE DIAGNOSIS OF TUMORS OF THE JAW

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IT is not the purpose of the writer to present anything new on this subject; but his object is to correlate the few salient points which he has been able to gather, in this difficult but interesting subject. The diagnosis of tumor of the jaw is fraught with many difficulties for the surgeon, and the course of treatment is so radically different in the different varieties of growths, that any light which may be shed upon the subject from a roentgenological standpoint should be extremely beneficial for all concerned. We shall consider the benign tumors first.

Epulis

This is by far the most common tumor of the jaw. It is a topographical term applied to a new growth, seated at the edge of the alveolar border. Histologically considered it arises from the periosteum or connective tissue beneath the mucous membrane, and is a border-line growth between an inflammation and a neoplasm. While it is essentially a fibroma, it sometimes undergoes a giant cell formation. There occasionally occurs a variety which contain small spicules of bones which are thrown off from the growth from time to time, and which can be demonstrated roentgenologically.

Being essentially a growth of the young it occurs most frequently between the ages of twenty and forty, and is more frequently seen in women than men. Its favorite location is in the upper jaw in the region of the canine, bicuspids, or first molars, almost never occurring back of the first molar.

These various pathological and clinical points are mentioned because they have a direct bearing on the roentgenological appearance of the growth, and should be borne in mind when attempting a diagnosis.

Roentgenologically an epulis appears as a small cystic formation, which is confined to the alveolar border of the jaw and does

Fig. 1. Polyp in Right Antrum.

Fig. 2. Dentigerous Cyst of Right Antrum.

The tooth has been carried up into the antrum by the growth.

not invade the body. The walls of the growth are clear cut, and there is no evidence of any inflammatory reaction, characterized by new bone formation surrounding the growth. Occasionally it takes on a giant cell formation when it is very difficult to differentiate from the giant cell sarcoma; and occasionally, as above mentioned, small spicules of bone may be seen in the growth projecting out beyond the alveolar border.

Odontoma

The next most frequently occurring tumor of the jaw is the odontoma. This is a term applied to a tumor of the jaw arising from a portion of a root follicle. Under it are grouped the Adamantine Epitheliomata, Dentigerous cysts, Dental Root cysts, and the Hard Odontoma. There have been many more elaborate classifications, but for our purposes the one which we have adopted will suffice.

Adamantine epitheliomata arise from epithelial rest or paradental epithelial debris, which start an adventitious development during the formation of the tooth. It is the least malignant form of epithelial tumor found in the lower jaw. We usually find this tumor in the lower jaw at the angle in the region of the last molar, although we occasionally find it in the upper jaw. It is twice as common in the female as in the male, and occurs more frequently between the ages of twenty and forty. Its roentgenological appearance does not differ materially from dentigerous cyst with which it is frequently confused.

Dentigerous cyst is the most common form of odontoma, always occurring in young people. It never starts after the permanent set of teeth are erupted. It may be found in the body of the jaw at the angle, and may be found also in the ramus of the jaw and in the antrum.

Its roentgenological appearance is that of a cyst occurring in the regions described, having a dense, bony capsule, so that there is a marked swelling of the jaw before the capsule ruptures. The cyst may contain either a whole tooth or a portion of one, and it is quite common to see one or more teeth absent from the jaw. It is characterized by bone absorption, there being no new bone formation.

The dental root cysts are much smaller than the dentigerous cysts. They are found at the root of a tooth and are quite difficult to differentiate from large alveolar abscesses.

The hard odontomata present the appearance of a cyst filled with solid bone. They are relatively infrequent.

Giant Cell Sarcoma

We have classed the giant cell sarcomata as benign, because, like the tumors already described, they will not recur nor cause metastases if properly removed. This is the most common variety of sarcomata found in the jaw. In fact, of the whole anatomy, the jaw is its favorite location. It rarely appears after the thirty-fifth year, and is found much more frequently in the lower jaw than the upper. It is the only variety of sarcoma of the jaw that we find in very young children.

Roentgenologically we see a growth which involves the body of the jaw in the region of the angle. Sometimes we may find it at the symphysis. It has a perfectly characteristic appearance, there being absorption of bone and a very extensive network of trabeculæ running through the whole of the growth. It is in no wise invasive in character, although it may occasionally rupture through the cortex of the bone. While its general characteristics are benign it may, if allowed to grow a sufficient length of time, involve a very large portion of the jaw, so that its local effects are really as bad as a malignant growth. Occasionally we see a giant cell sarcoma undergo a malignant change.

Osteomata occasionally, though rarely, occur in the jaw. When they do appear they present the usual appearance of a hard, dense, bony growth, such as are seen elsewhere in the body.

Fibromata are more common than osteomata, though they are relatively infrequent. The bone changes produced by fibromata are due principally to pressure, causing absorption of the bone. The writer has seen one case which occurred in the lower jaw, and which had the roentgenological appearance of a huge cyst, involving the whole of the body of one side of the jaw. This appearance was brought about entirely by pressure of the growth on the bone.

Fig. 3. Giant Cell Sarcoma.

Outline of jaw remains intact with the characteristic trabeculated appearance of growth.

Fig. 4. Osteomyelitis of Jaw.

Although there has been great destruction of the mandible, the teeth occupy their normal position.

If one will keep in mind the characteristic appearance of each of the benign growths of the jaw, as well as their histological structure and usual location in the jaw, the differential diagnosis should be fairly easy. There is one condition, however, that should always be borne in mind, that is osteomyelitis. At times this condition may very closely simulate the appearance of a growth; but it is usually accompanied by the ordinary symptoms of bone infection, viz.: thickening of the bone around affected area, occurrence of periostitis, formation of sequestra, etc.

Malignant Growths

Our principal concern in considering tumors of the jaw is to determine whether the growth is benign or malignant. This is not always an easy matter, and when one notes that the surgeon will frequently wait until he cuts down on the growth before he will give his diagnosis, one will appreciate the difficulties of the situation.

We have the usual types of sarcomata occurring in the jaw, just as they do elsewhere in the body. They may originate in the medulla or from the periosteum. The periosteal type usually occurs at the angle and may completely encase the body and ramus in a new growth. Sarcomata occur more frequently in the lower than the upper jaw, and, of course, are more frequently seen in young people than in old, except in sarcomata of the antrum, which are not uncommon in old people.

Carcinomata are more frequent than sarcomata both in the upper and lower jaw. They begin at the alveolar border in the lower jaw or in the antrum in the upper, and usually occur in old people. They naturally do not begin primarily in the bone itself, but are secondary to some growth nearby. Very rarely one may see carcinoma in the jaw when there is a general carcinomatosis of the whole body.

Once in a great while we find metastatic hypernephromata in the jaw.

Fig. 5. Sarcoma of Left Antrum.

Outlines of the antrum are irregular, and it is completely clouded. The growth has not broken through the wall of the antrum.

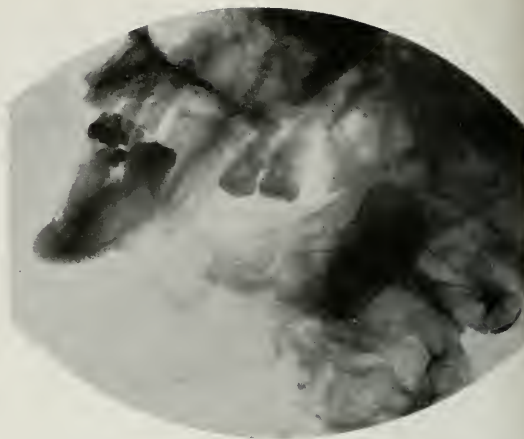

Fig. 6. Carcinoma of Lower Jaw.

Note almost complete destruction of mandible.

The roentgenological appearance of malignant growth is quite characteristic. If it occurs in the lower jaw the bone appears to be definitely eroded and destroyed; the edges of the growth are irregular and it presents an invasive appearance. There is usually very little bone reaction surrounding the tumor, for the growth is too rapid to allow of any. The earliest appearance of malignant growth in the lower jaw is a slight break in the continuity of the alveolar border. In the upper jaw the growth starting in the antrum soon breaks down the walls, and, depending on the direction which it takes, it may invade the orbit, nasal passages or mouth, causing a destruction of the bony walls of these cavities. The earliest signs of malignant growth of the antrum that we can detect, are a clouding of the antrum and a slight break in the outline of the walls of the antrum.

Malignant growths of the antrum are to be differentiated from empyema of antrum, polyp, odontoma, giant cell sarcoma, osteoma.

Empyema presents a homogeneous shadow, the walls remain intact.

Polypi appear as clear cut rounded masses wholly within the antrum.

Osteoma presents the characteristic appearance of a solid growth composed entirely of bone.

Odontoma shows well defined walls which may enclose one or more teeth.

Giant Cell Sarcoma presents its usual trabeculated appearance.

In considering the diagnosis of malignant tumors of the jaw, the writer wishes to lay particular emphasis on two points which have been mentioned, namely, the slight breaks in the continuity of the wall of the antrum and the slight irregularities along the alveolar border of the lower jaw, occurring early in these cases.

These points are not presented as representing any new diagnostic feature; but because they are easily overlooked unless the case is carefully studied.

REPORT OF A CASE OF MYXOMA OF FEMUR

BY ALBERTUS COTTON, M.D.

and

STANDISH MC CLEARY, M.D.

BALTIMORE, MD.

THIS case is considered worthy of report on account of infrequent occurrence, difficulties of diagnosis, and the damage done by a non-malignant tumor.

M.C.D.—female, aged 35 years, married, was referred to me for diagnosis and treatment by Dr. J. C. Madara. The following history was obtained:

Family History.—Brother died of pulmonary tuberculosis. Otherwise history was negative.

Previous History.—Negative.

Active trouble in right thigh began a little more than one year before (spring, 1915), but patient had experienced pain in right limb, especially the knee, for four or five years, and had been treated for rheumatism. At this time (spring, 1915), patient had severe pain in thigh with lameness and well-marked swelling about the middle one-third. She does not think that she had fever at this time.

At that time she was taken to the County Hospital, where a diagnosis of tuberculosis of bone was made. Tonic and hygiene treatment with rest of limb was advised by attending surgeon, and patient returned home.

Pain, lameness, and swelling gradually became worse and she returned to the County Hospital in November, 1915. At this time an operation was performed. The patient's report was that no pus was found and that examination of specimen of bone removed showed tuberculosis; she remained at the hospital four weeks and returned home.

During the winter of 1915 and 1916 patient walked with crutches and attended to her household duties, although suffering constant pain. The operative wound healed in about four months.

In spite of the fact that the wound healed, the patient experienced no relief from pain or lameness, and swelling of thigh increased in size. In June, 1916, she consulted me.

PHYSICAL EXAMINATION

Patient was about five feet six inches tall; of slight build and thin. Face had a white and pinched appearance, but mucous membranes were of good color. She had been taking opiates in moderate quantity for several months. Examination of chest showed heart and lungs normal. Stereoscope roentgen ray examination of chest confirmed findings of physical examination, showing no evidence of tuberculosis or malignancy in lungs. Examinations of abdomen, urine, and blood were negative.

Wassermann was negative. In about the middle third of right thigh there was a large swelling, irregularly fusiform, involving the whole circumference but more prominent anteriorly and externally. On palpation, swelling was hard and firm except at site of scar of previous operation on the anterolateral surface, where there was an area the size of an egg that was soft and fluctuating. Circumference of right thigh at site of tumor was three and one-half inches greater than that of left in same location.

ROENTGENOLOGICAL EXAMINATION

Plates were taken to show the anteroposterior view of the whole femur including the hip-joint and lateral view of lower two-thirds of the bone. These plates, lantern slides of which will be shown, presented the following characteristics, viz.:

(*a*) The whole shaft of femur from neck to condyles was involved in the pathological process.

(*b*) There was enlargement of the bone with rarefaction and thinning of outer compact bone.

(*c*) The rarefaction was not uniform, some areas more marked than others.

(*d*) Contour of bone was irregular on all surfaces.

(*e*) At the middle of bone an area about three inches long and involving one-third circumference was shown where bone had been removed by operation.

(*f*) Along the shaft of bone, especially at site of previous operation, were numerous small projections of new bone extending outward from periosteum in different directions.

(*g*) The shadow of the tumor could be seen extending in the soft tissues on all sides of femur.

While the clinical and roentgen ray evidence seemed to point to diffuse osteosarcoma, a diagnosis was reserved until an exploratory operation could be done.

On June 20th, 1916, an incision was made over the soft part of the tumor in the old scar. A cystic area was found containing a serosanguinolent fluid with wall of soft friable material like granulation tissue. The cyst extended into the bone at site of previous operation. The bone itself was rough and irregular under the periosteum with small processes of new bone extending in different directions into surrounding muscles which were firm and hard. No tumor tissue other than the soft friable tissue and spicule of new bone was noted in the exploration. Grossly, the condition did not look like sarcoma. Portions of the bone, cyst wall and muscles were removed for microscopical examination. The wound was partially closed and drainage provided.

The report of the pathologist, Dr. Standish McCleary, at this time was as follows: Tissue removed showed process of repair, granulation and fibrous tissue with new bone formation. There is no evidence of malignancy.

This report would seem to indicate an inflammatory lesion. Diseases considered as possible cause of condition, were:

(*a*) Myositis ossificans.

(*b*) Osteomyelitis, pyogenic, tubercular or luetic.

(*c*) Osteitis fibrosa or bone cyst.

Myositis ossificans was dismissed at once from roentgen ray examination. Pyogenic osteomyelitis was excluded because there was no pus (pyogenic) and tubercular osteomyelitis because of its very great infrequency in adults. Lues was excluded by negative Wassermann, history, clinical and roentgen ray examination. Neither the clinical signs nor roentgen ray plates were typical of osteitis fibrosa or bone cyst, unless the character of pathological process had been changed by the exploratory operation.

The patient experienced some temporary relief from pain and was allowed to go home in about three weeks to be looked after by her family physician.

Five months later, November 20th, 1916, patient returned to Mercy Hospital. Physical examination at this time showed general condition not so good; patient thinner, anemic and weak. She had suffered increasing pain and had been taking morphia in moderate dose daily for past three to four months. Examination of right thigh showed enormous enlargement, more than twice the size of left limb; numerous large surface veins; greater portion of tumor firm, but two or three areas of softening; small sinus from previous operation.

ROENTGEN RAY EXAMINATION

The plates showed same appearances as my previous examination with the following exceptions: the bone was larger and showed more general rarefaction; there was a pathological fracture at site of previous operations; there was no increase in periosteal new bone formation. In spite of the long duration of the disease, over one and one-half years, a diagnosis of osteosarcoma was made and amputation at hip-joint advised.

On November 28th, 1916, disarticulation of the hip-joint was done. Patient suffered very little shock from the operation, had a satisfactory convalescence and after several weeks completely recovered. It is now nearly one year since the operation and patient's general and local condition is good with no indication of recurrence of tumor.

Examination of amputated limb was made at the time of operation and was as follows: The femur was split longitudinally from top of greater trochanter to knee joint. The medullary cavity was enlarged and compact bone thin. At the site of exploratory operations there were areas of softening of bone which connected with cystic areas in the muscles similar to the one found at exploratory operation. There was new bone formation, especially about the old operative wound and fracture showing a feeble attempt at repair. Extending from the operative opening all along the shaft of bone from the trochanter to condyles between bone and periosteum, was the tumor. In some places the periosteum was broken through and the tumor extended into the muscles. The tumor was soft (not jelly-like, but firm enough to be handled without crushing), and grayish white in color. No hemorrhagic areas were found in the tumor. Neither hip nor knee joint was involved.

Report of the microscopical examination of tumor removed by Dr. Standish McCleary is as follows: Sections were made of the gelatinous material contained in the loculi found in the bone. This material is composed of pure myxomatous tissue, showing the characteristic stellate cells, slight fibrillar framework, and the gelatinous ground substance. At places in the section, rather robust bands of fibrous tissue are seen traversing the ground substance.

Sections from the osseous tissue show two distinct processes taking place. Areas showing distinct resorption of bone are met with, and with these are areas in which new bone formation is actively progressing. There are present osteoblastic cells forming cartilage and the beginning of new lamellæ.

The pathologist's diagnosis of this case is not osteosarcoma but myxoma, a non-malignant tumor. Had it been possible to obtain the pathological report before operation, the treatment would have been the same. The limb was so badly damaged that it could not subserve its function and the pain and dragging weight of the enlarged limb were weakening the patient and making her so miserable that life was not worth living.

In myxoma of bone we have a tumor which is capable of producing so great damage that amputation may be necessary, yet it is non-malignant, which means that it does not recur after removal.

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DEATH OF CAPT. W. E. HARWOOD

The first American roentgenologist to lose his life since America's declaration of war in April, 1917, was Dr. William Elvis Harwood, Captain, Medical Reserve Corps, U. S. Army. Captain Harwood, whose home was Joliet, Ill., died from pneumonia on January 7, 1918, while on duty with Base Hospital No. 12, serving in France.

The deceased was born in Joliet, November 16, 1858. He graduated from Rush Medical College in 1880 and for several years practiced in Eveleth, Minn., where he was surgeon in charge of the Fabiola Hospital and attending surgeon of several mining companies. He later returned to practice in Joliet, the city of his birth. When Base Hospital Number 12 was organized, he volunteered for service as roentgenologist, but was rejected on account of his age. He was later accepted for the roentgen ray work, because of his insistence that he was entitled to a chance to serve. Shortly after his arrival in France, in recognition of meritorious service, he was promoted to be captain.

The writer has known Dr. Harwood for several years, and can testify to his unfailing devotion to high ideals of practice. He has also had the opportunity of visiting Base Hospital No. 12 in France and of personally inspecting the work of Captain Harwood. Only one who has seen and experienced the peculiar difficulties which had to be met in the accomplishment of satisfactory roentgenologic work where Captain Harwood was stationed, can appreciate the credit due our friend for his work. His example in making the best of a difficult situation, and of succeeding in spite of mechanical difficulties, may well be held up for the consideration of those who feel that, in France, in war time, under conditions of extreme necessity of restricting one's demands to absolute needs, they should be furnished with the same luxurious conveniences they have enjoyed in civil practice at home. J. T. C.

WAR ROENTGENOLOGY

With the beginning of hostilities, in accordance with the French system of mobilization, most of the roentgen ray men found themselves thrown at once into military service, many of them in other lines of medical work, and some of them n the fighting branches of the service; but as soon as the authorities found themselves and got the management of the war systematized, the roentgen ray men were gradually called into the service for which they were peculiarly fitted. In some instances, the transfers were made gradually. For instance, Haret, who to-day with Hirtz has charge of the roentgen ray work of the French armies, served a year in the field with a roentgen ray automobile unit. Other similar instances might be cited.

Later a school was established at the Val-du-Grace Hospital, Paris, where our honored friend, Prof. A. Béclère has charge of the didactic work. With his corps of assistants he puts the men who are assigned to this school through a course of theoretical and experimental instruction and they are later assigned to some of the fixed hospitals for practical instruction before being sent out into the field.

A school for technicians has also been maintained, the French authorities having long ago recognized the necessity for supplying roentgen ray medical workers with technicians so that the medically trained men would have more time for purely professional work. These technicians are for the most part men although there are a few women technicians. The men are trained at the general shops (*ateliers*) of the Service du Sante of the Franch Ministry of War. The term "*manipulateurs*" is applied to these male technicians. The women, "*manipulatrices*," are trained in a school established by Madame Curie.

The manipulators are trained in the care of roentgen ray apparatus, and in the art of plate making and developing. No attention is paid to diagnostic work in the course for these workers. In fact, the course for the women does not include the care of apparatus, and for this reason, the women are not popular as roentgen ray assistants.

The apparatus employed in the French army is generally recognized as being more or less below the desired standard owing to the necessities of the situation. Due to a peculiar difficulty in the manufacture of interrupterless transformers, there have been practically none of this type of instrument in the French mobile hospital. The writer has been told that the Italian roentgen ray automobiles are equipped with interrupterless transformers. Not long ago, Colonel Hirtz told me that he wished it were possible to replace the present type of old apparatus with interrupterless transformers. Owing, however, to the difficulties above referred to, interrupterless machines will not be furnished to any except the most important general hospitals. The men are obliged to content themselves with coils and mercury interrupters, instruments of the type which most of us discarded a decade ago.

The tables, tube stands, and other accessories have reached a high degree of development for the peculiar needs of military roentgenology, although the apparatus as a whole, both from the standpoint of workmanship and material, is not what we, in this country, have been accustomed to. Every move in France seems to be actuated by the overwhelming necessity of making all efforts productive of the greatest possible results with the least possible expenditure of material. The French have very frankly told us that they expect us to begin where they have left off, and it will be a great disappointment if we have to go through a period of development either in the production of roentgen ray apparatus or in the recognition of the important position which the roentgen ray must play in the war surgery of to-day. We earnestly hope that all of this experience will not have been lost and that the outcome of our present campaign of preparation for the herculean task before us will show that we have lived up to the expectations of our heroic French *confrères*.

The sense of all the above remarks applies also to our British brethren who have favored us with every possible opportunity for observation of methods. We are indebted to both French and British radiologists for many valuable suggestions.

J. T. C.

TRANSLATIONS & ABSTRACTS

Hess, J. H. Osteogenesis Imperfecta. (*Arch. Int. Med.*, Feb. 15, 1917, Vol. XIX, p. 163.)

The roentgen literature has from time to time contained very valuable contributions to this subject, but this paper undertakes to give a summary of the roentgen ray findings in this disease and the author is surely to be congratulated upon the degree of success attained. The following are summarized as the roentgen ray findings which are characteristic and diagnostic for the disease:

1. Multiple, mostly intraperiosteal fractures, often showing areas of bone resorption at the seat of fracture.
2. Excessive callus formation.
3. Deficient shadow formation seen in all bones of the body, due to increased permeability to roentgen rays. Often the bone shadows show but little more density than the surrounding soft parts.
4. The diaphyses of long bones may be slender, and only very rarely show any curvature or bending.
5. The cortex is of irregular thickness, on the whole very thin and parchment-like in appearance and may even appear to be absent in some places. There is little or no tendency toward thickening on the concave side of the shaft.
6. The spongiosa contains wide meshes and an absence of structural markings. These changes are not limited to the diaphyses. All bones show this change, but not to the same degree, the most marked changes being found in the bones of the hands.
7. The medullary cavity is increased in size and shows irregularly mottled shadow.
8. The epiphyseal cartilages and their centers of ossification are larger than normal and the epiphyseal lines are straight.

The following is quoted at length because of its value in roentgenologic diagnosis.

"The roentgen ray is invaluable in the differential diagnosis of osteogenesis imperfecta, and also chondrodystrophia fœtalis, cretinism, mongolism, rachitis, infantile scurvy, syphilis (early congenital and later manifestations) and tuberculosis of bones.

"In chondrodystrophia fœtalis the trunk is normal, while the extremities are shortened and deformed. In the skull the clivus is often seen in the lateral position and there is usually malposition of the nasal bones. If the root of the nose is retracted, they are almost horizontal, while if flattened, they are more vertical. The flattening of the bridge of the nose is due either to a primary tribasilar synostosis or a failure of development, which causes the base of the skull to be shorter. The ribs are thickened at the epiphyseal lines. The extremities are short and thick and the epiphyseal regions prominent. The center of the body is displaced upward. The shafts of the bones often show great thickenings and shortening of the cortical substance, and overgrowth of the bony epiphysis is so marked that it often appears to overlap that of the epiphyseal line. The periosteum shows great thickening, the cortical substance is broader and thickened and the medullary canal is narrow, and sometimes the latter is replaced by hard cortical tissue. Thus it will be seen that the bone changes are marked in both the length and breadth. The shortening of the long bones is due to the cartilaginous ossification of the epiphyses, and it is very evident that these abnormalities are brought about by the disturbance in the normal process of ossification in the primary cartilage" (Rotch).

"In cretinism the body length is normal at birth, but shows later a greatly retarded development. The degree of retardation varies with the degree of thyroid atrophy (directly), and the amount and length of time of treatment. There is a universally retarded development of the bony skeleton due to delayed endochondral and periosteal growth, which is especially marked in the carpal and tarsal bones and in the phalanges. There is delayed development of the bony nuclei in the epiphyses and delayed union between the epiphyses and diaphyses. The delays in bone deposits are usually very marked. A 2-year-old child may show the bone development of a 6- or 12-month infant.

"In mongolism roentgen ray examination has no great practical value, as in marked cases clinical diagnosis is easy and the bone changes have no definite pathognomonic characteristics. The general skeletal development shows no pathognomonic changes, the degree of retardation varying in different cases and different regions in the same case, while others may show no retardation. On the whole, the bones are well developed for their age, in fact occasionally the short bones are developed too early. The skull is usually microbrachycephalic, the orbits low and converge inward, the sella turcica small, with overlapping clinoid processes, which often appear to involve the hypophysis. The hands are short and broad, due to small metacarpal and phalangeal bones. The thumb and little finger show the shortening to the greatest degree. The little fingers often show concavity on the side approximating the ring finger. This is chiefly due to shortening and curving of the middle phalanx. The thumb often shows a button-like appearance with circular-like contraction at the proximal end of the metacarpal and distal end of the basal phalanx. There is a tendency to congenital anomalies, among which bone deformities are common; clubbed feet, syndactylism, superfluous toes, spina bifida, and micromelia of the upper extremities are often associated with other congenital deformities, as of the heart, genitourinary tract and ears.

"In rickets partial or complete fractures are usual, but they are not intraperiosteal and there seems to be very little tendency toward callus formation, although apparently enough to make the bone more or less solid. The calcium content of the callus is so very low that it is almost invisible in a roentgenogram. Deformities in rickets are much more marked in the lower than in the upper extremities. Bowing and bending is characteristic. In the femur the greatest change may be in the neck, causing coxa vara. The pelvis may become flattened and the body shortened as a whole. Not infrequently palpable nodular thickenings involving part of the cortex are seen on the convex surface of the long bones. Increased radiability of bones is a property which rickets in its active stage shares with osteogenesis imperfecta. After the process in rickets subsides, the bones, while still showing deformities and curvatures, appear broader than normal and show even increased density of bone, which is especially marked at the ends of the diaphyses. The periosteum in rickets is definitely thickened, but the periosteal bone shadow is often pale, due to the low calcium content. The cortex has about the same appearance as in osteogenesis imperfecta. On the concave sides of long bones the cortex is thickened, which is almost pathognomonic of rickets; it may be thinned on the convex side. The medullary cavity is often increased in size in rickets and constantly so in osteogenesis imperfecta. The epiphyses, which in osteogenesis imperfecta are normal, show most marked changes in rickets. The zone of proliferation is widened, with an irregular, toothed appearance on the epiphyseal side of the diaphysis, and there is also a broadening and flaring out of the epiphyseal end of the diaphysis, which is very characteristic for rickets. The epiphyses tend to be larger than normal, irregular in outline and may be of decreased density. The end of the shaft is streaked and presents an irregular line at the joint end and above it a curious transverse zone of different structure from the rest of the bone.

"Lovett divides bone lesions of rickets into three stages. As only the severe types of rickets call for differentiation from osteogenesis imperfecta and only from the late type of the latter, the author describes only the severe lesions, as noted by Lovett. In the first stage the epiphyses cast little or no shadow, while the center of ossification is small or absent and at times appears multiple. The diaphysis becomes frayed out, instead of clear cut, the periosteum thickened, and the whole joint appears hazy. Multiple fractures are common. This is the stage which is frequently classed as osteogenesis imperfecta. In the second stage the shadow of the epiphysis becomes more marked, the area is ragged and irregular, the ends of the diaphysis begin to broaden, especially on the side on which the strain is greater and here produces a ledge or lip next to the epiphyseal line. There is a thickening on the concave side of the shaft, which is a compensatory change. The diaphysis begins to give a more definite shadow. The ends next to the diaphysis are streaked longitudinally and are the area of maximum disturbance. At the epiphyseal end of the shaft there is generally a transverse area of increased density, reaching about a quarter or half an inch from the epiphyseal line. This continues into the third stage. Further changes in the second stage consist in the chambering of the interior of the bone, where light areas in the shaft indicate the absence of marked bone deposit, and heavier lines of ossification show the irregular development of trabeculæ. The second stage is generally a period of systemic reaction to the disease, in which signs of returning ossification occur when deformity begins. In the third stage, the epiphysis begins to resume its normal contour and homogeneous shadow density. Irregularities persist in the marginal outline, and there is still a little mottling in the ossification. The lipping of the diaphyses has enlarged the bone ends, and there is in consequence a discrepancy in breadth between the diameters of the diaphysis near the epiphyseal line and the epiphysis.

"In infantile scurvy the most constant finding is an irregularly circumscribed shadow of varying diameter and intensity at the end of the diaphysis at the seat of new bone formation. This shadow, according to Rehn, enables one to make an early diagnosis of scurvy when all other classical clinical signs of scurvy are absent, provided it is possible to exclude congenital syphilis. Less constant than this shadow are the subperiosteal shadows at the seat of hemorrhages. These shadows may be invisible even at the height of hemorrhage, becoming more and more distinct with age, probably due to the deposit of osteophytes. Fractures and infractions are demonstrable in scurvy. Other findings in scurvy, which, however, are not always demonstrable by roentgen rays, are epiphyseal separation and displacements, hemorrhages within the joint capsule (considered to be very rare by Reyher) and occasionally, but rarely, intramuscular hemorrhages may be demonstrated. The clinical symptoms often enable one to make a diagnosis of scurvy and, according to Frangenheim, especially in older children a diagnostic triad makes diagnosis comparatively easy; (1) hemorrhagic diathesis, which is manifested by tendency to hemorrhages and multiple hemorrhages anywhere in the body, with its sequelæ, marked anemia; (2) severe pain in extremities accompanying every movement; (3) swelling of the joints. From these signs multiple subperiosteal hemorrhages are pathognomonic.

"In syphilis we must distinguish between the early congenital and the later bone changes. As to the diagnosis of syphilitic lesions of the bones, Fraenkel says: 'If in an infant in its first weeks of life we find roentgenologically at the epiphyseal line either homogeneous transverse shadow or a streak interrupted by lighter transverse streaks, the epiphyseal line being well outlined toward the diaphysis, and toward epiphysis a serrated ribbon-like shadow, we have a positive proof of existence of osteochondritis syphilitica.' In early congenital syphilis the entire skeletal system is affected, the long bones suffering chiefly. In later manifestations, in which periostitis ossificans is a very important finding, we see newly formed subperiosteal bony masses with bony structure. They are most marked in the middle of the diaphysis of the femur and less marked in other long bones. Old cortex may often be differentiated from the newly formed subperiosteal bony masses. Cortical thickening is therefore an important point in differential diagnosis from osteogenesis imperfecta, in which disease the cortex is always very thin. In the phalanges the epiphyseal line is somewhat lighter, the diaphysis is stronger and more compact and forms a dark, sharply circumscribed shadow. The phalanges are longer and thickened. There are definite changes in the exterior of the bone without any change in the interior, unless suppuration has taken place and other long bones of the body are similarly affected, which differentiates syphilitic dactylitis from tuberculous dactylitis. Fractures are comparatively rare in syphilitic infants.

"A characteristic of tuberculous lesions is primarily and definitely a destructive local process, without evidence of a tendency to bone stimulation. Osteogenesis, on the other hand, appears to be a general atrophy of all the bones of the body. In tuberculosis light shadows, due to bone destruction and calcium absorption, are seen surrounded by otherwise normal dark bone shadows, while in osteogenesis all the bones of the body show more uniformly increased permeability to roentgen rays. The neighboring bone areas show atrophy, the cortical substance is thinned and the spongy portion appears less dense, often giving a shadow of a density but little greater than the soft tissues. Callus formation in tuberculosis is very deficient. When tuberculosis affects joints, there is a high-grade atrophy and destruction of the bone. The bone ends show marked transparency. This increases the nearer it approaches the joint, thereby decreasing and often impairing the visibility of the joint contour. The entire region of the joint may become less visible. Comparison should be made with the well side, especially early in the disease, when diagnosis may be difficult. The tuberculous joint lesions and fractures are very painful, thus differing from fractures of osteogenesis imperfecta, which seem to be attended with but little pain.

"Osteomyelitis presents an outline showing periosteal reaction in the form of proliferation of new bone about the necrosed area, or again the sequestra may be plainly visible. It is difficult to make a positive diagnosis before the second week. By the second week we have evidence of a more or less marked periosteal proliferation and new periosteal bone formation about the necrosed area. Light and irregular shadows at the seat of the bone involvement are also now visible, due to bone destruction. Later in the disease distinct bone sequestra surrounded by a definitely lighter shadow are characteristic."

In concluding the author points out the tendency of two of the cases under observation to develop secondary rachitic bone lesions. These rachitic changes led to a questionable diagnosis in these particular cases. However, a brief review of the changes characteristic of the two conditions tends to clear up the situation. The combination of the two conditions in the late form of the disease is the rule rather than the exception, while the early congenital type has not infrequently been described as fetal rickets.

"Most of the cases are sent into the wards as scorbutus, because of the pain at the seat of the fractures following motion of the extremities; the roentgenograms, however, readily show the cause of the pain.

"Segawa describes for the first time the combination of osteogenesis imperfecta as a congenital affection with Barlow's disease and rickets as acquired affections in an infant. The former was diagnosed clinically, the latter two only anatomically."

Lowman, C. L. Delayed Development in the Tarsus. (*Am. J. Orthop. Surg.*, Vol. XV, No. 6, June, 1917, p. 479.)

This article embodies the report of a case of a baby, aged 15 months, whose feet had always turned in and were getting worse. A diagnosis of absence of the tarsal bones was made and roentgenologically confirmed. As the child seemed to be backward in mental development, the author administered $\frac{1}{8}$ grain of thyroid twice daily, in addition to orthopedic treatment. A remarkable improvement followed both in the mental condition and the growth of bone, so that six months later the cuboid could be seen in the roentgenogram and a faint beginning of what seemed to be the scaphoid on the right foot. The patient has since continued to improve in both directions.

The author, therefore, advises in cases where the feet have turned in since birth, not to be content with the assumption of simply "another case of congenital clubfoot," as it might be a case of delayed development.

In order to determine the relation of abnormal, delayed, or asymmetrical development of tarsal elements to subsequent deformity, he suggests more careful roentgen study of congenital clubfoot cases. He will, hereafter, attempt to have roentgenograms of all cases taken at uniform times: On first presentation of the case, at six months, one, two and three years. In this way it may be possible to discover some of the reasons for relapses, for persistency of deforming factors in the presence of good treatment and for continued overgrowth of one side of the foot at the expense of the other.

Ehrenfried, Albert. Hereditary Deforming Chondrodysplasia. (*Am. J. Orthop. Surg.*, Vol. XV, No. 6, June, 1917, p. 464.)

The author attempts to lift this disease out of the class of uninteresting rarities by demonstrating that it is fairly common, by establishing it as a clinical entity, defining its manifestations, and by giving it a name which adequately describes its chief characteristics. He adds two more cases to his previous collection of twelve and illustrates one of them by six excellent roentgenograms.

Roentgenographic examination is absolutely necessary to make a diagnosis and especially to differentiate the condition from developmental or epiphyseal exostoses which are fairly common but little recognized. The latter group themselves particularly about the knee, but they may appear singly at other points such as the scapula and upper end of the shaft of the humerus. They are sometimes associated with a moderate deformation of the adjacent epiphyseal region, but they are never accompanied by the bony alterations and deformities characteristic of hereditary deforming chondrodysplasia. Whether heredity plays a part in their occurrence is not known. They develop during the period of skeletal growth and become stationary at skeletal maturity.

On the other hand, the roentgenograms of Ehrenfried's recent case of the hereditary form in a boy, 13 years of age, are described as follows:

Right arm.—Plateau-like hyperostosis on shaft of humerus; short ulna with irregular bulbous tip; bowed radius with an irregular and tilted epiphysis; potential manus vara.

Left arm.—Upper end of the humerus squared off; slight relative shortening of the ulna.

Wrists and hands.—Irregularities in bony structure of some of the phalanges; relative shortening of the right middle metacarpal; ulnar deviation of the last phalanx of the corresponding finger.

Pelvis.—The upper ends of the femora are broadened and irregular, and the necks are thick.

Left knee.—This shows the fractured exostosis due to accident, which brought the patient under the author's treatment.

After removal of fragment.—Both knees are shown illustrating the relative shortness of right fibula and apparent beginning fusion with tibia.

Lateral views of knee.—These show irregular contour of all the bones and fine stalactite exostoses on the femur, and vacuolated enlargement of upper end of right fibula.

From this description it is evident that roentgenograms of the entire skeleton should be made, in order to arrive at a correct differential diagnosis.

Case, James T. Comparison of the Operative and Radiotherapeutic Treatment of Uterine Myomas. (*Surg. Clin.*, Chicago, 1917, p. 579. *J. Surg. Gynec. & Obst.*, Vol. XXV, No. 6, December, 1917.)

The writer refers to previous papers in which he has presented evidence tending to show that the roentgen rays and the gamma rays of radium are practically identical, the choice being largely a matter of convenience in application. The article constitutes a contrast between radiation and operative treatment of uterine myomas, the contrast having been represented by one reviewer as follows:

1. Radiation, no mortality; operation 2 or 3 per cent.

2. Radiation, a certain remote danger of necrosis or malignant degeneration, which is absent after operation.

3. The discomfort of the patient from *roentgenkater* and the repeated treatments Case believes to be at least equal to, if not greater than, operative shock and recovery.

4. The possible mal-effect on the skin and the probable narrowing of the vagina (after radium) are placed against the operative scar, and possible hernia.

5. Ovaries completely destroyed by radiation and often completely, or at least partly, saved by operation.

6. Radiation must be rather general while, by operation, myomectomy is often possible.

7. And, as of rather more importance, Case considers the added probability of accurate diagnosis by open operation.

8. In conclusion, "only cases of uncomplicated intramural fibroids, or cases in which operation is declined or contraindicated by serious organic disease, should be subjected to ray treatment. Possibly there are some extremely neurotic individuals for whom the rays would also be preferable. The ray treatment should not be used when time is a factor, and it cannot be used with safety in rapidly growing tumors, in fibroids, complicating pregnancy, or where serious disease exists in the tubes or ovaries. The rays should never be used in any case where complete preliminary curettage with microscopic examination of the curettings is not feasible."

Medicolegal. Privileged Knowledge and Roentgenograms—Right to Se'ect Physicians. (Stapleton vs. Chicago B. & Q. R. Co. Neb. 162, N.W.R. 644. *J. Am. M. Ass.*, Vol. LXIX, No. 24, Dec. 15, 1917, p. 2065.)

The Supreme Court of Nebraska holds, in this personal injury case that when a party submits to an examination, or inspection, by a physician, for the purpose of learning the state of his health or the physical condition of any part of his anatomy, the knowledge thus acquired by the physician is privileged, and under Section 7898 of the Revised Statutes of Nebraska of 1913, the physician is not permitted to testify to the condition he found, over objection based on the statute. And when a plaintiff has permitted a physician to make a roentgenogram of his injured foot for the purpose of ascertaining the extent and character of his injuries, the roentgenogram so made is not admissible in evidence over objection of the plaintiff based on the statute.

The court says that the statute cannot be given a strained construction, but must be taken in its plain and ordinary sense. When it says that a physician shall not be allowed to give testimony or to disclose confidential communications properly intrusted to him in his professional capacity, and necessary and proper to enable him to discharge the functions of his office, it means to exclude the disclosure of any information that comes to such physician by reason of the professional capacity in which he acts. It does not matter whether the patient seeks a prescription for a disordered stomach or a roentgenogram of an injured foot. Nor does the statute make any distinction between a regularly retained physician of a railroad company, and a physician paid by the patient. And the same rule which would exclude the oral testimony of the physician would exclude the roentgenogram of the plaintiff's foot. Its introduction in evidence would be a disclosure of a confidential communication.

The defendant complained because on cross-examination it was not permitted to inquire whether the plaintiff had submitted himself for examination to specialists for the purpose of qualifying them as witnesses, and whether he did not intend to produce these witnesses on the trial. This line of examination was not pertinent to anything developed in the examination in chief of the witness. He had the right to select his own physicians and his own witnesses. If counsel for the defendant disbelieved the testimony of the physician who testified as to the character and extent of the plaintiff's injuries, he might have procured the testimony of men eminent as physicians and surgeons by application to the court for the appointment of a commission to make an examination of the person of the plaintiff.

Berger, A. Root Amputation, Its Principles and Indications. (*Dental Items of Interest*, March, 1917, p. 161.)

This article, while more or less technical and dealing with the side of the work of most interest to the operating dentist, nevertheless is important because it emphasizes the fact not sufficiently appreciated by many roentgenologists that apical abscess may often be successfully treated by root amputation without sacrificing the entire tooth.

Boggs, Russell H. Differential Roentgen Diagnosis in Bone Diseases. (*N. Y. Med. Jour.*, Vol. CV, No. 3, Jan. 20, 1917, p. 112.)

The object in presenting an abstract of this article is more to call special attention to it rather than to review the wealth of details it contains. It is one of those rare articles in which every word tells, the information given bearing the stamp of study, observation and experience not only of the affections themselves but also of the variety of roentgen shadows they produce. Full justice can not be done to such a description by a cursory summary; it ought to be studied in the original and inwardly digested so as to form the mental property of the reader.

Aside from giving due consideration to the precautions necessary to avoid misinterpretations in the shadows observed in bone affections, Boggs goes into particulars of the more common pathological conditions of the osseous system. He omits the rarer affections, such as osteomalacia, osteitis deformans, etc., since "the physician must be familiar with the roentgenological aspects of the common diseases before he is competent to differentiate between the rarer lesions," and it is on the latter, therefore, that he concentrates the reader's attention.

The affections thus discussed are dealt with in the following order:

(1) *Tuberculosis of the Bones and Joints.* — Attention is called to the importance of the clinical history, physical examination and other tests. The variations of the picture according to extent and age of the condition are duly considered.

(2) *Tuberculous Osteitis.* — The typical roentgenogram is described, with emphasis on the fact that this does not appear until the nutrition of the trabeculæ is interfered with. The differentiation from injury, typhoid spine, sarcoma and metastases secondary to carcinoma is dwelt upon.

(3) *Tuberculosis of the Hip-Joint.* — In this affection the youthful age of the patient furnishes different pictures from those in later life, where atrophy of the epiphyseal line of

the femur and acetabulum, and other skeletal changes, make their appearance.

(4) *Tuberculosis of the Knee in Children.* — As the starting point in this condition is of prime importance, the details for differentiating between them are explained.

(5) *Shoulder-Joint.* — Diagnostic points between tuberculosis, syphilis, rickets and scurvy are enumerated.

(6) *Osteomyelitis.* — In spite of the difficulty of roentgenologically detecting this affection in the early stage, a concise summary of the points to be considered in the various stages has been worked out by the author.

(7) *Sarcoma,* the most common form of bone tumors, can not be roentgenologically distinguished in the early stage from a simple inflammatory process. The changes occurring as the disease progresses and which can be roentgenologically visualized, are clearly described.

(8) *Periosteal Sarcoma.* — The guiding points are elucidated, although the author admits this to be the most difficult type to diagnose by the roentgen rays.

(9) The roentgenograms of *syphilis of the bone* are truly characteristic. Boggs describes these as well as the pictures of other bone affections, for which they should not be mistaken.

(10) *Myeloid sarcoma* must be differentiated from bone cyst, and the details are given how to succeed.

(11) *Carcinoma of the bone* is accorded a similarly careful analysis.

(12) *Carcinomatosis of the bone,* secondary to a growth in some epithelial organ, concludes this compact and highly instructive contribution.

Sommer, E. Roentgenological Studies of Callus. Suggestion of a Rational Treatment of Secondary Sequelæ after Fractures, etc. (Roentgen Taschenbuch, 1915, p. 7. Ref. *Zentralbl. f. Roentgenstr.*, 1916, Nos. 5 and 6, p. 158.)

Having examined a considerable number of roentgen plates, Sommer found that the ossification of the callus sets in two weeks after the injury.

In order to prevent muscular atrophy in the plaster jacket, Sommer proposes faradization by means of electrodes built in with the plaster jacket. It would then make little difference how long the jacket is allowed to remain in place.

Lord, Frederick L. The Newer Methods of Diagnostic Technic. (*Boston Med. and Surg. Jour.*, Sep. 6, 1917, p. 310.)

While admitting that to a certain degree diagnostic errors are unavoidable, Lord holds that they can be largely prevented by making more systematic use of the newer methods of diagnostic technic, among which he assigns a prominent place to roentgenological examination. He does not pretend to exhaust the subject but gives a very creditable survey over the possibilities within our reach.

Involvement of the paranasal sinuses and concealed pockets of pus about the teeth may be detected. The nature of lesions of mediastinum and lungs can be interpreted with much greater accuracy by adding a roentgenological examination to the clinical findings. It should be made an invariable rule to incorporate in the record all physical pulmonary findings before the plates are inspected, and then note any discrepancies between the two methods. It not infrequently happens that more is disclosed by the roentgen rays than by the physical method.

In abdominal cases roentgenology is of great assistance, but its findings should be judged in combination with the clinical features, if their utmost value is to be realized. Gastric abnormalities can by this means be demonstrated in practically all cases of carcinoma in its more advanced stages, while negative roentgen findings are of great value in excluding such lesions. The roentgenological differentiation between carcinoma and ulcer is often impossible. Carcinoma is not yet detected early enough to make the outlook for surgical interference hopeful except in rare instances. Peptic ulcer presents a high proportion of successful interpretations, but negative roentgen findings do not exclude ulcer. In the matter of gallstones the author holds no optimistic views, as in a large proportion of cases the diagnosis of cholelithiasis must still be made on the clinical features. But he admits that indirectly a roentgen examination is of value in helping to exclude peptic ulcer in a differential diagnosis with gallstones. Stone in the urinary tract, on the other hand, is shown in almost all cases, especially when an examination of the pelvic portions is included.

FRIEDLANDER, ALFRED. Enlargement of the Thymus Treated by the Roentgen Ray. (*Am. Jour. Dis. of Children.* July 17, 1917, p. 40.)

In this paper the facts are emphasized that the diagnosis of enlarged thymus can be definitely made by a simple physical examination, aided by the roentgen ray, and that in the latter we possess a therapeutic agent which will effect a cure in the vast majority of cases. After detailing the physical signs and symptoms, the author states that definite information as to the existence of the enlargement is afforded by the roentgen ray, provided that certain technical requirements are fulfilled. These, with special consideration of the examination of young children, have been laid down by Sidney Lange as follows:

"The child is placed flat on the back. The slightest lateral tilting produces on the roentgen plate an asymmetry of the two halves of the chest and a 'flopping' or displacement of the mediastinal and heart shadows to one or the other side. Repeated trials must be made until a plate is produced which shows the chest areas, i.e., the distances from the midline of the spine to axillary borders of the ribs, to be equal on right and left sides. Under these conditions, enlargements of the upper mediastinal shadow, whether to the right or to the left of the midline, can be readily recognized. It is essential in very young children that the exposure be almost instantaneous. If the time exceeds one-thirtieth of a second, blurring will result. A very soft tube should be used, as the delicate thymus tissue will fail to cast a shadow if the quality of the ray be too hard or penetrating."

The normal roentgen shadow is a median one, resting on and continuous with the heart shadow. Marked enlargement of this shadow, especially lateral enlargement, is characteristic of hypertrophied thymus. There is no difficulty, as a rule, in differentiating the shadow produced by enlarged thymus from that produced by congenital heart lesions or caseous lymph nodes. A broadening of the shadow to the right may at times be due to large vessels, especially the vena cava superior. But this can not hold good when the larger part of the shadow falls to the left of the vertebral column.

Enlarged bronchial glands give an extra median shadow separate from the heart shadow and not connected with it.

In doubtful cases, where symptoms of thymic asthma appear without clearly demonstrable physical signs, roentgen treatment given as a therapeutic test will often clear the diagnosis.

The technic of the treatment, as worked out by Lange, is as follows:

A Coolidge tube, backing up a 9½-inch spark gap and a filter consisting of 4 mm aluminum and a piece of thick leather were employed. The target-skin distance was 9 inches; the routine exposure 25 milliampereminutes. In mild cases a single dose given over the anterior surface of the chest proved sufficient. In more urgent cases 50 milliampereminutes were administered at the first treatment, 25 anteriorly and 25 posteriorly. Sandbags were placed across the arms and legs. The treatments proved entirely harmless to young children, but should be comparatively heavy and repeated at sufficiently short intervals. Failure to administer full doses and to repeat them promptly has in very urgent cases led to fatalities under roentgen treatment. To guard against such disasters, all patients with urgent symptoms should be kept under close observation and the roentgen treatments should be pushed boldly.

In the average case improvement of symptoms has been noted within twenty-four to forty-eight hours.

FOOTE, EDWARD M. The Place of Radium in Surgery. (*Annals of Surgery*, Vol. LXV, No. 3, March, 1917, p. 273.)

The value of radium in replacing the knife in cancer operations has, according to Dr. Foote, not yet been fixed with any degree of definiteness. There are extremists in both directions, and the author has set himself the task of curbing vaulting ambition on the one hand and counteracting undue pessimism on the other. He does not go into the details of technic and holds that even the dosage must rest with those who use it according to the individual case, but he enjoys "the humor of the situation when the possessors of a hundred milligrams or more of the element object to treatment being made by the men who have only ten or twenty milligrams, on the ground that small quantities do more harm than good on account of their stimulating effect; and when the owners of the small amounts publish striking successes." In a happy strain, Foote suggests if for no other reasons than the interests of veracity, that the owners of radium should be officially registered together with the quantity of radium they possess.

Dealing with the vexed question of deciding when radium has effected a cure, the author demands further experience to definitely determine to what depth tumor cells have been influenced beyond the possibility of regrowth. The microscope may still reveal islands of cancer cells in apparently cured cases, but their mere presence is no proof of whether they are dead or only dormant.

The question as to what kinds of tumors are susceptible to the influence of radium, elicits different answers by nearly every writer, but it is generally admitted that surface or near-surface growths, such as keloids, lymphangiomata and basal-celled epitheliomata in very early stages will disappear under radium treatment. Isolated instances of almost every kind of tumor have been published with claims of cure, but "thus far no rule has been discovered by which the effect of radium in any particular case can be predicted with certainty." The effect on sarcoma, though more favorable than on any other kind of tumor, is very variable—probably from the same unexplainable reason that, while one sarcoma will destroy the human body another is driven out by some apparently inadequate cause, Coley's fluid, for instance.

Prickle-celled epithelioma, which the author places next in the favorable list, offers more resistance probably due to its vitality or tendency to rapid growth away from the surface. A favorable effect of radium on other tumors is claimed by some, and denied by others. Without committing himself over these disputes, Foote thinks it a little far-fetched to explain the disappearance of cancer of the cervix and much more so of the body of the uterus as due to artificial sterility produced by radium treatment of fibroids, for the reason that no such phenomenon takes place in the normal menopause. He rather endorses the conservative view of Ransohoff who advises operation in uterine cases but uses radium to stop the discharge and hemorrhage, incidentally destroying any cauliflower masses that may develop. At the same time he has found that any resulting improvement of symptoms is in most cases only temporary.

The author also considers it unlikely that secondary cancer nodules anywhere can be cured by radium, as its influence lower than one inch from the surface is said to be practically nil. He offers three possible explanations for the reported disappearance of cancer when lymphatic glands were involved. His first point is that lymph glands are often enlarged from other causes; the second point is that ulcerative cancers often produce enlargement of the regional glands without infecting them; and the third possibility is that even non-ulcerating cancers may produce glandular enlargement by irritation. It is therefore not safe to assume that radium has cured metastases, unless at least one gland was previously removed and found to be cancerous.

What Foote considers perhaps the most important question is whether operable cancer should be treated by radium. Weighing the evidence in the light of the published literature, he concludes that a patient is done a grave injustice by having radium advised for a primary prickle-celled epithelioma or for any primary cancer of considerable bulk, if the conditions are favorable for surgical removal. In rapidly growing tumors so situated that operation is likely to prove unsuccessful, radium may be tried, but the proper place to test it is in the recurrences. Primary basal-celled epithelioma of the face, lymphangiomata, uterine fibroids, angiomata and keloids may be safely treated with radium.

Summing up his experience, the author concludes:

"When the investigator in radium becomes so expert that he can say with definiteness, 'Here is such and such a type of tumor and its bulk is approximately so and so; I know from experience that I can cause its entire disappearance with so much radium applied for so many hours,' it will be time enough to advise radium in primary operable cases."

Réchou: Roentgenotherapy of War Wounds. (*Jour. Radiol. et Electrol.*, Paris, May–June, 1917. Ref. *Jour. Am. Med. Assoc.*, Sep. 25, 1917, p. 1035.)

Réchou describes the efficacy of roentgen rays in modifying the fibrous connective tissue which forms around nerves after a war wound, facilitating the absorption of the newly formed exogenous sclerosis, as Hesnard calls it. This connective tissue proliferating around the nerves binds it to adjacent organs, and mischief follows. The rays seem to disintegrate this newly formed tissue, while the nerve tissue does not seem to be influenced by the rays in doses just sufficient to accomplish this. He has found most effectual a monthly large dose, 10 or 12 H units, under an aluminum filter with cross-fire application, if possible. He reports the details of seven cases, in which the neuroma, contracture of the biceps and of the fingers, and the reaction of degeneration and atrophy of the muscles subsided in two or three months, or were materially improved. In a group of five other cases the cicatrix after a war wound was adherent and interfered with functioning. The use of the limb was regained more or less completely after a few exposures. Keloid and painful cicatrices were also favorably modified. Neuritis and even ankylosis may show marked improvement. In the discussion that followed, Beaujard reported over 66 per cent. cured and over twenty-three improved in ninety-three cases of crippling or painful wounds and all but 20 per cent. cured or improved in fifteen cases of troublesome neuromas, while all were cured of the ten patients with typical causalgia. All but 21.5 per cent. were cured or improved in fourteen cases of cicatricial compression of a nerve and in both of two cases in which the spinal cord was thus compressed. Laquerrière described the fine results obtained in a number of cases of infiltration and inflammation of tendon sheaths, also as an adjuvant in old hydrarthosis. The speakers emphasized that their remarks applied exclusively to war conditions, and that the rays were most effectual with young cicatricial tissue.

Roch, C. Mechanical Switching Device for Roentgen Tubes. (*Paris Médical*, Vol. 7, No. 4, Jan. 27, 1917.)

The inconvenience and loss of time experienced over carrying out the roentgenologist's orders to an assistant for handling the switches has been apparently overcome to some extent by Roch. He has devised a small apparatus consisting of a lever and a pear-shaped rubber bulb which is so arranged that two currents can be alternately c'osed or opened. When at rest, the lever closes the lighting circuit and opens the primary circuit of the high tension transformer. A quick, short squeeze of the bulb changes the position of the lever, so that the current is conducted into the roentgen tube, cutting off the lighting circuit. When the roentgenoscopic examination is over, another pressure on the bulb interrupts the communication with the tube and re-establishes the lighting connection. The apparatus is always ready for use and may be either hung up with the regular equipment or fixed at the operator's gown; it may be carried in the hand or placed on the floor to be operated with the foot. It is manufactured by Croullebas & Mottier, 8 rue de Maistre, Paris, France.

Young, Hugh H. The Use of Radium in Cancer of the Prostate and Bladder. (*Journal of the A. M. A.*, Vol. LXVIII, No. 16, April 21, 1917, p. 1174.)

The author presents a number of new instruments and new methods of application of radium in cancer of the bladder and prostate. The instruments are masterpieces of ingenuity. The article is replete with technical details which it is hardly possible to abstract. Dr. Young began his work timidly and cautiously, being fearful of burns from short ureteral or rectal treatments. The methods described in the article were evolved slowly, step by step, after he had demonstrated that by exact methods it was possible to place radium where he willed and to change its location sufficiently often to avoid injury to normal adjacent, intervening or remote structures. Astonishing results have been obtained in some cases: disappearance of obstruction, shrinkage and great softening of certain cancers of the prostate, and extensive retrogressive changes in inoperable cancers of the bladder. Fairly large amounts of radium, in high concentration, are desirable in order to make the treatments, amounting to 2 or more milligram-hours of as short duration as possible. This is particularly true of cancers of the bladder, in which the patient is often intolerant of long treatments.

While the author does not venture any statements as to the possibility of cure, he is sure that large relief can be afforded.

BAILEY, HAROLD. The Use of Radium in Gynecological Diseases. (The *American Journal of Obstetrics*, Vol. LXXV, Whole No. 472, p. 556.)

The author is convinced that radium has a place in gynecological treatment and that it will no doubt fill a much larger field when the technic has become standardized. If scientific advancement is to be expected, enthusiastic reports must hereafter be accompanied by a complete history of the physical findings together with the histopathological report and all the details of the technic. Prophecies are out of place.

Histological proof is at hand that carcinoma cells may be destroyed by radium; also that this action even after tremendous doses of radioactive substance does not extend much if any more than 3 cm into the tissue. If this were the whole story no one could doubt that the proper treatment of the beginning cancers of the cervical lip would be radiation, but in order to apply an amount of radium sufficient to insure the destruction of the cells in such a case, severe radiation of normal parts must occur and the resultant damage cannot be looked upon lightly. Stricture of the rectum and rectovaginal and vesicovaginal fistulæ have been reported too many times (and there are probably many cases that have not been reported) from our leading clinics for us to accept offhand the statement that radium can be used without local or general injury to the patient.

The question arises: Could not a moderate dose of the radium be used as a preoperative treatment to destroy or prevent the reproduction of the cancer cells? Bumm, Wertheim, Kelly and a number of others state that the radical operation is made more difficult by the infiltration, hyperemia and sclerosis of the pelvic connective tissue. Whether this induration in the pelvis will prohibit the attempt at removal, time only will decide; so far it has not. It would seem that in this field lies the great future of radium—preoperative treatment.

The knowledge of the pathology and the dissemination through the lymph channels of the cancer cells and the uncertain action with the entire lack of standardization of the radium treatment, of necessity, causes us to uphold the dictum that radical excision must be the treatment for every operable cancer of the cervix.

Cancer of the Fundus.—Statistics show a 70 per cent. cure of this disease by operation. Radium could be used as a preoperative measure, for the uterine muscle acts as a filter for the damaging hard beta and secondary beta rays. The condition within the uterus and in the broad ligaments must be unknown and the cessation of hemorrhage and discharge is no indication that the patient is cured. Here as in the former type of the disease operation must be performed.

Inoperable Cancer of the Cervix and Borderline Cases.—Radiation, radium and *x*-ray have a valuable field. Palliation will occur in many cases and in a few temporary cure. The outlook is good for a number of permanent cures in this group. In recurrent cancer the results have not been encouraging. We must always have before us Kelly and Burnham's 28 per cent., and Schmitz's 35 per cent. of clinical cures in this class and live in the hope that these results may be duplicated. The opinion of Clark that in those cases in the inoperable class which respond to the treatment it is better to leave well enough alone and not attempt to operate later, seems well founded.

Treatment of Fibroids.—In a paper on the operative treatment of fibromyomatous uterine tumors, John B. Deaver says: "A patient treated by radium even though symptomatically improved, still has her fibroid, for I do not take seriously the claim that such tumors disappear under the influence of radiations. Also is it not time for the profession to take a stand and condemn the excessive zeal of those who would displace operation or relegate it to a last resort, and instead put radium in its proper place as a symptomatic treatment to be employed only when operation is contraindicated."

Most operators will find that the indications outlined by Frank for the *x*-ray treatment of fibroids will also apply to the use of radium. Cases with serious heart, lung or renal disease or those who refuse operation providing the tumor is uncomplicated and not too great a size, might be selected for the ray treatment.

BOOK REVIEWS

Notes on Military Orthopædics. By Colonel Sir Robert Jones, C.B., Inspector of Military Orthopædics, Army Medical Service; with an introductory note by Surgeon-General Sir Alfred Keogh, G.C.B., Director-General, Army Medical Service. 128 illustrations. Paul B. Hoeber, 67 East 59th Street, New York. $1.50.

This little book is of genuine value because it is the outcome of an immense experience in dealing with the increasing problems of the disabled soldier. The style is one of marked simplicity, brevity and military directness.

For instance, in discussing fractures about the elbow joint, Colonel Jones says, "The limb should therefore be extended to push away any fragments likely to obstruct extension afterward. The forearm should be supinated to make sure of clearing a right of way in that direction, and then the elbow should be fully flexed and bandaged." This laconic disposition of a surgical problem is characteristic of this wonderful primer.

The title, Military Orthopædics, acquires meaning when you become familiar with the burden of derelict human bodies which have been invalided home from the front and placed in orthopedic centers in England, with Robert Jones at the head of the work. Curative workshops, they should be called.

Instead of the monotonous movement with mechanical apparatus of the "boche" Zander type, a man with stiff ankles is set to drive treadle, lathe or foot saw. Men with stiff hands and fingers are given big swabs to clean windows or a paint brush to handle.

This book, though small, covers a wide range of new orthopedic thought, made necessary by new military conditions. There is a fine chapter upon "The soldier's foot; flat foot, claw foot, hallux rigidus, valgus, hammer-toe, metatarsalgia, painful heel, spurs, etc." When you see that 34 pages out of 130 are taken up with the discussion of the soldier's foot, you realize how important the subject is.

We do not consider that the military surgeon alone will be interested in this book. It is of equal value to the civilian practitioner. There are chapters as follows:

1. Positions of Election for Ankylosis following Gun-shot Injuries of Joints.
2. Suture of Nerves and Alternative Methods of treatment by Transplanting of Tendon.
3. The Soldier's Foot and the Treatment of Common Deformities of the Foot.
4. Malunited and Ununited Fractures.
5. Transplantion of Bone, and some uses of the Bone Graft.
6. Disabilities of the Knee Joint.
7. The Mechanical Treatment of Fractures under War Conditions.

The book reflects the judgment of the most thoroughly experienced orthopedist in the English-speaking world. Thousands have been sent home to be made over into earning civilian units who will be able to help themselves instead of being pension barnacles upon society, because of this man's work and this extraordinary book.

E. H. S.

Radium Therapy in Cancer. At The Memorial Hospital, New York. (First Report, 1915–1916) by Henry H. Janeway, M.D., with a discussion of Treatment of Cancer of the Bladder and Prostate by Benjamin S. Barringer, M.D., and an introduction upon the Physics of Radium by Gioacchino Failla, E.E., A.M. Paul B. Hoeber, New York, Publisher. 1917. Price $2.25 net.

This is a very satisfying book, especially to one working with radium. Of course, the pages contain reports of many remarkable results, which will interest many surgeons, notwithstanding the difficulty of convincing them that other agents besides the knife may possibly be helpful in the fight upon malignancy. But we may be sure that this report upon Radium Therapy at the Memorial Hospital during 1915–16 will be eagerly read by the many purchasers of small amounts of radium—25 to 50 milligrams.

Not that there has not been sufficient radium literature but it has been inefficient. The radium articles in the current medical press have been upon the order of pot-boilers, which this book decidedly is not.

This report covers 237 pages and is divided into three parts. The first by Gioacchino Failla, a physicist, undertakes to describe "Physical Considerations Relative to the Application of Radium." All of which appears quite formidable. But it is all necessary to the radium therapist. Just as necessary as a knowledge of gastric physiology is to the thinking successful abdominal surgeon.

Dr. Henry H. Janeway contributes the second part upon "Radium Therapy in Cancer." He relates principles and methods of applying radium at the Memorial Hospital, showing numerous new and ingenious applicators and then proceeds to the report of the results at the Memorial Hospital in carcinoma in the various and usual sites. Naturally, this makes up the bulk of the report, but it is not tiresome as frank comment is woven into and between the case histories.

The third part is upon "Radium Treatment of Bladder and Prostatic Carcinoma" by Dr. B. S. Barringer. There are only ten pages but they are wonderfully illuminating.

Every radium therapist will welcome this book and the publisher is to be congratulated upon his temerity in undertaking to give it wider circulation with little hope of financial reward. This report is so different from certain ambiguous super-heated reports from other renowned and orthodox sources, that it will probably pass with little attention, because it is too modest. Diogenes! Awake Ye need not travel further! Here are three honest authors! E. H. S.

International Clinics. Vol. II, 27th Series, 1917. J. B. Lippincott Company, Publishers, Philadelphia.

This number of the Clinics contains a valuable article by Henry A. Christian on "Gout and Infectious Arthritis." Numerous illustrations are appended, chosen from the collection in the Roentgen Department of the Peter Bent Brigham Hospital, and although no new roentgenological points are brought out, it will pay every roentgenologist to study the article in its details.

The article by James J. Walsh on "Constipation and Natural Food" makes very interesting reading.

Another article of interest to roentgenologists is by Arthur F. Hurst (well and better known to readers of this journal as Arthur F. Hertz of London, *ante bellum*) on "Mucomembranous Colitis." The clinical aspects of the subject are well treated, but the reviewer regrets that no reference has been made to roentgenological examination, as he has found the latter a valuable adjunct in the differential diagnosis.

The Surgical Clinic of the Presbyterian Hospital by John Speese and P. G. Skillern, Jr., contains, among other interesting case reports, one case of unusual interest, in which a diverticulum of the stomach was diagnosed upon roentgenological findings. Unfortunately, the patient declined surgical help, so that the diagnosis could not be operatively confirmed. Antisyphilitic treatment relieved the pain and distress, greatly improving the patient's condition. It would have been a matter of the highest interest to have had an operative check upon this case.

It is a commendable fact that medical journals of a general trend feel increasingly inclined to acquaint their readers with the progress of roentgen rays and radium. Thus, the May number of *Southwestern Medicine* has no less than three articles dealing with that subject: the first, by W. W. Wilkinson, on "Roentgen Therapy"; the second, by George E. Bushnell, entitled "Extension of Tuberculosis of the Lungs as Shown by the X-Ray"; and the third, by Rex Duncan, which is devoted to "Radium: Its Properties, Action and Local Application as a Therapeutic Agent." The articles do not contain any new research work or discovery, but serve to familiarize the general practitioner with the achievements of radium and the roentgen rays and as such are a welcome addition to the literature.

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A BRIEF HISTORY OF THE DEVELOPMENT OF FOREIGN BODY LOCALIZATION BY MEANS OF THE X-RAYS

WITH BIBLIOGRAPHY

BY JAMES T. CASE, M.D., F.A.C.S.

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In reviewing the methods of localizing foreign bodies, one is immediately impressed with the fact that the publications of the year *1896* set forth the principles at the foundation of most of the localizing methods of to-day. This year saw the publication of Buguet and Gascar, setting forth the classical formula

$$\text{Depth equals } \frac{b \times h}{a+b}$$

when a represents the distance the tube is shifted; b the distance of shift of the shadow of the projectile; and h the height of the screen or plate from the focus of the tube. Early in this same year Elihu Thompson in America, and Imbert and Bertin in France, proposed stereoscopy in connection with x-ray localization. The method of making two exposures at right angles, the so-called method of right angled planes, was proposed by White, Goodspeed and Lester Leonard.

1897.—This year marked the publications of Mackenzie Davidson and Hedley on the triangulation method, visualizing in space the position of the foreign body by means of crossed threads, and the method of Gerard and of Levy-Dorn which utilized the same principle of triangulation, but without the cross-thread visualization. Stechow wrote further on the method of making two exposures at right angles. Exner described a method combining a ring localizer with the triangulation principle, and later used the parallax principle. The parallax principle was also used by Levy-Dorn. Payne described a method similar to that of Mackenzie Davidson, and added a consideration of its application to mensuration of the pelvis. Wentzlik laid a small chain on the skin between two points marked with silver nitrate, and located a foreign body in relation to the links of the chain. Rémy and Contremoulins described an elaborate apparatus which was apparently the forerunner of the Hirtz compass as used to-day. Marie and Ribaut published their paper on precise stereoscopy, and Mackenzie Davidson successfully produced stereofluoroscopy for the first time. Mackenzie Davidson's achievement laid the foundation for a train of experimental work closely followed up by Caldwell of New York, which is now culminating in the production by Caldwell of a practical stereofluoroscope. Walsh published his method of visualizing the skin of the part containing the foreign body by the application of a bismuth paste. He employed this method in a case of needle in the hand.

1898.—Caldwell brought out an apparatus consisting of two or more metal rods which were pointed at the ends, and held in a framework of wood or of aluminium in such a way that they could be placed on a photographic plate, resting exactly perpendicular to it. During the exposure of the plate these rods cast pointed shadows on the plate which made an angle with each other. By means of lines drawn through these shadows and certain calculations and measurements, the position of the foreign body could be accurately indicated.

The Dennis fluorometer, consisting of an upright grid or ladder attached to the table, was used frequently in the Spanish American War, where it was found to work rapidly and well, especially in screen localization. The Hall-Edwards "grid" was described this same year.

The parallax method was further described by Angerer and by Sehrwald.

The single tube shift and triangulation method first described by Buguet and Gascar was again set forth in papers by Harrison, Turner, Wagg, and Hedley; Mergier used the same method and the same formula, but, instead of shifting the one tube, used two tubes.

Morize used four small adhesive discs of lead: one he placed at the points on the skin where the vertical ray passing through the foreign body entered and left the part; the other two were placed in a similar manner at right angles (or nearly so) to the plane of the first two. The intersection of the two diameters joining these four points gives the location of the foreign body. The method of Araujo (Lima) was similar, though published a month later.

1899.—Galeazzi was apparently the first to publish a description of the "pierced screen," the ordinary fluoroscopic screen with a small hole drilled through it and the lead glass cover, sufficiently large for the insertion of a small rod for estimating the depth from the screen surface to the skin in those locations where it was not possible to bring the screen in actual contact with the party under study. He also employed the triangulation method with single tube shift, and added a direct-reading scale, obviating the necessity of calculations. The method described by Guilloz was similar to that of Mergier in 1898.

Sechehaye, in January of this year, published a review of the literature on the subject and was able to summarize thirty-two methods and authors; to which he added one new method, a complex mathematical procedure, employing a sort of grid, as previously mentioned for Hall-Edwards and Dennis.

Warluzel and Jollant, before the French Society for the Advancement of Science, described the use of malleable metal bands applied over the part as giving assistance in the localization of projectiles and other foreign bodies, the work of these authors thus considerably antedating later publications on this feature of localization methods.

Wildt called attention to the fact that foreign bodies move with passive motions of the tendons in which they may be located, and with passive motions of the skin. He thus was probably the first to publish the method of locating a foreign body by determining the point in the skin nearest to it, a method described again by Holzknecht in 1914, and by several others in 1915.

1900.—This year marked the publication of a very extensive work on the principles and applications of stereoscopic roentgenography by Lambertz, and the description of Barrell's metal cylinder method, very similar to that described by Caldwell in 1898 before the staff of the New York Polyclinic.

1901.—The ring localizer was again described, this time under the name "prevetograph" by Addyman in his book on "Practical *X*-Ray Work."

A caliper method was brought out this year by both Caldwell and Little. Caldwell's device was a special caliper, the ends of the caliper arms being so shaped that when the shadows of the two were superimposed, they formed a cross. One arm of the caliper was flat so as to fit more closely against the screen. Little's caliper was fitted with a graduated direct-reading scale.

The malleable metal device susceptible of being moulded to the part under study was further developed by Fox who made a complicated metal frame arrangement to assist in locating a bullet in the head.

Caldwell this year described and produced stereofluoroscopy, the principles of the device being in the main similar to those of Mackenzie Davidson. Several new ideas were introduced, however, as follows: (1) The conception of the double-focus tube; (2) an electrically controlled shutter; (3) the shutter run by the same current which activated the tube, so that the shutter and tube action were synchronous.

Another entirely new localization principle was first published this year, that of inserting a needle into the tissues to the site of the foreign body, and leaving the needle *in situ* as a guide to the surgeon in removing the projectile. This method was published under the term "fremdkoerperpunktion" by Perthes.

1902.—Van der Goot described a method similar to that of Sechehaye (1899).

1903.—Bermbach published a highly complex calculation method, which he believed was new. Apparently no new principle was added to that formula first published by Buguet and Gascar in 1896. Little described a direct-reading scale for the application of the single tube shift and triangulation method, apparently not different from several scales already described. Grünfeld and Perthes both published further studies on the "harpooning" method of locating foreign bodies. Moritz, whose name has always been prominently associated with orthodiagraphy, described a method of using the orthodiagraph for determining the location of projectiles.

1904.—Contremoulins continued the discussion and improvement of his apparatus for localizing, which, as before mentioned, was probably the forerunner of the Hirtz compass, now so popular in the French military hospitals. Grünfeld and Holzknecht continued their consideration of the "harpooning" method of localization, and Holzknecht brought out a special operating table for the extraction of projectiles under fluoroscopic screen guidance at the moment of the operation.

1905.—Nothing of importance in relation to foreign body localization or extraction was published this year. Notes relating to the Russo-Japanese war do not give much detail with reference to the *x*-ray work of either side. A few of the field hospitals of the Japanese army were equipped with portable *x*-ray equipment, but of a rather unsatisfactory nature, some of it run by hand. Localization apparatus is mentioned occasionally, usually on account of its absence, but no details of procedures are given in any of the literature available to the writer. Some of the hospital ships were equipped with roentgen apparatus, but the reports of the official observers indicate that it was little used. Most of the base hospitals, however, were equipped with first-class *x*-ray equipment, and the rays were extensively used, at least in the study of fractures. Perhaps a more thoroughgoing investigation of the literature would uncover more information as to the localization methods employed: one British observer, however, states that the Japanese surgeons felt that they could get along just as well without the *x*-ray as with it.

1906.—Shenton published a description of his method of employing the parallax principle in localization. Kocher described a compass, which served especially as a guide to the operator during extractions. No new principles were exhibited in the device. Hall-Edwards gives a long but very interesting and helpful account of his experiences in the localization of foreign bodies in civil practice.

1907.—Bailey presented a description of his method of using malleable metal strips moulded to the part under investigation. Carothers described the ordinary stereoscopic roentgenographic method in common use among x-ray workers, and calls attention to the value of this method in estimating the situation of foreign bodies.

1908.—Daviot wrote at length advocating the control of extractions of foreign bodies by intermittent observation with the fluorescent screen during the progress of the operation. Ironside Bruce published a description of a rather elaborate but very accurate device for inserting needles into the tissues, thus indicating the site of the projectile, a sort of compass for indicating to the surgeon at the time of the operation the exact position of the foreign body. The instrument could be removed to the operating room, sterilized, and a needle prepared and adjusted in a little holder of its own, the length which it projected beyond its own holder being made equal to the depth of the foreign body from the surface of the plate. The instrument having been placed in position, the needle was inserted, released from its holder and left in position. The surgeon then dissected down to the point of the needle which was usually found in contact with the foreign body.

1909.—Fürstenau published his caliper method, the instrument being graduated in order to be direct-reading. This method enjoyed considerable popularity as a device for private practice, but in times of war it did not prove sufficiently rapid.

Bouchacourt advocated the stereoscopic method as giving the most accurate data upon which to base anatomical localizations. Gillet published a very extensive treatise on stereoscopic roentgenography.

The single shift triangulation method was further considered by Perdu, by Kreuzfuchs and by Müller.

1910.—In America, Coon described a practical device for localizing foreign bodies for use in civil practice. Manges brought out an elaborate and attractive method of estimating the measurements of the female pelvis by means of stereoscopic roentgenograms, and called attention to the value of this method in the localization of foreign bodies.

1911.—The publications of this year were almost entirely devoted to the value of fluoroscopic screen control during the extraction of foreign bodies, and dealt particularly with the technic of the combined radio-surgical procedure. Wullyamoz designed forceps of special form to facilitate extractions without endangering the fingers of the operator, the forceps having blades bent at right angles. Laval, and later Raoult-Deslongchamps, wrote further on the subject, the latter describing a special design of radio-surgical table permitting the operator to see the fluoroscopic image with one eye, while the other eye observed the operative field. This method was described by Grashey this same year. Laval's paper is a well-illustrated elaboration of the work of Wullyamoz (Lausanne).

1912.—In America, Blake published a triangulation method, not new, which required a complex mathematical calculation. The same method had been employed with direct-reading scales which were certainly more convenient. Coleschi, in Italy, seemed to take the lead in the subject of localizations; summarizing methods, but not presenting any new principles. The same may be said of the work of d'Halluin.

1913.—Sorge gave an excellent review of the subject, and offered what he thought to be a new method, though it differs from those previously reported only in some minor mathematical details. LeNestour revived the subject of extraction of projectiles under screen control at the time of operation, and suggested that the difficulties encountered by the anesthetist working in the darkness could be eliminated by constructing a sort of tent to contain him and the patient's head, so that he could have a light upon the patient's face at all times during the operation. Another compass for the guidance of the surgeon during the operation of extraction was proposed by Miramond de Laroquette. This was a simpler form of compass than that of Hirtz, but its usefulness is correspondingly limited.

1914.—The majority of the papers of this year were published before the beginning of the Great War. Aubourg and Lebon in January published an extensive review of the subject of localization. Locke again called attention to the value of *x*-ray aid at the time of the extraction operation. Henrard in March summarized the various means of localizing, and spoke favorably of the supplementary aid afforded by the telephone probe of Hedley.

Hirtz this year first published a description of the compass which bears his name, although the writer understood, while in France, that the compass was really first used in 1907. It is an instrument formed of three horizontal branches turning about a common center, bearing on each branch a vertical rod, adjustable in length and in position on the branch, so that the ends of the vertical rods can be brought in contact with the skin, the horizontal branches remaining level. A fourth peripheral rod traverses a hole in the very axis of the compass, or it may be attached to a curved branch which also revolves about the common center, the curve being such as to form the arc of a circle with a given radius. Space will not be devoted here to the description of the instrument, the reader being referred to previous numbers of the JOURNAL. The instrument has been very widely used during the present war and is at present the standard method in most of the French hospitals. It is reserved for difficult cases, and especially for late removals, as contrasted with methods for localization of foreign bodies to be removed within a few hours of the injury when the surgeon must of necessity open up the original wound in the course of his necessary work. This method is not primarily a localization procedure so much as a means of providing the surgeon with a guide to be used once more during the course of his operation for extraction of the projectile. The most exact results are obtained when the method is used roentgenographically, but the instrument also serves very satisfactorily when used by means of the fluoroscope, with the added advantage of reducing the time of the localization to four or five minutes.

After the opening of hostilities, papers began to appear at an increasing rate until the curve of production of articles on the subject reached the highest point during 1915. The earliest papers on localization based on experiences in the present war were written by Wilson, who recommended the method of right-angled planes; Manuel and Nogueras described the single tube shift method, and produced a graduated direct-reading scale, the tube being shifted 20 cm.; Jaugeas recommended the single tube shift method, moving the focus 15 cm. between measurements; while Haret, employing the same method, shifted his tube 10 cm. Prof. Béclère also recommended and taught this method, all the men mentioned preferring to use it as a screen procedure. Haret also devised a wall scale which permitted direct reading of the depth of the projectile by using a thread to reconstruct the triangles formed during the procedure, thus reading the distance from screen to projectile. Hernaman-Johnson recommended the ring localizer, marking four points on the skin, and reconstructing the intersection of the two diameters passing through the projectile.

1915.—Space is too small for an adequate review of the work of this year. The work of Ombredanne and Ledoux-Lebard should be consulted for a complete exposition of the more useful roentgenologic methods of localization and extraction of projectiles which have grown out of the experiences of the present conflict.

Blake revived the cylinder method of Barrell.

Bramwell recalled attention to the triangulation method, using an arithmetical formula for calculating the depth of projectiles. The triangulation method, as practiced and automatically measured by the wall device of Haret, or by a direct-reading scale (*barême*), was further discussed by Charlier, Clark, Colardeau, Coleschi, Cotton, Davidson, Duncan, Hallam, Hampson, Jallot and Guerrée, Lagoutte, Mackenzie, Ménard, D. F. Shearer, Stenning, Viallet and Dauvillier, and by

Thurstan Holland who also devised a wall metric arrangement similar to Haret's for direct reading of the depth. Many of these writers doubtless believed their pet methods original with them at the time of their publication, though a perusal of the literature shows that the method is as old as roentgenology, having been first described by Buguet and Gascar in 1896.

The parallax method found preference in the writings of Jordan, LeFaguays, and Pirie.

Debierne and Vergely both described the multiple diameters method, and Vergely employed cardboard cut-outs conforming to the outline of the part studied, upon which he reconstructed the diameters and located the projectile.

Harris discussed the "nearest point" method, previously mentioned as first described by Wildt in 1899.

Hirtz and Gallot brought out their "pierced screen" method, which has found considerable favor among French *x*-ray workers.

Baese, in Italy, constructed a special device by which the tube and screen always moved together, the vertical rays from the tube being always perpendicular to the screen. This instrument is a very ingenious device by which the depth of a foreign body can be read off almost instantly in any diameter. It has not found favor in France, however, for some reason. It has the disadvantage of being of use only for the localization of foreign bodies, although it is as elaborate as most combination tables and tubestands.

Shaxby described his "ladder," a sort of grid device similar to the Dennis fluorometer used in 1898. The method recommended by Stenning involved the use of a special localizing mat, consisting of a number of pieces of straight lead wire embedded in a sheet of transparent material, parallel and equidistant. By means of a direct reading scale the depth is readily estimated.

H. Béclère and Mayet both spoke in commendation of the stereoroentgenographic method, calling special attention to the greater ease and accuracy of correct anatomical localization when the stereoplates were possible.

As an operating guide, the Hirtz compass continued to find enthusiastic support, and several other instruments serving a similar purpose were described: (1) The apparatus of Aubourg; (2) an elaborate instrument of Ironside Bruce, a further development of the instrument previously described by him seven years before; (3) a sort of Hirtz compass by Buffon and Ozil; (4) Lebon used the malleable band method, recommending the use of block tin; (5) a "radiologic sextant" by Loro; (6) an elaboration of the Mackenzie Davidson apparatus by Marion, the so-called Marion-Danion Compass, which not only permitted the visualization of the position of the foreign body in space, but furnished the surgeon with an operating guide, simpler than the Hirtz compass but also less generally applicable; (7) a special belt of wood and malleable metal which could be adjusted to the part, and in reference to which localizations could be made; (8) Menuet specially commended the Hirtz compass.

Screen aid in the surgical extraction of projections was discussed and recommended by J. R. Caldwell, Gosset, Réchou, and by Ledoux-Lebard and Dauvillier, the latter authors specially commending the "bonnet fluoroscope" which permits intermittent screen control of the surgical removal while the operation is being carried on in the usual bright light of the operating room. Lefort discussed the application of the electromagnet under the guidance of the screen observations.

1916.—The single tube shift triangulation method, used with a wall metric device, a direct reading scale or a chart, was further described by Desplats, Laroquette and Lemaire, Mahar, Oram, Gamlen, and Kirkwood. Gamlen employed small screens so that by pressure he could always assure definite contact with the skin, thus eliminating the factor of error due to the distance the screen may rest above the skin of the part measured. Kirkwood preferred to mark the skin rather than the screen to make sure of correcting this source of error.

The "nearest point" method was recommended by Bocciardo.

The parallax principle formed the basis of the method of Grandgérard who also devised a rough compass to serve as an operating guide.

A method of two equal triangles, involving special apparatus by which the screen could be moved upward from the patient without disturbing any of the other relations, the height to which the screen is elevated being equal to the depth of the projectile, was described by Carver, by Guyenot, and by Shenton. Shenton's date of publication antedates both the other authors.

The trocar and cannula method was supported by Lyle who attributed the method to Sutton. Flint described the profondometer method which combined the malleable band idea, the trocar and cannula method, and the utilization of multiple diameters each passing through the projectile.

Barclay added a new idea in the bell-ringing forceps, as an aid to the surgical extraction of projectiles.

Belot and Fraudet and Nogier advocated and discussed the "*méthode de la pince*," a ring localizing method, for which special localizing forceps were devised, somewhat similar to the calipers described so many years before by E. W. Caldwell.

A very simple, rapid method, with double tube shift and double fixed wires, obviating the need of knowing the focus-screen distance or the distance of tube shift, was devised by Strohl. The article by de Moncetz is similar, though less exact.

A simple form of compass for operating guidance was devised by Maréchal, and simplifications of the Hirtz compass technic were suggested by Chaperon and Vanderhaegher, by Charlier, and by Morin and H. Béclère. The latter authors especially simplified the calculations necessary for the working out of the Hirtz compass method.

The stereoscopic method was again advocated by Beck, by Colombo, and by Ribaut and Brocq. Beck produced a two-volume atlas illustrating many types of foreign bodies, few of them, however, the result of firearms. Ribaut and Brocq especially dwelt on the necessity of using stereoscopy in order to secure accurate anatomical localization.

Extraction methods were discussed by Barclay, whose bell-ringing forceps is above alluded to; by Lamarche, who favored the telephone probe and the *électro-vibreur* at times as adjuncts to the screen control method; and by Monod who preferred extractions under the screen. Monod called attention to the fact that seventeen per cent of foreign bodies are not magnetizable, and hence cannot be vibrated with the *électro-vibreur*.

Sources of error in foreign body localization were discussed by Eager, Lehman, Ghilarducci and Maragliano. Metcalf and Keys-Wells published an elaborate and very valuable table of depths from various points on the skin to various internal organs and tissues. This table should be on the wall of every roentgen examining room for frequent reference.

1917.—Last year witnessed a considerable falling-off in the number of articles relating to the localization of projectiles. Shaxby continued the consideration of his "ladder" method. Tousey brought out again the "grid" method, now nearly twenty years old. Young, quite independent of previous workers, devised an apparatus almost a duplicate of that of Le Faguays for the utilization of the parallax method. Castelvecchio and Pittarelli both published complex mathematical methods which do not seem to present any practical advantage over the other methods already in common use. Aimé published a method of employing the Hirtz compass with the screen in place of the more tedious plate method. Deverre devised another chart for estimation of depth by the triangulation method, single tube shift, using a direct-reading scale. Coppola discussed modifications of the ordinary x-ray operating table for the purpose of better suiting the needs of radio-surgical procedures.

Eastman and Bettman, in America, after spending some time in Austrian hospitals, described the localization methods in use in the Austrian armies; and Bettman describes his "bonnet fluoroscope" which is identical with the bonnet already described by several French authors, notably Dessane.

Cole of New York described a localizing device which, while very useful, does not embody any new principles. It is best adapted to a double tube shift, triangulation method. It has attachments giving it some of the characteristics of the profondometer method, and a guide for the surgeon during the operation of extraction.

A very good summary of the methods actually in use in the military hospitals was published by Wilkins, speaking from experience in the British army, and by Luisada.

In the foregoing pages, the writer has attempted to give a concise summary of the development of the elaborate list of localization methods in use to-day. In the following pages is given a list of the authors, titles and references, the arrangement being in alphabetical order. A great deal more might have been said, but on account of the limitations of time and space, it is thought best to leave the subject here, hoping that this presentation will be of great interest to many and of special service to those whose inventive minds may tempt them to spend valuable time in the development of what will very likely prove to be a rediscovery.

It is easily noted that German references are conspicuous by their absence, owing to the fact that since early in 1915 the delivery of German and Austrian medical periodicals has been suspended. Dutch, Scandinavian, and Russian references have also been omitted, in fact the writer was able to find but very few of them.

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THE INVERTED COMMA SIGN IN PULMONARY ROENTGENOLOGY*

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THE inverted comma is a sign found in roentgenograms of the chest. It is located along the right margin of the main bronchus with the head at about the level of the bronchial bifurcation and the tail tapering upward along the bronchial border. The average size of the head is that of a pea. The length of the tail is three or four times the diameter of the head but is indeterminate because its extremity fades into the shadow of the margin of the bronchial tube.

It is a definite body distinct from the hilus glands and other structures. A study of stereoscopic plates shows that it is not an appearance due to the juxtaposition of other shadows. It does not consist of normal structures, viewed edgewise or otherwise, because it is found in a certain per cent of cases only. It cannot be made to appear and disappear by placing the patient in certain positions. It is often sufficiently dense to be seen with any position of the patient and in the more pronounced cases it can be followed by the eye as the patient is turned behind the fluorescent screen.

The comma is not, however, a proper subject for detection by the screen. It is a sign for plate study. It is best observed in stereoroentgenograms but is readily recognized on single anteroposterior plates. Prints and illustrations in books and periodicals rarely show the comma, although one set of the plates in the Dunham's "Pulmonary Stereoroentgenography" shows it with unquestionable distinctness. No special technic is required but it is an advantage to place the patient prone upon the plate with the face turned to the right so that the right side of the bronchus will be thrown beyond the shadow of the spine. Sufficient penetration to reveal the vertebral detail is desirable because the comma is frequently overlapped by other structures.

I first drew attention to the comma sign Oct. 14, 1914, before the Chicago

* Read before the American Roentgen Ray Society at the Eighteenth Annual Meeting, New York City, September, 1917.

FIG. 1. SHOWING SMALL DENSE INVERTED COMMA.

Apparently a normal chest. Calcification of hilus clusters absent.

Medical Society and exhibited a number of lantern slides illustrating it. At the mid-winter session of the western section of the American Roentgen Ray Society in Cincinnati, 1916, I again called attention to it and showed slides. I intended to make an exhaustive study of the comma at my leisure, but never finding leisure I have responded to an invitation of our president by bringing before you at this time a presentation of the inverted comma sign, which is still woefully incomplete in respect to pathologic and postmortem studies.

I have run through three hundred recent consecutive cases of which we had on record the case histories, the physical examinations, the laboratory findings and the *x*-ray studies. These cases were gastrointestinal, renal, cardiac, psychopathic, etc., as well as pulmonary. Chest plates had been made in all the cases regardless of the fact that pulmonary symptoms were or were not present. Where the sign was doubtful the plate was counted as negative; in some cases I believe that better plates would have shown an unquestionable comma, so that I consider twenty per cent a conservative estimate.

We have made a thorough analysis of sixty positive cases. Of those under observation 24 were women and 29 men. Sex is not a factor. Seven were under 22 years of age, 27 were between 21 and 46, 18 were over 45 years, so that most of the cases were found in middle life. It has not been found by me in childhood. I can see no reason for this and believe that a sufficient series of cases would yield a positive percentage. Nineteen out of 52 were without pulmonary signs or symptoms excepting calcified glands; 64 per cent had pulmonary signs or symptoms; 48 per cent had an expectoration; 46 per cent had a cough; 15 per cent had tubercle bacilli in the sputum; 12 per cent had active tuberculosis. It is not, therefore, a sign of active tuber-

FIG. 2. SHOWING INVERTED COMMA.

Asymmetry of chest; calcification of hilus clusters; remains of left pleural effusion.

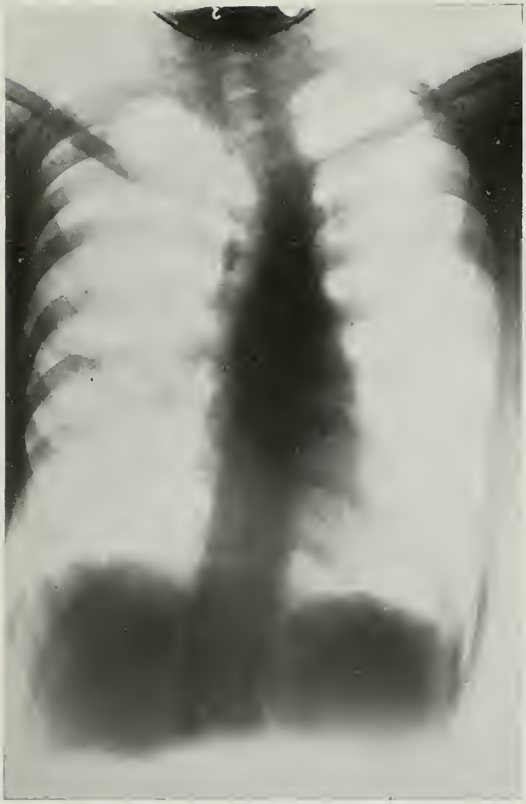

FIG. 3. SHOWING INVERTED COMMA.

Upper dorsal scoliosis to left leaving calcified comma in bold relief. No other pulmonary focus of calcification.

culosis. Known syphilis was present in but 2 out of 52 cases and a negative Wassermann was present in 8. It is obviously not a sign of pulmonary lues. Previous pneumonia was present in 19 per cent. Pulmonary infection other than tuberculosis was present in 19 per cent. Fever was present in 28 per cent; a leucocytosis in 38 per cent; marked oral sepsis in 35 per cent; pain in the chest in 17 per cent. Eighty-eight per cent had roentgen signs of pulmonary tuberculosis of some grade.

The size, shape and density of the comma vary in these cases to an extent which may be of clinical value. While the average measurement of the head on the plate is 0.7 cm for the short diameter and 1.2 cm for the long diameter, these dimensions are halved in some cases and trebled in others. It may be spherical or the usual oval may be greatly exaggerated. Instead of rounded ends, these may be pointed. The central portion of the head may show marked rarefaction, a finding which has been observed only in the larger bulbous types. Varying degrees of calcification may be found, which here as elsewhere in pulmonary structures may be taken as an index of chronicity. Variations in the tail are less marked but difference in thickness and density are observable.

From this analysis we would conclude that the inverted comma is a sign of tuberculosis; that it is a sign of a chronic, rarely an acute process; and that it signifies a past rather than a present infection. In the 23 per cent which were found in active cases of tuberculosis, the comma is possibly evidence of a previous infection.

Much remains to be answered. Is the comma evidence of a lymphogenous, an hemic, or an inspiratory origin of tuberculosis? If the latter, then is it evidence of a bronchial tuberculosis? Is it the result

FIG. 4. SHOWING INVERTED COMMA.

Consolidation in left upper third showing cavity f infection by the tubercle bacillus only r may it result from other types of in-ection? May it result from inorganic de-osits as in pneumoconiosis? Why is it ith rare exceptions found only on the right ide? Is the comma when once present ermanent, or may it be absorbed if not alcified? Why is it not present in all cases f pulmonary tuberculosis? Is this sign apable of practical application in x-ray liagnostics?

What is the comma, is a question to be lecided by postmortem and pathological tudy. While at the Cincinnati meeting of he western section, following my commu-iication on the comma, Dr. Kennon Dun-iam took several of the members to the City Tuberculosis Hospital where he had nany lungs, preserved entire in large jars. He had stereoroentgenograms of them nade after their removal postmortem. He elected one showing the comma sign and hen dissected the lung to find the comma. It was readily found and was the size of a hazel nut. It appeared to be a calcified lymph gland. The tail could not be definitely separated but macroscopically was lymphoid tissue along the outer margin of the bronchus. Since then in an adult negro, dying of pneumonia, I found in the exact locality of the comma a swollen glandular structure shaped like a lima bean. It was not calcified. In two other cases, one without pulmonary lesions and one with secondary sarcoma, I could find nothing. But neither the negro nor the two other cases were x-rayed. From such scanty premises no conclusions can be drawn and on its pathological side the subject is practically untouched. But the likelihood remains that it is one of the bronchial glands which drains an area of special susceptibilities. It seems to be a single gland and not a conglomeration of several glands. No other bronchial gland and no bronchial adenopathy ever give a similar roentgenological appearance.

Fig. 6. Showing Inverted Comma.

Left hilus consolidation; remains of left pleural effusion; parenchymatous involvement of right upper third.

Fig. 5. Showing Long, Thick Inverted Comma.

Parenchymatous involvement of lower two-thirds of oth sides. Apices unaffected.

In his discussion of my paper at Cincinnati, Dr. Henry Hulst suggested that the comma was a lymphatic node in the

Fig. 7. Showing Inverted Comma Along Both Right and Left Border of Bronchus.
Case of long-standing healed tuberculosis.

region of Tendeloo. This region extends from the 5th rib upward in the lung along the vertebral border as viewed on antero-posterior roentgenograms. This paravertebral area, Tendeloo describes as a region of biochemic susceptibility. The lymph flow is here relatively slower and tuberculosis of the lymphogenous type is likely to originate in this region. According to Tendeloo, human tuberculosis, in the overwhelming majority of cases is lymphogenous, and it is here that we should look for the first signs of incipient disease.

It is interesting to observe in this connection that in a certain proportion of early cases of tuberculosis the pulmonary lesion surrounds the comma so as to suggest it as the focus of extension. It may be possible that the presence of an enlarged gland at this particular point in the angle formed by the branching of the bronchus may exert sufficient pressure to impede the lymph-flow still farther and thus accentuate the natural susceptibilities of the paravertebral region.

At my request Dr. Hulst supplied me with Tendeloo's article in the *Transactions of the Sixth International Congress of Tuberculosis*, 1908. There is not the slightest hint in this of any structure resembling the comma.

The prominence and frequency of this sign lead me to wonder if it has not already been noted and described under other names. I know that many rediscoveries have been made in roentgenology due to the extent and difficulties of foreign scientific literature. For this reason I do not claim priority.

After twenty years of pulmonary roentgenology we are still beset with difficulties in recognizing specific signs of tuberculosis. The roentgenographic distinctions between an active and a quiescent lesion in the lung are most often doubtful in those cases where we most need to speak with decision, because of the uncertainty of the physical signs. For these reasons the inverted comma should be fully investigated and its diagnostic possibilities developed and applied.

A ROENTGENOLOGIC STUDY OF THE EFFECTS OF DUST INHALATION UPON THE LUNGS *

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THE possible pathologic features and the various causes of increased thickness of the prominent linear shadows, especially those extending from the hilus to the base of so many individuals examined for tuberculosis and other conditions, have been questions about which more or less doubt has existed. Furthermore, it is frequently difficult to assign to their exact diagnostic value, in the detection of early pulmonary tuberculosis, the more isolated thickened trunk shadows often found in the apical regions. In attempting to derive a better understanding of the causes of these changes from normal appearances it was decided to approach the subject by a study of the chests of a large number of individuals engaged in various dusty occupations. This work was instituted about a year ago on a small scale, but it soon proved to be of so much clinical and roentgenologic interest that it has been continued throughout the past year as time could be spared.

As a rule, we have found firms and corporations quite willing to have the investigations carried out upon their employees, and it has frequently been to their advantage so to do, either by being assured that the dust inhaled by their men was not so harmful as was claimed, or by having ways and means suggested whereby the dangers from dust inhalations could be lessened. The Trenton Potteries Company and the Whitehall Cement Works have been most generous in supplying material and otherwise aiding us. A number of carpet, plush and silk workers were furnished through the kindness of Dr. J. W. Schereschewsky, Surgeon U. S. Public Health Service, and the remainder has been supplied through the Occupational Clinic of the University Hospital. Up to the present time one hundred and thirty seven individuals have been examined, distributed through the following occupations:

Organic dust	
Carpet and plush workers .	18
Tobacco workers	13
Silk workers	1
Inorganic dust	
Potters	39
Metal grinders	20
Cement workers	20
Asbestos workers	15
Coal miners and marine firemen	10
Not classified	1
Total	137

Each case has had a thorough clinical examination, followed by a roentgenoscopic study and a roentgenographic examination by stereoscopic plates. The clinical and roentgenologic studies have

* Read at the Eighteenth Annual Meeting of the American Roentgen Ray Society, New York City, September, 1917.

been made independently, and as this is in the nature of a preliminary report during the progress of our investigations, there has as yet been no comparison of the details brought out by the two methods of examination, except in a general way. It is obvious, therefore, that all minor details should be omitted from this report, and the results of our investigations at this time be limited to a statement of certain well-established general facts.

The entire subject is naturally to be regarded as a study of pneumoconiosis, a general term employed in referring to the effects induced in lung structure by the prolonged inhalation of abnormal quantities of dust. In a general study of the subject we have preferred to omit all reference to such terms as anthracosis, siderosis and chalicosis for the reason that they are indicative of the results of inhalation of certain kinds of dust, whereas many occupations imply the breathing of various forms, and the effects are the same in general but may vary in degree.

This report deals entirely with the roentgenologic aspect of the subject and is made at this time in an endeavor to aid in the more accurate roentgen diagnosis of pulmonary disease. The clinical and pathologic aspects of pneumoconiosis are by no means new, but thorough roentgenologic studies have been very few. Perhaps the most valuable contribution is to be found in United States Health Bulletin No. 85, issued January, 1917, comprising a clinical and roentgenologic study of 433 cases of "miners' consumption" among the zinc miners in Missouri, by Dr. A. J. Lanza, Surgeon of the U. S. Public Health Service and Dr. Samuel B. Childs of Denver. Another important contribution was made

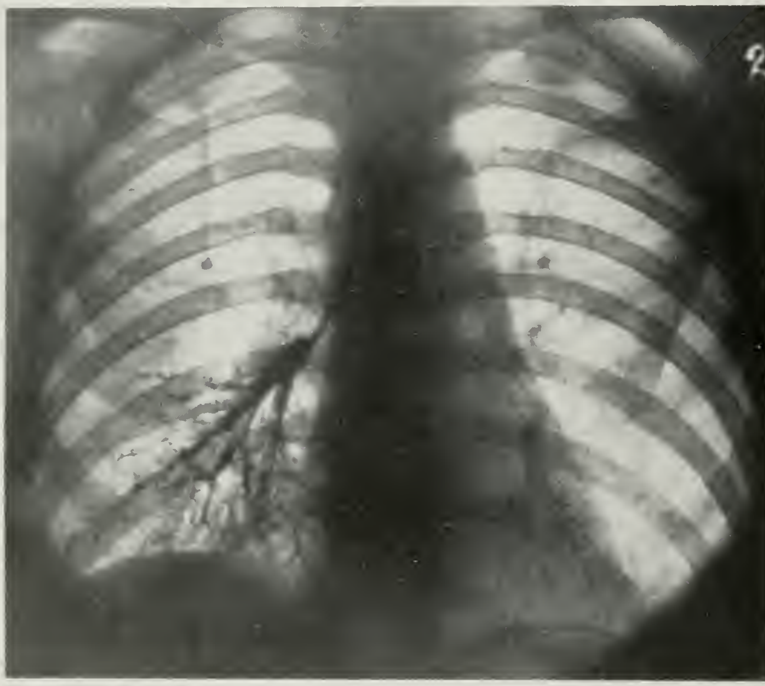

FIG. 1. OUTLINE OF THE LOWER PORTION OF THE BRONCHIAL TREE BY BISMUTH.

Chest of a young girl with supposed esophageal stricture, but in whom the supposed obstruction was merely neurotic in origin. The bismuth meal passed directly into the trachea and most of it descended into the right bronchus. Note the distribution of the lower branches. Dust inhalation does not seem to affect the outermost ones.

Fig. 2. Pneumoconiosis in Metal Ball Grinder (Dry), Seventeen Years' Occupation.

The hilus shadows are greatly enlarged and linear markings are thickened, especially to the right base. There is intense mottling with small dense discrete spots on both sides, but more on the right.

Fig. 3. Pneumoconiosis in Potter, Forty Years' Occupation, Showing Comparatively Little Evidence of Dust Effects for This Time.

The hilus shadows are slightly increased, linear markings thickened, and there is a moderate amount of discrete mottling most marked around the middle of each lung.

by Dr. W. W. Boardman in the June, 1917, issue of the AMERICAN JOURNAL OF ROENTGENOLOGY, dealing with cases of coal dust inhalation and reviewing the roentgenologic literature on the subject. Both of these were published while we were in the midst of our investigations, and it is interesting to note that the conclusions drawn by all of us, working independently, from the roentgenologic standpoint, have in the main been very much the same, differing only in minor details. Each of the above contributions has dealt with pneumoconiosis of a single origin, whereas we are endeavoring to study the condition as it arises from as many occupations as possible, and we have not, therefore, felt that our work conflicts with that of the other investigators. It has been proven by all that the roentgenogram, supplemented by a careful roentgenoscopic study, is by far the most accurate means of studying the effects of dust upon the lungs. The pathology of the disease has been well established by autopsy, and roentgen observations serve to accurately portray the exact conditions *in vivo*.

FIG. 4. PNEUMOCONIOSIS IN COAL MINER WHO WORKED THIRTY-EIGHT YEARS OUTSIDE THE MINES.

Roentgenoscopic examination: No interference with diaphragm excursion. Stereoroentgenograms: Increased hilus shadows, linear markings obscured, diffuse pneumoconiosis, with discrete spots, distributed from bases to apices, somewhat more marked on the right side where fibrosis is beginning. Note also the fibrosis in the subapical region. There were no unusual chest symptoms. This is a transitional case between the second and third stages.

Practically all roentgenologists have had more or less opportunity to examine cases of pneumoconiosis, but most of these have been isolated examples of an advanced stage of the condition. In order to comprehend the various phases and to suspect and recognize them whenever seen and, most important, to differentiate the appearances of pneumoconiosis from those of other conditions, particularly tuberculosis, one must make a systematic study of the roentgen pathology through all the stages and from the standpoint of every source of invasion. When one realizes the very numerous occupations that provide sufficient dust to induce changes in the lungs, and the fact that dwellers in some large cities are subjected to sufficient dust to produce perceptible shadows in the lung structure, it seems quite probable that errors in diagnosis must be frequent unless the possibility of pneumoconiosis be constantly borne in mind.

FIG. 5. PNEUMOCONIOSIS IN COAL MINER WHO WORKED THIRTY YEARS INSIDE THE MINES.

Roentgenoscopic examination: Diaphragm almost fixed. Stereoroentgenograms: Extreme fibrosis of the third stage, with greatest density in subapical regions, where the density simulates consolidation. Emphysema at bases. Bronchiectasis left side. Intense dyspnœa. Repeated sputum examinations negative.

Three stages are to be recognized in the progress of the condition. In order to explain the condition itself and the changes which take place brief reference must be made to the pathology, which is very simple. The first marked effect of excessive dust inhalation is irritation of the air passages which amounts to a chronic bronchitis. This in itself is responsible for more or less fibrous change which becomes legible in the roentgenogram as a thickening of the trunk shadows. This is no doubt also due to a certain amount of dust deposition in the cells and neighboring lymph structures. The thickened trunks and the lymphatic structures with increased density tend to increase the size and density of the hilus shadows. Added pigmentation of cells and increased depositions of dust particles in lymphatic structures further out along the branching systems of the air passages gradually produce small areas of such density as to be visible and give to the lungs the characteristic mottled appearance so common in advanced cases of pneumoconiosis. Our experience has shown that this density is more or less closely related to that of the dust inhaled, being least in organic dust and greatest among metal grinders. Naturally the fibrous change that starts early from irritation increases, and there is later a decided fibrosis following up the deposition of dust. This seems finally to involve a large part of the lung structure and is no doubt responsible for the dyspnœa by rendering the lung inelastic, which is readily determined by the lack of expansion noted by the fluoroscope, and particularly in the diaphragm. Bronchiectatic cavities are quite common in the late stages, and a similar process is manifest in the ultimate divisions of the passages as usually prominent trunk shadows, and an undue prominence of the finer linear markings. This is due to the causes just mentioned. It is the rule that the increase in thickness of bronchial trunk shadows is fairly uniform, which is the main dependence in distinguishing the case from one of peribronchial tuberculosis, but there are

Fig. 6. Pneumoconiosis in Potter, Forty-Five Years' Occupation.

Roentgenoscopic examination: Almost complete fixation of diaphragm (intense dyspnœa). Stereoroentgenograms: Hilus shadows increased; linear markings obscured; emphysema bases; dense mottling becoming conglomerate, especially toward apices; extreme diffuse fibrosis, with bands to diaphragm, and heart and vessels drawn to the left; bronchiectatic cavities both subapical regions. Repeated sputum examinations negative.

emphysema. The division of the process into three stages seems to be a foregone conclusion among those who have made a study of the subject. Before any access to literature could possibly modify our views, we had made practically the same classification which has been presented by the authors already referred to.

The first stage, roentgenologically speaking, is characterized by an increase in the hilus shadows and a thickening of the exceptions, and it is these which makes the roentgenologic diagnosis difficult or uncertain. Boardman aptly calls attention to the fact that roentgenologists have no doubt been mistaking early evidences of pneumoconiosis for tuberculosis. If the distribution of the thickening is irregular, as it frequently is, and the trunks to one apical region only are involved, the two conditions are quite difficult to distinguish by the inexperienced observer, and often almost impossible to differentiate by even the most experienced. A still more difficult problem is the detection of a peribronchial tuberculosis in the presence of evidences of the first stage of pneumoconiosis. In several instances we have recorded our plate readings as suspicious but we have not yet checked these up with the clinical findings. Abnormalities in the diaphragm excursion are to be included in all the stages of the condition. We have certainly noted them in many instances in the first stage, contrary to the experience of Lanza and Childs. There is no general rule about them, however, in the first or even the second stages. When the excursion has been equally shallow on both sides in the first stage, we have frequently been unable to decide that this was not due to habit or to inability of many individuals of the labouring class to "show off" their diaphragms to best advantage. The position of the excursion during ordinary respiration between the limits of extreme inspiration and expiration is very variable. The most common finding was a restriction at the inner portion of the right diaphragm during full inspiration and either a decided flattening or a concavity of the outer aspect. It seemed as though the inner portion were halted in its descent by the process responsible for the thickened trunk shadows. It was our impression that the descending trunk shadows were usually more thickened on the right side than the left, but the interference offered by the cardiac shadow prevented a satisfactory proof of this supposition.

FIG. 7. PNEUMOCONIOSIS IN POTTER, FORTY-TWO YEARS' OCCUPATION.

Roentgenoscopic examination: Right diaphragm fixed at mid-point. Heart and vessels pulled to right. Emphysema at bases. Stereoroentgenograms: Hilus shadows and linear markings uncertain; dense mottling still visible but becoming conglomerate; extreme fibrosis in both apical and subapical regions. Repeated sputum examinations negative.

The second stage is characterized by a more or less uniformly arranged mottling throughout the lung structure due to depositions of dust in the lymph structures, cells, and fibrous tissue interspaces, with the addition of a certain amount of localized fibrosis. This stage comprises what has usually been regarded as the typical case of pneumoconiosis. Its onset seems to depend largely upon the quality of the dust inhaled. It occurs comparatively early in coal miners, cement workers and certain metal grinders, somewhat later in potters and asbestos workers, and quite late in those inhaling organic dusts. The volume of dust will, of course, enter into the statistics of this aspect of our work, and while this has been measured by Dr. Miller, comparisons have not yet been made. In metal grinders it was quite noticeable that mottling was observed before the usual first stage appearances were well advanced. Cement, asbestos and carpet mills were the dustiest buildings examined by Dr. Miller, but no computations were made in coal miners. On the whole, it has been our experience that certainly quality and probably weight or density are more important factors in pneumoconiosis than quantity, contrary to the statement of Boardman. The distribution of the mottling is interesting. Invariably we have found it first appearing in the right lung, on a level with the hilus shadow, which is quite contrary to the statements of Lanza and Childs. It certainly becomes quite perceptible on the right side before it appears on the left, and for some time after it does begin on the left side, it is noticeably more marked on the right. Later on it is impossible to demonstrate any difference on the two sides. The distribution is more or less symmetrical, but naturally not uniform, throughout the lung. From the starting point it gradually spreads to the bases and apices, but is never so marked at the extreme apices or bases as around the mid portion of the lung. The appearance of the

Fig. 8. Pneumoconiosis in Potter, Twenty-Nine Years' Occupation. Dense mottling throughout both lungs. The appearance at the left apex suggests an associated tuberculous process.

Fig. 9. Chest of a Male Aged Twenty-Nine, Who, When a Child, Inhaled a Vegetable Burr: Resulting Fibrosis.

The appearance is that of an extreme fibrosis which prolonged clinical study has proved not to be tubercular in origin. In the right base are numerous bronchiectatic cavities which, under the fluoroscope, could be seen opening on inspiration and collapsing on expiration. Compare this with fibrosis due to pneumoconiosis.

Fig. 10. Old Healed Pulmonary Tuberculosis Involving Right Lung, with Resulting Fibrosis.

Large bronchiectatic cavities previously found are now irregular in shape. The left lung is the seat of a more recent process now healed clinically. Commottling depends more or less upon the quality of the dust. In certain metal grinders the spots are very dense and sharply circumscribed and can be seen when very small. This is so to perhaps a less extent in coal miners, potters, and probably many other occupations. In cement and asbestos workers, among the inorganic dust occupations, the spots are noticeably softer and less sharply defined and the appearance is more like the early individual or conglomerate tubercle. In the organic dusts there is still further difference. Toward the end of the second stage the spots tend to enlarge and become conglomerate.

Errors in diagnosis are not so apt to occur in this stage. The appearance is so typical that no one is likely to mistake it for tuberculosis except possibly the miliary or bronchopneumonic types, and the history of the case is all that is necessary to correct any tendency to error. In a case examined without history, the distribution of the spots in the early stage and the comparatively slight amount of mottling in the apical regions later should put one on guard to ask questions. Here again, however, it may be exceedingly difficult to detect an early tuberculosis engrafted upon a well advanced case of pneumoconiosis in the second stage.

The third stage is the most interesting period in this condition from the roentgenologic standpoint. It is characterized by the appearance of diffuse fibrosis and all that the term implies. As an end result it does not differ greatly from the fibrosis that represents the terminal stage of chronic tuberculosis or some other less common causes. It is sometimes difficult to draw the line between the end of the second and the beginning of the third stage, and we are as yet uncertain as to the appearance at the period of transition. In some instances it would seem that the mottled appearance becomes increasingly conglomerate and passes over into the appearance of dense fibrosis, sometimes closely resembling consolidation. In other instances a general haze seems to spread over a certain portion of lung, resembling a thickened pleura in a flat plate but resolving itself into lung structure in stereoscopic plates. The greatest density is in the subapical regions, although this is not the region of most intense mottling in the second stage. We have imagined that the marked emphysema usually present at the bases must have some bearing upon this distribution. Dense fibrous bands can be seen extending in various directions, and frequently to the diaphragms, causing marked retractions. The heart and vessels are frequently dragged out of place. Bronchiectatic cavities are quite common. There is a very noticeable effect of inelastic lung structure upon respiration as studied by the fluoroscope. The ribs move little enough, and the diaphragms sometimes not at all. Is it in the least surprising that these unfortunate individuals suffer intensely from dyspnœa? In this stage the mottling has become extremely coarse and sometimes is to be no longer recognized as such.

The differential diagnosis between the fibrosis resulting from tuberculosis and pneumoconiosis is frequently a most difficult problem, and, we have had to acknowledge, sometimes well-nigh impossible. It has been hard to believe that some individuals have not had tuberculosis; but repeated sputum examinations, sometimes over a number of years, have been negative. Still more difficult frequently is the detection of a tuberculosis engrafted upon this stage of pneumoconiosis. Suffice it to say that our studies have convinced us that errors in diagnosis have been made with considerable frequency.

THE CLASSIFICATION OF PULMONARY TUBERCULOSIS, WITH A COMPARATIVE ANALYSIS OF THE DIFFERENT METHODS EMPLOYED *

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PULMONARY tuberculosis is a disease of such varied manifestations as to render classification of it upon any absolute basis almost impossible. Many attempts have been made by many men both independently and in collaboration to establish some method of classification which would be generally useful, not too cumbersome and at the same time would include most of the cases as usually seen. These attempts have been based upon the various aspects of the disease or upon a combination of the aspects. Thus we find [1] classifications based upon the following:

1. Origin of the disease (Hereditary, congenital, acquired).
2. Temperament of the patient (Erethismic or torpid).
3. Age (Infantile, developmental, adult, senile).
4. Dyscrasias (Gouty, scrofulous, diabetic, alcoholic, luetic, hysterical).
5. Ease of diagnosis (Latent, larval, manifest).
6. Onset (Catarrhal, anæmic, dyspeptic, pleuritic, hemoptoic, febrile, nervous, dyspneic).
7. Course (Active, stationary, progressive; remitting, intermitting, retrogressive; acute, subacute, chronic).
8. Extent of lesion (Circumscribed, disseminated or diffuse; incipient, limited, moderately extensive, advanced).
9. Pathologic changes (Consolidation, softening, cavity formation; germination, conglomeration, softening, cavity formation; parenchymatous, interstitial, bronchitic, postpleuritic).
10. Degree of susceptibility (Decided, yielding, or lost organic resistance).
11. Secondary infections (Pure tuberculosis, stage of mixed infection, or phthisis).
12. Prognosis—in part (Phthisis incipiens, confirmata et desperata).

It can readily be seen from these that no one classification can be made to embrace all of the factors mentioned and at the same time not be too cumbersome or too complicated for general use and comprehension.

In 1887 Dr. E. L. Trudeau formulated a classification based upon pathology as determined by physical signs and upon the local and constitutional disturbances. With this as a basis the National Association for the Study and Prevention of Tuberculosis formulated its classification which has since been modified several times. The American Sanatorium Association classification has arisen from the National Association classification and has itself been modified. Both physical signs and symptoms are used as a basis and both the intensity and extent of the physical signs are taken in consideration. The classification of Turban based purely upon physical signs is generally employed in conjunction with the Sanatorium Association. So we speak of Incipient Turban I, Moderately Advanced Turban I, II, and so forth. Recently, Dr. Rathbun of Otisville has suggested an additional notation in classification based solely upon symptomatology. Absence of symptoms or the presence of

[1] *Brown, Lawrason.* The Classification of Pulmonary Tuberculosis, *Jour. Am. Med. Assn.*, Vol. LII, pp. 341-348.

* Read at the Eighteenth Annual Meeting of the American Roentgen Ray Society, New York City, September, 1917.

very mild ones would be noted by "a," moderately severe symptoms by "b," and severe symptoms by "c." Thus the classification would be fully noted as Moderately Advanced II, R. L. b, etc., meaning that the patient's condition is included under the term "Moderately Advanced" as explained in the classification; that he had physical signs to the extent of "II" as described by Turban and that one lobe of each the right and left lung showed evidence of the disease and that the patient furthermore had the moderately severe symptoms as mentioned under "b" in Dr. Rathbun's subdivision. Following are the terms and limitations of the classification as usually employed to-day by the sanatoria for tuberculosis.

EXPLANATORY NOTE

The classifications regarding the extent of disease on admission and condition on discharge are those adopted by the National Association for the Study and Prevention of Tuberculosis, in May, 1913, and govern all the terms used in this report.

The classifications and their definitions are as follows:

1. On Admission

These definitions indicate the furthest extent of disease and the greatest severity of symptoms that a patient can present and still belong to the stage defined. All patients beyond the incipient stage fall under the moderately advanced stage unless the physical signs and symptoms exceed those of the moderately advanced stage, when they should be classified as far advanced.

Incipient.—Slight or no constitutional symptoms (including particularly gastric or intestinal disturbance or rapid loss of weight). Slight or no elevation of temperature or acceleration of pulse at any time during the twenty-four hours.

Expectoration usually small in amount or absent. Tubercle bacilli may be present or absent.

Slight infiltration limited to the apex of one or both lungs or a small part of one lobe.

No tuberculous complications.

Moderately Advanced.—No marked impairment of function, either local or constitutional.

Localized consolidation moderate in extent with little or no evidence of cavity formation; or infiltration more extensive than under incipient.

No serious complications.

Far Advanced.—Marked impairment of function, local and constitutional.

Marked consolidation of an entire lobe.

Or disseminated areas of beginning cavity formation.

Or serious complications.

Miliary Tuberculosis.

2. On Discharge

Apparently Arrested.—All constitutional symptoms and expectoration with bacilli absent for a period of three months; the physical signs to be those of a healed lesion.

Quiescent.—Absence of all constitutional symptoms; expectoration and bacilli may or may not be present; physical signs stationary or retrogressive; the foregoing conditions to have existed for at least two months. The length of time mentioned is of course somewhat arbitrary, but is intended to cover the cases which frequently occur, where the patients leave a sanatorium for various reasons, contrary to advice, after a stay of a few weeks, although all active symptoms may have ceased completely soon after entrance.

Improved.—Constitutional symptoms lessened or entirely absent; physical signs improved or unchanged; cough and expectoration with bacilli usually present.

Unimproved or Progressive.—All essential symptoms and signs unabated or increased.

Died.

3. Ultimate Results

Apparently Cured.—All constitutional symptoms and expectoration with bacilli absent for a period of two years under ordinary conditions of life.

Well.—Patients who fulfil all the conditions required under "cured" but about whose sputum no definite information can be obtained.

Arrested.—See "Quiescent" above.
Improved.—See above.
Progressive.—See above.
Dead.

DEFINITION OF TERMS

Terms Used in Definition of "Incipient"

1. *Slight Constitutional Disturbance.*—Slight loss of appetite, of strength, of weight; lassitude; possibly slight acceleration of pulse or possibly slight elevation of temperature. The impairment of health may be so slight that the patient does not look or feel sick in the ordinary sense of the word.
2. *Slight Elevation of Temperature.*—Maximum temperature after rest for one hour, never over 99.5° to 100° F. by mouth (or 100.5° per rectum).
3. *Slight Acceleration of Pulse.*—Maximum pulse rate not over 90 after rest for one hour, sitting or lying, except when due to causes other than tuberculosis.
4. *Absence of Tubercle Bacilli.*—Each monthly examination (if the sputum be negative) to consist of a careful microscopic examination, with a mechanical stage, of two smears, devoting at least three minutes to each smear, made from selected particles (at least six from different parts) of the sputum on each of three successive days. The morning sputum should always be obtained, or, better, the minute bits that some arrested patients raise at very infrequent intervals. It is not yet deemed wise to insist on digestion and centrifugalization or on inoculation of guinea-pigs.
5. *Infiltration.*—Physical signs of, slight prominence of the clavicle, lessened movement of chest, narrowing of apical resonance with lessened movement of base of lung, slight or no change in resonance, distant or loud and harsh breathing, with or without some change in the rhythm (*i. e.*, prolonged expiration), vocal resonance possibly slightly increased; or fine or moderately coarse râles present or absent. If sputum contains tubercle bacilli, any one of these.
6. *Apex.*—That portion of the lung situated above the clavicle and the third vertebral spine.
7. *A Small Part of One Lobe.*—An area of one or two intercostal spaces, or an area not exceeding 60 to 80 sq. cm. in extent, according to the size of the patient.

Terms Used in Definition of "Moderately Advanced"

8. *Marked Impairment of Function, Either Local or Constitutional.*—Local: Marked dyspnea on exertion limiting seriously the patient's activity.
   Constitutional: Marked weakness, anorexia, tachycardia.
9. *Moderate Extent of Localized Consolidation.*—An area of one-half lobe or less, but may involve both apices; marked dulness, bronchial or decidedly bronchovesicular breathing; markedly increased vocal resonance; râles usually present. These signs are to be sharply limited as to area instead of gradually shading into normal physical signs.
10. *Evidence of Destruction of Tissue.*—Presence of tubercle bacilli or elastic fibers in the sputum or the presence of the physical signs of a cavity. There are no absolutely certain physical signs of cavity but a combination of any four of the following signs is to be taken as indicative of a cavity: (1) cracked-pot note; (2) amphoric breathing; (3) intense whispering pectoriloquy; (4) a veiled puff or post-tussive suction; (5) bubbling or resonant râles. "Physical signs of softening" do not admit of any definition apart from that of cavity formation, and the term should not be used.
11. *Disseminated Fibroid Deposits.*—More or less localized areas of fibrous tissue, producing on physical examination some change or dulness in the percussion note, more or less increase of vocal resonance, harsh, suppressed, or bronchovesicular breathing, râles sibilant or sonorous usually, but at times fine and moderately coarse.
12. *Serious Complications.*—These should be limited to tuberculous complications, such as meningitis, pharyngitis, laryngitis (except slight thickening of the posterior interarytenoid space, and superficial ulceration of a vocal cord), enteritis, peritonitis, nephritis, cystitis,

orchitis, adenitis (unless very slight), etc.

Terms Used in Definition of "Far Advanced"

13. *Marked consolidation* indicates dulness merging into flatness, bronchial or tubular breathing and other signs of consolidation as defined in Paragraph 10.

Terms Used in Definition of "Apparently Arrested"

14. *Constitutional Symptoms.*—These include elevation of temperature, loss of weight, loss of strength, night sweats, chills, tachycardia, cyanosis, loss of appetite, amenorrhea, etc.

15. *Physical Signs of a Healed Lesion.*—These may embrace every physical sign of infiltration or consolidation (see Paragraphs 6, 10), with the exception of râles, which must be permanently absent, except possibly a few fine râles at the base, probably atelectatic in origin, and at one apex or over a small part of one lobe. Râles in the latter two places are to be heard only during the cough, at the end of a prolonged expiration, or during the inspiration which follows the cough.

Terms Used in Definition of "Improved"

16. *Constitutional Symptoms Lessened or Entirely Absent.*—By this is meant an improvement in the general condition as shown either by a gain in *both* weight and strength or by reduction of previous febrile temperature to normal without loss of strength.

Terms Used in Definition of "Unimproved or Progressive"

17. *Essential Symptoms and Signs.*—These include, among others, weight, strength, appetite, night sweats, hemoptysis, pleurisy, dyspnea, temperature, pulse rate, dulness, changes in vocal resonance and respiratory movement, râles.

Terms Used in Definition of "Apparently Cured"

18. *Ordinary Condition of Life.*—This term as used implies that the patient is able to live in an environment where he is able to support himself without the assistance of others, or to live in his former surroundings and pursue his former occupation.

Using the above classification we have recently compared the findings upon roentgen ray examination, classified according to type into peribronchial and parenchymatous and according to extent into 1, 2, 3, 4, the unit being one half of one lung field. In addition, such individual symptoms, physical signs and laboratory findings as would in themselves aid materially in diagnosis were likewise compared with the roentgen ray findings, with the following results, in a series of 235 cases, examined by the same examiner and of all of which stereoscopic plates were taken.

A. COMPARISON OF CLASSIFICATION BY PHYSICAL SIGNS WITH COMPARISON BY ROENTGEN RAY

1. A positive history of tuberculosis was obtained in 19 cases in which the physical signs were negative or doubtful. Of these, 16% gave negative or doubtful roentgen ray findings and 68% showed a definite peribronchial lesion. Parenchymatous lesions were found in 16%.

2. Of the incipient cases (78), negative roentgen ray findings were obtained in 9%, peribronchial evidence in 42% and parenchymatous evidence in 49%.

3. Of the moderately advanced and far advanced cases (120) 2% showed negative roentgen ray evidence, 8% showed peribronchial lesions and 90% showed parenchymatous lesions.

From this it is seen that in those cases having a history of tuberculosis with little or no physical signs a definite parenchymatous lesion can be demonstrated in over 10%, while the majority (50%+) will show evidence of the peribronchial type. The absence of physical signs, therefore, does not warrant a negative diagnosis or classification.

B. COMPARISON OF EXTENT AND LOCATION BY MEANS OF PHYSICAL SIGNS AND ROENTGEN RAY FINDINGS

1. The extent as determined by physical signs was the same as that determined by roentgen ray in 28% of cases.

2. The roentgen ray revealed a greater extent in 54%.

3. The physical signs showed greater extent in 18%.

4. Physical signs were present on one side or the other where the roentgen ray gave no evidence in 17%. [The physical signs in these cases were mostly found at the right apex and at the bases.]

5. In 6% the physical signs and roentgen ray evidence were on opposite sides. [In 5% the physical signs were on the right and the roentgen ray evidence on the left; and in 1% the reverse was found.]

From this comparison it is seen that the roentgen ray in the majority of cases reveals a more extensive lesion than is found by physical signs, and that in a fair percentage of cases (10%+) physical signs are present over regions where the roentgen ray shows no definite lesion. The comparison as to locality would also show that physical signs at the right apex are not always indicative of an existing lesion. This is particularly true in those cases in which the physical signs are not marked and in those cases in which râles can not be detected.

C. COMPARISON OF ROENTGEN RAY EVIDENCE AS REGARDS TYPE WITH THE OCCURRENCE OF DEFINITE AND CORROBORATIVE SYMPTOMS AND LABORATORY FINDINGS

1. Fever occurred at some time during the present illness in about the same percentage of cases of peribronchial and parenchymatous types (65%).

2. Pleurisy with effusion occurred in about the same percentage of peribronchial and parenchymatous types (8%).

3. Pleurisy without demonstrated effusion occurred in 48% of the peribronchial and 67% of the parenchymatous types [50% increase in the parenchymatous].

4. Streaked sputum [not accompanied by expectoration of ʒi or more of pure blood] occurred in 20% of the peribronchial and 25% of the parenchymatous cases [25% increase in the parenchymatous].

5. Hemoptysis of a teaspoonful or more occurred in 13% of the peribronchial and 42% of the parenchymatous cases [225% increase in the parenchymatous].

6. Fine râles were present in 17% of the peribronchial and 20% of the parenchymatous cases [19% increase in the parenchymatous].

7. Medium coarse râles were present in 3% of the peribronchial and 57% of the parenchymatous types [1800% increase in the parenchymatous].

8. In those cases having a peribronchial lesion on one side and a parenchymatous lesion on the other râles were present on the parenchymatous side in 62% and on the peribronchial side in 4% of the cases, while in 34% râles occurred on both sides [1450% increase on the parenchymatous side].

9. Tubercle bacilli in the sputum, found only before entrance to the sanatorium; this condition occurred in 8% of the peribronchial and 13% of the parenchymatous types [63% increase in the parenchymatous].

10. Tubercle bacilli found upon entrance to or during residence at the sanatorium: this occurred in 7% of the peribronchial and 65% of the parenchymatous types [828% increase in the parenchymatous].

11. Of the peribronchial cases included under number 10, one half showed Gaffky I with one or two bacilli found only once during residence. The other half showed Gaffky II or III found only once during residence.

12. The complement fixation test as done by Mr. Petroff showed a much higher percentage of positives in the parenchymatous than in the peribronchial types.

13. The intradermic skin test with O. T. gave a higher percentage of reactions to the weaker dilutions [0.00001 O.T. and under] in the parenchymatous types and a higher percentage of reactions to the stronger dilutions [0.001 O.T. and over] in the peribronchial types.

From this comparison it is seen that elevation of temperature without reference to character or degree gives no evidence as to the type of lesion to be found upon roentgen ray examination. This is also the case when pleurisy with effusion occurs.

However, when streaked sputum or hemoptysis occur, or when râles or tubercle bacilli are demonstrated, the type of lesion is more apt to be parenchymatous. This holds true to such degree as to warrant the classification into peribronchial and parenchymatous.

SUMMARY

The roentgen ray picture, properly taken, is of great value in the more exact classification of pulmonary tuberculosis. It will locate more definitely the seat of the lesion, often revealing one not detectable by physical signs, and failing to reveal one suspected by physical signs. The extent of the lesion is more accurately obtained by the roentgen ray than by any other available means and the character or type of lesion or pathology is much more correctly determined. Using the types peribronchial and parenchymatous as a basis for classification, it is seen that not all negative lung examinations made by physical signs denote an absent pathology, for in over 10% a definite parenchymatous lesion can be found whereas in over two-thirds of the above mentioned cases a peribronchial lesion can be detected.

The roentgen ray pictures would also show that not all incipient cases nor all moderately advanced cases have the same type of pathology; and what is more important in classification and prognosis than the type of pathology present?

The two types peribronchial and parenchymatous hold quite true to the clinical and laboratory findings, but the terms are not definite enough to signify extent and location; and in the case of parenchymatous the term does not signify sufficiently the characteristics of the lesion seen. It is very desirable that a more detailed classification should come into general use; one which would be practicable and not cumbersome and easy of interpretation. Your own president has been much interested in this subject and has offered a very good scheme for its accomplishment. To date no scheme has been adopted by the Sanatoria, and we would like to take the opportunity of presenting for your consideration a very incomplete but practical suggestion for classification by means of the roentgen ray. We would make use of the two terms peribronchial and parenchymatous and would denote extent and location in the following way. Any lesion not more extensive than the area of one interspace [15 to 20 sq. cm.] would be termed I, and any lesion greater than I but no greater than the upper ½ [root upward or 3d rib upward] of one lung field would be termed II. All lesions more extensive than II would be classified as III. The sides right and left to be indicated by the letters R and L. Thus upon complete classification we would have something like the following:

Incipient I R; Pb I R; a, or

Moderately Advanced II RL; Pc I R, Pb II RL; b, and so forth.

Of course this idea is offered merely as a suggestion in the hope that at some future date discussion may bring forth a workable and acceptable method of classification. This is sorely needed by all who practice in tuberculosis and especially needed to further the study of pulmonary tuberculosis about which we really know so little.

DISCUSSION ON PAPERS OF DRS. PANCOAST, HEISE AND CRANE.

DR. HENRY HULST, Grand Rapids, Michigan.—While I do not care to say anything now about the subjects treated by Drs. Pancoast and Heise because I did so a year ago in Chicago, I do wish to dwell for a moment upon the occurrence and the meaning of Dr. Crane's inverted comma.

I had almost forgotten about this sign, at least it had not entered my field of consciousness for a long time until Dr. Crane again called my attention to it a week ago when he came to Grand Rapids and asked me to get out my lung plates and look for the comma. We had not the time to look into this during his visit, but after he had gone I went over some one hundred and forty plates. I also looked over Dunham's Atlas. I found none in Dunham, though I am told there are several there, a fact of considerable psychological interest. In the one hundred and forty plates from my own collection I came across but one comma that was fairly prominent and not an illusion. Strange to say this occurred in an incipient case of tuberculosis in a young child, though Crane states that he has never found it in children.

Now I have no doubt that Crane's inverted comma is not an illusion. It must have an anatomical basis. The question remains, however, what can it mean? Accordingly, I consulted the third volume of Spalteholz's Hand Atlas of Human Anatomy. In Figs. 630 and 631 are illustrated the relations between septum mediastinale and pleuromediastinalis, the formation of the pleura pericardiaca and lamina mediastinalis. These viewed edgewise, when thickened and hardened from any cause, account, I think, for the inverted comma, especially if there happens to be involved a gland in the hilus. The left not being viewed edgewise but somewhat more laterally naturally does not show up so well or not at all. The presence of this sign, though not pathognomonic of tuberculosis, is evidence of disease and is well worth looking for.

DR. FREDERICK H. HEISE, Trudeau, N. Y.—After hearing Dr. Dunham's remark, I would like to say that, fundamentally, as Dr. Dunham knows, there is really no "disagreement in the family."

DR. FREDERICK H. HEISE, Trudeau, N. Y.—Dr. Dunham gave you, in a very lucid and detailed manner, the method of production of what we term the *peribronchial form* of tuberculosis. There is one thing, one fact, which is very evident to those who specialize in tuberculosis, and that is, that nodular shadows which are peribronchial in distribution are not all proven to be tuberculous.

DR. FREDERICK H. HEISE, Trudeau, N. Y.—In approximately 30 per cent of all cases sent to us we find peribronchial lesions, and we send back quite a few of those as not having clinical tuberculosis—that is, we cannot prove they have it. And we use the most up-to-date and comprehensive methods to prove that they have. In other words we keep a patient until, by all the means available to us, we fail to prove that he has active tuberculosis, before we send him away. Nevertheless, as Dr. Dunham has said he believes, there is a peribronchial form of lesion occurring in patients with symptoms which are almost undeniably symptoms of tuberculosis.

DR. FREDERICK H. HEISE, Trudeau, N. Y.—So there is no difference or argument, you might say, in the family. That brings out the point which I mentioned in my last paper and which I am so pleased to hear has been taken into consideration by this military report: that is, the fact that there must be coördination between the symptoms, the physical signs, and what we see on the *x*-ray plate. There must be coördination, for tuberculosis is a disease; and disease means something which alters the individual constitution in an unfavorable way. It makes the patient sick. On the other hand there are patients who have not been ill but who have, to my belief, evident tuberculosis, which cases, as Dr. Dunham and Dr. Cole rightly say, should not go into the Army.

However, it has been my experience recently—when examining (by both the stethoscope and the plate methods) men who have been at Plattsburg, and in a few instances men who have gone through seven months of intensive training or have seen service on the border—to find that they have definite parenchymatous lesions, apparently recent infections, down fully to the second or third rib on one or both sides. If I am correct, a certain proportion of the men showing this condition have been sent to the front. It would be interesting to know whether these men will eventually relapse when they have both the physical and mental strain of warfare.

COMPARISON BETWEEN CLINICAL AND ROENTGENOLOGICAL FINDINGS

IN the Section on Diseases of Children of the 68th Annual Meeting of the American Medical Association, Dr. Henry Dwight Chapin read a very timely and instructive paper on the above subject, the importance of which lay in the fact that the interdependence of the clinical and roentgenological methods of diagnosing pathological conditions in infants and young children is illustrated with peculiar emphasis in diseases of the chest.

Aside from the difficulty of keeping these little patients quiet during the exposures which might easily result in exaggerated heart shadows in any direction, Dwight Chapin enumerated a number of other instances where differences have been observed between the results of the two methods of examination, and the *Medical Record* for June 9, 1917, contains a summary of the author's paper from which we learn the following:

A comparison was made in fifteen cardiac cases between the roentgen ray findings and the result of physical examinations. Seven of the cases showed an agreement, one partly agreed, and seven failed to correspond in the conclusions reached by those two methods of examination. The interpreter of the roentgenograms considered that an early mitral lesion caused accentuation of the normal left auricular and pulmonic curves, producing a spherical or rounded appearance. It was difficult to distinguish by heart shadows mitral stenosis from insufficiency when either were present in only a moderate degree. In regard to the lungs the combined study of the physical signs and roentgen ray pictures was made in ninety-seven cases, with a substantial agreement in seventy-seven and disagreement in twenty of the cases. As examples of the latter, five gave roentgen ray evidence of lobar pneumonias that were not detected by physical signs; two gave physical signs of lobar pneumonias which were not confirmed by the roentgen ray; three showed physical signs of bronchopneumonia not exhibited by the roentgen ray. As a general rule it was found that the roentgen ray would often give a showing in the absence of physical signs in congestion, small consolidations, hilum infiltrations, intralobar pleurisy, miliary tuberculosis, and mediastinal tumors. The difficulty in diagnosing hilum infiltrations and enlarged nodes was very great, and here the roentgen ray was very helpful. A study of the transmission of voice sounds below the seventh cervical vertebra, known as d'Espine's sign, in connection with the roentgenograms made in eighteen cases of children gave the d'Espine sign from the second to the fourth dorsal vertebra. The comparison here made showed that d'Espine's sign had considerable diagnostic value in diseased conditions at the root of the lung. Another point emphasized was that in all cases central pneumonias were peripheral pneumonias and that all so-called central pneumonias started at the periphery of the lung.

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EDITORIALS

THE PRINCIPLES OF LOCALIZATION

It is a matter of medical history that one of the first uses to which the roentgen rays were put after the announcement of their discovery in December, 1895, was the localization of foreign bodies. The principles of localization which are being utilized today, in a great multiplicity of procedures bearing the names of the individuals who published them, are the same principles which were evolved and published within the first few years after Roentgen's original publication. For instance, the method of making two plates at right angles was employed in 1896 by Brissaud and Londe, in a case of a projectile in the head. In January, 1897, Mackenzie Davidson and Hedley began their publications on the "cross-thread" method which forms the basis for so many of the methods bearing more modern names. Remy and Contremoulins, in 1897, recognizing the elements of error in the methods then employed, published a description of their *compas*, an instrument of precision. In the same year Leduc published a description of the screen methods of localization. Some one has estimated the number of localization methods which have been published up to date as exceeding two hundred; yet it may be said of practically all of them that they fall into one of the classes of methods described in the beginnings of roentgen ray work. For these reasons it will be the policy of this journal to avoid as much as possible reference to names of individuals in describing methods, giving preference to such terms as "the cross-thread method," "the parallax method," etc.

One should not infer too quickly that the author of a so-called new method intentionally retreads ground gone over by his predecessors or by his *confrères*. It is not always easy for the roentgen ray worker in a military hospital, in his sometimes much isolated position, to keep in touch with the literature; and unless the editors watch carefully, slips will occur, and localization methods will be rediscovered and republished. There was recently a reference in these columns to a device of Dr. Young, for the utilization of the parallax method of localization. The editor is personally convinced from first-hand information and personal observation that the instrument described by Young entirely originated with him; yet investigation of the literature shows that the same method was previously described and the same instrument pictured in an article by Le Faguays (*Journal de Radiologie,* 1915, p. 711).

As a matter of fact, the natural tendency of any one with a mechanical turn of mind placed in a large hospital, and confronted with the necessity of rapid and reasonably accurate localization of foreign bodies, will be to devise short-cuts. Even the beginner in military roentgenology will be tempted to put his mind on working out some, entirely new to him, mechanical device for shortening the time and labor incident to localization operations. Our advice to all is that they shall familiarize themselves with as many as possible of the multitude of methods which have been born of the great war, which, although to us only in its first months, is well along in its fourth year. Before putting any time on a strange or new method suggested, it would be well to perfect one's self in the approved and accepted means.

There will shortly be published from the Surgeon General's Office, and we hope also in these columns, a digest of the localizing methods which have been accepted and approved as the preferred procedures for use in the United States Army Medical Service. It is only after a great deal of study and personal observation that we have been able to decide on a few methods as being standard. As our esteemed French *confrère* Ledoux-Lebard says, "We do not lack procedures; rather the opposite. Such a large number of methods of localization have been described since the war that we should be greatly embarrassed to make a fair selection between them if we had to acquire the necessary practice with each, because the days of our life would not be sufficient for the purpose. . . . Among the recent publications there are many old and well-known procedures which have been re-edited under a new name. These regrettable errors are largely committed by roentgenologists who have been improvised since the beginning of the war and who . . . honestly believe that they have 'discovered' something unknown in roentgenology. But they are to some extent excused by the extreme difficulties of a scattered and largely inaccessible bibliography."

J. T. C.

The *X*-Ray Diagnosis of Pulmonary Tuberculosis

In recent books and current periodicals will be noticed a strong tendency to discredit the *x*-ray diagnosis of pulmonary tuberculosis. This is deserving of attention because the authors in many instances are internists of unquestionable standing. Surprise and resentment are the first feelings of the roentgenologists. But this tendency is not without foundations.

Almost universally we find the assumption on the part of internists: (1) That the roentgenologist claims to present a complete exposé of pulmonary conditions and (2) that tuberculosis shows on the plate certain specific signs pathognomonic of the disease. They may be pardoned for this assumption because it is true that the roentgenologist is very likely to give, not an interpretation of *x*-ray findings, but a diagnosis of disease.

The same contest which we see between roentgenographic and physical methods was once waged between laboratory and physical methods. Indeed the smoke of battle is yet visible in the medical atmosphere. We may recognize and even admire the pride of craft which leads the skillful internist to guard with jealous care his diagnostic province, but we believe that this attitude is fundamentally wrong. The *x*-ray is a part of the physical examination, not a method to supplant it; it is an extension of our faculties of right, not a substitute for the auditory or the tactile sense; it is an analysis of different tissue densities, not a chemical reaction; and it records certain gross pathologic changes but does not seek to usurp the microscopic slide or the culture tube.

While the x-ray diagnosis of fractures and foreign bodies is final, the x-ray diagnosis of internal disease should rarely be attempted. Likewise a laboratory, a physical or a symptomatic diagnosis is rarely admissible. Occasionally brilliant feats of interpretation and intuition are achieved by the use of a single method just as a musical score has been executed upon a single string of a violin or a phenomenal run made by a one-armed billiard player. But x-ray diagnosis, even in such apparently clean-cut cases as renal stone, aneurism or osteosarcoma, demands a correlation of clinical data to avoid a repetition of the humiliating mistakes that are on record.

However, papers and discussions before this society have so often emphasized the interdependence of different lines of diagnostic data that it seems a matter of supererogation to elaborate upon this point. We would ask that writers recognize the attitude of representative roentgenologists towards the correlation of the case history, physical examination and laboratory analyses, with the x-ray findings.

With this attitude of mind we come to the question of x-ray findings in pulmonary tuberculosis. The roentgenologist and the internist are peculiarly alike. Neither is able to distinguish pathognomonically between the tuberculous and the non-tuberculous, to detect infallibly the first signs of incipient disease or to decide unequivocally between the active and the quiescent lesions. But given physical signs and we can demonstrate the exact extent of the pulmonary involvement; given a positive Wassermann and we can define the location of each luetic focus in the lungs; given the history of primary carcinoma and we can show the first signs of thoracic metastasis;—all with a precision unapproachable by clinical methods alone. The roentgen analysis is quantitative rather than qualitative and the roentgen map is accurate for boundaries but indefinite for specific names.

Are we yet to learn new signs, can we find new meanings in old signs or have we reached the limitations of plate and screen?

In the privacy of our own minds we may be as theoretical and hypothetical as we please. If we were to assume the same privilege in the editorial columns we might suggest a number of lines of research which, as is often the case with hypothetical suggestions, may be barren of results.

In the recognition of incipient tuberculosis and to distinguish between an active and a quiescent case, why should not the serial plate method be used? It obviously cannot be the rapid serial used in gastric and duodenal roentgenology. It must be more akin to the cinematographic serials of plants. If a growing flower can be made to expand before our eyes why cannot a progressive lung lesion be similarly demonstrated? The objections are the number of plates required and the length of time during which the patient is losing valuable ground. But in the case of pulmonary lesions it is solely the point of progression that is to be demonstrated. And a few plates only, possibly of circumscribed areas would suffice. As for the length of time required we must appreciate the fact that the methods of the internist in similar cases are essentially serial. He takes serial temperature and pulse records. He repeats for days, weeks or months his physical examinations. It is only in the well-marked case or in one where tubercle bacilli can be found in the sputum that he can reach a decision from a single interview. And yet the roentgenologist is expected to reach his decision from a single examination. As well make an instantaneous photograph of an automobile to determine whether or not it is moving as to make an instantaneous plate of the chest to show whether or not the lesion is progressive. To be sure clever inferences can be made in both cases.

We have, it is true, ignored the whole subject of specific signs which various authors describe as distinctive of the progressive lesion. The peribronchial inflammation, the smoke cloud, the fan and linear markings, the pleuritic effusion, the indefinite borders of a consolidation and the absence of calcified foci are unquestionably significant. These are all signs which are the exclusive property of the *x*-ray plate, excepting the pleuritic effusion, and the certainty with which pleuritic fluid, whether pocketed or free, can be located or excluded by the *x*-ray finds no parallel in other clinical methods. The sole advantage of the exploring needle, albeit a mighty one, is its portability, but the frequency of the dry-tap and the attitude of the patient towards repeated insertions of the needle, are indices of its disadvantages.

The valuable work of Dunham in conjunction with Miller on the architecture of the lung with special reference to the lymph channels is of fundamental importance to the interpretation of the chest plates. We have in the work of Pancoast, Childs and others a differentiation of pulmonary changes due to dust inhalation with inorganic deposits. The inverted comma sign is an example of a recurring shadow of definite form and position, yet to be fully understood. The studies of calcification processes in the human body have been shown to be matters of unexpected complexity and are of particular moment in pulmonary roentgenology. These are but few of the indications that pathology is being rewritten in terms of roentgenology.

For healed lesions we have a positive sign, a calcified focus without a nebula. But unfortunately a lung may show a healed lesion in one part and an active lesion in another. Calcified foci do not mean immunity and healed lesions may light up anew. A tuberculous deposit in a chest is like a mine with a fuse—we do not always know whether or not it is burning.

Another suggestion is that the hilus cluster of shadows should be carefully charted in hopes that definite figures will recur to which some significance may be attached. The inverted comma sign is a differentiation in this direction. The hilus cluster, the pulmonary pleiades, like a swarm of foci tangled in lymphatic braid, is at once the hope and despair of the roentgenologist. It is here that he must look for the first signs of pulmonary infection. The lymphatic system of the lungs and lower bronchi and the upper abdomen drain mostly into these nodes. Dust particles as well as bacteria find lodgment here. The normal hilus of age would be pathologic for youth. The pulmonary history of each individual is here permanently recorded. It remains for us to decipher the hieroglyphics.

Yet another suggestion is a refinement of team-work between the internist and his natural consultant, the roentgenologist. When in a stereoscopic set of plates one or more lines of increased density can be traced from hilus to periphery, the exact location of the chest-wall endings may be marked on the patient. At this particular point the internist should place his stethoscope and listen for the oscultatory signs of active lesions. Along this line of density may be transmitted delicate sounds from the interior of the lung and from the hilus.

However these things may be, we must learn new signs, we must find new meaning in old signs and we must have faith that the limitations of tube and screen are still beyond human ken.

A. W. C.

TRANSLATIONS & ABSTRACTS

[F]ISHBERG, MAURICE. Localized and Interlobar Pneumothorax Complicating Pulmonary Tuberculosis. (*Arch. Int. Med.*, November 15, 1917.)

Certain complications in active pulmonary tuberculosis often escape detection unless all diagnostic aids are applied. Latent, partial and interlobar forms of pneumothorax are frequent, but only rarely recognized. The differentiation between these and pulmonary cavities is of importance in prognosis. It was this class of localized and interlobar pneumothorax cases which gave the first impulse to treat certain phthisical patients by the induction of pneumothorax. The roentgen ray has made the difficulties in diagnosis less, but even now it is sometimes impossible to differentiate. Pneumothorax with complete collapse of the lung is usually easily recognized. Acute symptoms, such as pain in the chest and dyspnea, may sometimes indicate the diagnosis. Some cases of localized pneumothorax run an acute course and are rapidly fatal. Case 1 was of this class. The clinical findings and the roentgenogram both indicated localized pneumothorax. Some forms are latent and after a stormy onset, the patient may feel well and show improvement. Case 2 was of this sort. Although the physical findings were ambiguous, the diagnosis of a localized pneumothorax was made. The roentgenogram confirmed this. Case 3 was of a similar nature. Cases 4 and 5 simulated cavity very closely, but were diagnosed to be pneumothorax. Case 6 was a case of pulmonary cavity cited to show that the average case is easy of diagnosis with or without roentgenographic examination. At times the clinical and roentgen findings are at variance. Case 7 was a case in which the roentgenogram showed distinct signs of a localized pneumothorax. Clinical signs were in favor of a cavity. Necropsy confirmed the clinical findings. Case 8 was a similar case in which the clinical and roentgen findings were at variance. The clinical findings were proved correct by necropsy. These two cases illustrate the fact that while roentgenography is an indispensable aid in diagnosis and in differentiating pathologic changes in the thoracic viscera, yet it is apt to prove misleading. Cavitary cases may sometimes be demonstrated by a series of plates taken under various conditions. The changes due to accumulation and emptying of secretions may be of diagnostic importance.

Discussion.—Localized and interlobar pneumothorax cases are frequent and are often diagnosed as cases of pulmonary excavation. These cases are found much more often since the introduction of the roentgen ray as a diagnostic aid. The mode of onset is important. Sudden onset points toward pneumothorax. If the sudden appearance of pain in the chest is not found to be due to pleurisy or myocarditis, a thorough examination should be made. Differential points are: In localized pneumothorax the cavity is "dry." Large excavations usually show large, moist, consonating râles and gurgles. The breath sounds in pneumothorax are amphoric or metallic. In some cases of pneumothorax a metallic tinkle is heard; in cavities rarely. Auscultation of whispered voice sounds is of great importance. In cavities whispered pectoriloquy is frequently absent, while in pneumothorax it is commonly present and is strikingly pronounced. This is distinctly heard high in the axilla. Over cavities, as a rule, the percussion note is dull. In pneumothorax, tympany is more frequently elicited. Cracked-pot resonance and Wintrich's sign are more frequent in cavities. Retraction of the chest wall is characteristic of large cavities, while bulging may be found in localized pneumothorax. The location of the mediastinal organs gives no reliable clue as to the true lesion. The roentgenographic findings are invaluable in most doubtful cases. A bright circumscribed area lacking in lung markings, when not surrounded by a thick dark shadow, is pathognomonic of a localized pneumothorax. On the other hand, the walls of the pulmonary cavity may not cast a shadow on the roentgenogram. In such doubtful cases fluoroscopy may be of more value than roentgenography.

John B. Jackson

GAUVAIN, H. J. Heliotherapy and X-Rays in the Treatment of Surgical Tuberculosis. (*Lancet*, CXCII, April 28, 1917, p. 653.)

At a meeting of the Royal Society of Medicine, Section of Electrotherapeutics, which was held on April 20, Gauvain entered into considerable detail on the favorable effect of sunlight in surgical tuberculosis which acted not only on the superficial lesions but also indirectly on the constitution, thereby increasing the resistive power of the patient.

The second part of his paper was devoted to the indications for roentgen treatment under like conditions. The importance of careful technic and selection of suitable cases was emphasized under strict observance of Iselin's table of tolerance. The author summarized his observations as follows:

(1) Roentgen treatment is of great help in certain local conditions, and in conjunction with general improvement the local benefit derived is often maintained.

(2) The value and applicability of the rays vary in different parts of the body.

(3) Roentgen rays are useful in certain cases of sinus formation and in the treatment of many tuberculous ulcers, leaving supple non-keloidal scars.

(4) Roentgenotherapy is especially valuable in certain cases of tuberculous adenitis, but the greatest benefit may usually only be anticipated in conjunction with other methods of treatment: it is particularly useful where there is much periglandular infiltration, and here forms a useful treatment preliminary to extirpation or aspiration. The latter, with the use of modifying fluids, is preferable to extirpation under opportune conditions.

(5) Roentgen rays are most safely applied in the neck, elbow-joint and knee-joint.

(6) Roentgenotherapy s apparently helpful in certain cases of caseous abscess formation.

Contraind cations to the use of the roentgen rays in the treatment of surgical tuberculosis are summarized as follows:

(1) Roentgen treatment is unnecessary and undesirable in abscesses which can be easily aspirated, and they should not be used in abscesses which leak from an aspiration puncture resulting from faulty technic.

(2) The application of roentgen rays is dangerous in abdominal tuberculosis and apparently of little value in costal tuberculosis.

(3) There may be untoward effects as the result of careless technic or too frequent exposures.

In conclusion the author lays stress upon the fact that, while roentgen rays are of great assistance in specific lesions, other aids are often required and should be associated.

Gekler, W. A. Phthisis Pulmonalis and Other Forms of Intrathoracic Tuberculosis. (Abstract of paper read before the Chicago Roentgen Society, Jan. 12, 1917.)

The writer calls attention to the fact that tuberculous disease in the chest does not always manifest itself in the same manner. It is possible to differentiate roentgenographically as well as clinically between these different forms of tuberculosis.

The first form discussed was the primary tuberculosis of children, with the invariable regional gland involvement. The later forms of tuberculosis are practically always metastatic from a glandular focus. The lesion at the point of inoculation is usually slight in extent and shows a marked inclination to healing. The disease may remain latent in the glands, however, for a long period of time and metastasis take place following some injury, whether that be an intercurrent disease, overwork, dissipation, etc.

Phthisis pulmonalis is a bronchogenic metastasis, a true bronchial infarct. This disease is intra-alveolar, pneumonic in type, and as a rule has a bad prognosis, no matter how slight the earlier lesion may be. The first manifestation of phthisis pulmonalis may be quite severe and the patient have a great amount of involvement within a very short time after the pulmonary symptoms have manifested themselves. In other words, the disease does not always begin as "incipient," and then later become moderately advanced and far advanced. It may be far advanced from the very beginning. Extension takes place via the bronchi by aspiration of tuberculous material into unaffected parts of the lung. Phthisis pulmonalis may in rare instances be caused by a re-infection from without.

Another form of bronchogenic metastasis is pleural tuberculosis, in which the metastatic tubercle instead of rupturing into the bronchus, with the discharge of its contents to the outside, ruptures into the pleura with resulting pleural disease.

Miliary tuberculosis, whether it be general miliary or only partial miliary, with local manifestations in joints, bones, kidneys, etc., is a hematogenous metastasis which very often comes from a diseased bronchial gland. The result of such a miliary tuberculosis depends upon the number of organisms getting into the rculation, as well as the "resistance" of the idividual. When the lungs are also involved a general miliary tuberculosis the roentgenogram is the best diagnostic means we have at resent.

Still another form of tuberculous disease is ne which is rather uncommon and has a fair- good prognosis. This is caused by an extenion of the disease by continuity from the landular focus along the lymph channels. It s interstitial in type, running a slow course nd responding usually more readily to treatnent than phthisis pulmonalis. Roentgenoogically one fails to see the cloudy shadows of the tuberculous bronchopneumonia in this type of disease.

The author's paper was based on the roentgenographic study of 700 cases, with all forms of tuberculosis, and clinical observations on 3,000 such cases.

Lilienthal, Howard. The Relation of Roentgenography to the Diagnosis and Therapy of Non-Tuberculous Diseases of the Lungs and Pleura. (*Med. Red.*, Vol. 91, No. 14, April 7, 1917, p. 587.)

The more Dr. Lilienthal has made use of the roentgen ray in thoracic surgery, the more convinced he has become of its usefulness and indispensability, and in the present paper he proceeds to sketch in a brief though pointed way the advantages he has derived therefrom in a number of serious conditions. Thus, in purulent pleurisies he has but rarely been misled by the roentgen findings and he considers the latter so important that he examines the plates in every case of suspected empyema and advises against diagnostic puncture until the patient is actually on the operating table, when the puncture can at once be followed up by the operation.

Furthermore, the roentgenogram has saved him several times from opening through a sacculated empyema into the clean pleural cavity with the result of having to do only one operation instead of two and obviating a considerable risk to the patient. His present method of operating for empyema, which Dr. Lilienthal describes with some detail, is only possible with the aid of roentgenography. It enables him to localize the pus and, instead of resorting to the intercostal method, he resects two or more ribs, usually together with the periosteum and, opening the cavity, treats it as an abscess, first packing with gauze and later draining as necessity arises. This selective surgery, which replaces the blind thoracotomy, would be quite impossible without the guidance of the roentgenogram.

Lilienthal has on several occasions seen an encapsulated empyema mistaken for a general one by experienced diagnosticians, when the taking of the roentgenograms was responsible for the substitution of a small and comparatively harmless operation for a greater and more perilous one.

Aided by the roentgen ray, the author has on three occasions freely incised the dangerous area in front and adjacent to the anterior mediastinum next to the heart, when operating for secondary pus collections. According to the older methods, even with the physical signs present, the operation would have to be postponed until pus had been discovered by an exploratory puncture, running perhaps through healthy pleura or even through the lung.

The author also mentions the interesting fact that he has had seven patients suffering from a loathsome, non-tuberculous pulmonary suppuration, four of whom were completely cured by radical surgery. As he explains, this is a new field which could only have been opened up with the help of roentgenography. In conclusion the author calls attention to the importance of correct interpretation of the roentgenograms, describing the information obtained thereby as uncanny in its import and correctness.

Packard, Maurice. Primary Malignant Neoplasm of the Lung. (*Am. Jour. Med. Sciences*, Sept., 1917, p. 351.)

This paper deals with the diagnosis of primary neoplasms of the lung and more particularly with the differential diagnosis of the affection from other pathological conditions. So far as the employment of the roentgen rays is concerned, the author's experience may be summed up as follows:

The roentgen rays may be of little use in differentiating between aneurysm and cancer, although in the diagnosis of cancer pure and simple they are of great service. Echinococcus cyst of the lung may be differentiated from cancer by the complement fixation test, but roentgenography is of considerable value in differentiating between these two conditions.

Roentgenology has considerably furthered the diagnosis of tumors of the lung. It is of considerable value in determining the origin and mode of extension. The commonest form seen by roentgenographers occurs in the upper lobe, where they produce an intense uniform shadow. This shadow does not quite reach the apex and it may be difficult to distinguish it from other forms of infiltration. Other infiltrating growths may extend from either hilus into the lung field, often merging with the diaphragm. Here fluoroscopic examinations in various positions will often differentiate t ese shadows from pleural effusions and tuberculous nodes by the density and sharp contours.

Waters, C. A., Bayne-Jones, S., and Rowntree, L. G. Roentgenography of the Lungs. (*The Archives of Internal Medicine*, Vol. 19, No. 4, April, 1917, p. 538.)

This is a report on roentgen studies in living animals (dogs) after intratracheal injection of iodoform emulsion.

A method is described by which shadows cast by the air passages of the lungs may be unequivocally defined in roentgenograms. This method consists of injecting into the trachea a 10 per cent suspension of iodoform in olive oil, which renders the air passages opaque to the roentgen ray. The limit of a safe dose of this emulsion for dogs is found to be approximately 4 c.c. per kilogram of body weight. The plates are made by an instantaneous exposure by a soft vacuum tube placed above the animal (20 to 30 inches above the plate). As similar suspensions of iodoform in oil have been used in the local therapy of human pulmonary diseases, it is hoped that perfection of the method may ultimately permit its application to man. This preliminary study is the basis of the belief of the authors that by such a method it may become possible to define with precision many roentgen shadows which are at present largely data for speculation.

Weber, F. Parkes. Acquired Syphilis of the Lungs. (*Proc. Royal Soc. Med.*, Sec. of Med., Nov. 28, 1916.)

After describing six cases of chronic nontuberculous disease of the lung, three of which he regarded as syphilitic and three as probably of the same nature, Dr. Weber said that while he was physician to the Mount Vernon Hospital for Diseases of the Chest he practically never saw a case which he could regard as one of pulmonary syphilis, but recently he had met with several in which he believed that that diagnosis could be made with more or less probability. In one of these, that of a man, the nature of the lesion had been suggested by a patch of syphilitic leucoderma on the neck, an eruption very rare in men. Many writers on the subject had had the opportunity of making post-mortem examinations. The chief pathologico-anatomical features were: (1) gummatous formation, with a tendency to necrotic changes; and (2) more chronic, and often widely-spread, fibrotic changes, tending to become associated with bronchiectatic dilatations. In the cases now described he thought the changes were chiefly of the fibrotic order, though gummatous formation might also have occurred, especially in two of them.

According to T. Tanaka (Beitrag zur Kenntniss der Lungensyphilis beim Erwachsenen, zugleich über sogenannte muskuläre Lungencirrhose, *Virchow's Archiv*, Berlin, 1912, ccviii, 429) the histology of the pulmonary indurative changes of acquired syphilis was very similar to that of the so-called "white pneumonia" of congenital syphilis. The most characteristic features were endarteritis obliterans, together with peri-arteritis and endophlebitis. Mesarteritis also occurred, and in three cases Tanaka found a noteworthy increase of the unstriped muscle tissue, which he regarded as derived from the walls of the small bronchi, and which had till then never been described as connected with pulmonary syphilis. In regard to clinical diagnosis the question of there being an aortic aneurysm or mediastinal new growth might arise, especially if the left recurrent laryngeal nerve were paralyzed. But the clinical differentiation from tuberculosis was the chief difficulty, for in tertiary syphilitic diseases of the lungs there might be pyrexia, the so-called "tertiary syphilitic fever," such as not very rarely occurred in tertiary syphilitic ease of the liver, or a complicating fever, due associated bronchitic and bronchiectatic anges with purulent discharge. Moreover, re might also be (though less in frequency ad degree than in tuberculosis) night seats, emaciation, hemoptysis, and copious mucopurulent sputum. (In some cases of moptysis many spirochetes had, he beved, been found in the sputum, though doubtss not the spirochæta pallida of syphilis.) pulmonary syphilis, however, the lower arts of the lungs were generally chiefly involved, and the absence of tubercle bacilli in e sputum on frequently repeated examinaons, together with a history of past syphilis, vidence of tertiary syphilitic lesions elsewhere, nd a positive Wassermann reaction ought to urn one's attention in the right direction. In egard to pulmonary syphilis, one had to bear n mind the possible coexistence of syphilitic lcers or stenoses in the bronchial tubes, rachea, or larynx. Stengel (1903) pointed out hat one of the most suspicious symptoms was ntense dyspnea of more or less spasmodic type, with a tendency to stridor and cyanosis, all of these being indicative of obstruction in the larger air passages. In some cases the respiratory symptoms were altogether much more severe than the ordinary physical signs in the lungs would lead one to suppose. There might also be recurrent severe spasmodic attacks of coughing, accompanied by more or less copious mucopurulent expectoration. In some cases pleurisy and pleuritic effusion might be associated with pulmonary (gummatous) syphilis, as they probably were in one of his cases. The therapeutic test was always of some importance, especially when the patient was found to derive obvious benefit from the use of potassium iodide, a drug which sometimes aggravated the symptoms in pulmonary tuberculosis. Old cicatricial stenoses of the respiratory passages could not, of course, be removed by antisyphilitic treatment. It must always be remembered that pulmonary tuberculosis was not at all rare in syphilitic subjects, and, vice versa, that tuberculous patients not very rarely acquired syphilis. He did not think that the two diseases had much effect, either good or bad, one on the course of the other, unless one or both of them had been sufficiently severe to produce a condition of cachexia and to lower the resistance of the body towards disease. Pulmonary tuberculosis, as far as he could judge, was uninfluenced by the presence of an old quiescent syphilitic taint. Though by some an antagonism between the two diseases had been supposed to exist, it was more probable that syphilis predisposed to tuberculosis, in so far as it lowered the vitality of the organism; and it was not unlikely that syphilitic tissues, as had been maintained, constituted a specially favorable soil for the growth and multiplication within the body of tubercle bacilli. When the tuberculosis was active and the syphilis quiescent or obsolete, the former naturally dominated the whole clinical aspect and the prognosis, and the effect of energetic antisyphilitic treatment by mercury and potassium iodide was not unlikely to be a bad one. Though salvarsan and neo-salvarsan in moderate doses seemed to do no harm in ordinary cases of pulmonary tuberculosis, yet, as far as he knew, they did no good.

Eckford, W. H. Early Diagnosis of Pulmonary Tuberculosis by the Use of the *X*-Rayed Guinea Pig. (*J. Lab. & Clin. M.*, Vol. III, No. 3, December, 1917, p. 175.)

The chief objections to the inoculation method in the diagnosis of early or obscure pulmonary tuberculosis are that the positive virus requires a long time to develop in the inoculated animal, and that some animals have sufficient natural resistance to overcome a mild infection. For these reasons any means of effectively breaking an animal's resistance so that the length of time is decreased and the "take" made more certain is worthy of a thorough trial.

Murphy and Ellis showed that white mice were remarkably more susceptible to bovine tuberculosis after having been exposed to the roentgen ray than were normal animals. They offered as an explanation the destruction of the lymphoid tissue which they cited as an important factor in the defensive mechanism against tuberculosis. Morton, assuming that the guinea pig would be affected in a like manner, tried the roentgen ray on a series of inoculations. He reported that when animals were subjected to a massive dose of roentgen ray about the time of inoculation, they were so sensitized as to reduce the time of development of recognizable lesions to ten days. He intimated that repeated exposures might be more effective but were unnecessary. He found marked reductions in the leucocyte counts following the exposure.

Haythorn and Lacy, while carrying out some studies in the healing process of tuberculous lesions treated by the roentgen ray, noted the continued fall in the resistance and the rapid extension of the lesions under frequently repeated large doses of roentgen ray. Their findings confirmed the decrease in the total number of leucocytes after a large dose of roentgen ray, but they did not find the decrease in the lymphocytes as described by Murphy and Ellis. They suggested that the well-known inhibiting influence of roentgen ray on the glands of internal secretion might be in a measure responsible for the decreased resistance of the animal.

With the idea of working out a practical routine procedure for sensitizing guinea pigs in the rapid diagnosis of tuberculosis by means of the inoculation method a small group of animals, weighing as nearly 260 grams each as it was possible to get, were inoculated with a uniform dose of tubercle bacilli and given different doses of roentgen ray at varying intervals. The uniform dose of tubercle bacilli was obtained by adding a few loops of tubercle bacilli from a culture of human bacillus tuberculosis to normal salt and placing the mixture in a vaccine bottle containing glass beads and shaking them for one hour in an electric shaker. An equal amount of 20 per cent India ink in normal salt was added and one-half cubic centimeter of the suspension injected into both the groin and the peritoneal sac of each of the animals. As the whole group was inoculated from the same suspension, each animal received approximately the same dose of the tubercle bacilli. The dose of roentgen ray was given with a Coolidge tube. The current was 60,000 volts, spark gap six inches; filter one half millimeter of aluminum; target twelve inches; length of time five minutes. The animals were examined each day and the effects on general condition, time of appearance of nodules, progress of lesions, etc., were noted. Leucocyte and differential counts were made regularly.

The Singer Laboratory, Pittsburgh, has, since the use of the roentgen ray for the purpose of sensitizing animals was begun, the records of fifty-six animals that have been inoculated either with known tuberculous or suspected tuberculous material. In several instances material from a patient has been injected into two animals at the same time, one animal being subjected to roentgen ray while the other was not. In one such instance both animals showed lesions on the same day, but the rayed nodule outstripped the other in the rapidity of development. In another instance the roentgen ray was not used until several days after the inoculation, and no nodules had appeared at the time its use was begun. Doses were then given on alternate days and after the second exposure a nodule appeared and developed rapidly.

Throughout the work it was obvious that the rapidity of appearance and development of the nodules depended more on the size of the dose of tubercle bacilli than upon the amount of roentgen ray given.

Based largely upon the above findings the following routine method for using roentgen rayed guinea pigs in the early diagnosis of tuberculosis is recommended.

The material must first be prepared for injection. If it is sputum or is of a mucoid nature, it is subjected to fifteen minutes' digestion with 4 per cent potassium hydroxide after Petroff's method and is centrifuged and washed before injection. If it is of a fibrinous nature, it is digested in 15 per cent antiformin, the length of time depending upon the resistance of the material to digestion. If it is a clear fluid, it is merely centrifuged and the sediment taken. From one-half to one cubic centimeter of the prepared material is injected into both the groin and the abdomen of the animal, which is then exposed every second day to a five minute dose of roentgen ray for at least three exposures. If a nodule has appeared and is still present in two weeks, it is removed under a local anesthetic, smeared, and examined histologically. If positive, it is reported at once; if negative, the animal should be kept for at least six weeks so that in case a few bacilli are present in the cavity they may develop independently from the node in the groin. If the animal is negative and a thoroughly "rayed pig" at the end of six weeks the test may safely be called "negative."

Finzi, N. S. Skin Ink. (*Arch. Radiol. & Electroth.*, July, 1917.)

During extensive search for a means of marking skin localization in such a manner that the marks will be indelible and proof against rough treatment, the author made a number experiments which finally brought out the llowing formula:

Acid pyrogallic	1 gram
Acetone	10 c.c.
Liquor ferri perchlor. fort.	2 c.c.
Sp. vini meth..........ad	20 c.c.

This solution meets all the requirements emanded of such a substance.

1. It stains the skin such a color that it will ow up against iodine.

2. The mark is unaffected when rubbed with pirit, acetone, ether, soap or tincture of iodine.

3. The mark lasts when covered up with ressings, at least five days, and longer.

4. The mark is quickly and easily made, and loes not hurt the patient when placed on a part that is acutely inflamed and tender.

5. The substance used for the mark does not damage or inflame the skin.

6. It is possible to see the mark immediately it is made.

7. The materials are easily obtainable.

The solution is best kept in a bottle with a camel's-hair brush attached to the cork so that it can be easily painted on. The mark is brownish gray at first but after a few hours turns a brilliant black.

Cole, L. G., and Hoguet, J. P. A. A Complication of Gastric Ulcer. (*N. Y. Med. Jour.*, Vol. CV, No. 13, March 31, 1917, p. 588.)

An interesting case, illustrated by four excellent roentgenograms, is described by the authors which had variously been diagnosed as gastritis and appendicitis in previous treatments. The patient was an unmarried woman of 26, very constipated and anemic. She had lost about twenty pounds in the last year. There had been periodical attacks of pain between the shoulders and in the epigastrium, of vomiting and pain after eating. When referred to the authors, Dr. Cole's roentgenograms ruled out gastric carcinoma but disclosed a minute punctate ulcer, surrounded by a small indurated area, on the lesser curvature about four inches from the pylorus. Furthermore, there was definite evidence of a veil or membrane involving the cecum and ascending colon. Incompetency of the ileocecal valve was demonstrated, admitting as it did of moderate regurgitation.

Operation confirmed these findings and the pathological report showed chronic ulceration of the gastric mucosa with chronic inflammatory changes which were extensive in the deeper layers and less so in the dilated appendix.

About three months after the operation a barium clysma passed back to the cecum. Another three months later, the lesser curvature at the site of the ulcer was absolutely smooth and the only roentgenological evidence of the original complaint was a slightly altered depth in the peristalsis in this region.

The importance of the case lies in the fact that it illustrates a complication of gastric ulcer which the authors consider a clinical entity which has previously been more or less overlooked. In their opinion it may throw some light on intestinal toxemia and autointoxication, and possibly on the etiology of gastric and duodenal ulcers inasmuch as the ileocecal valve ceased to exist and the intestinal contents were consequently regurgitated into the small intestine.

Cunningham, William P. Dermatological Aspects of Chronic Intestinal Stasis. (*Am. Med.*, Vol. XII, No. 4, Ap., 1917, p. 225.)

Cunningham is a staunch advocate of the radical Lane therapy for chronic intestinal stasis. He not only subscribes to all the distinguished British surgeon says in holding stasis responsible for a vast number of direct and remote physical ills but suggests, with all the appearance of firm conviction, that most, if not all, skin eruptions—notably the intractable ones—are due to intestinal stasis. He details a large number of these complaints, including alopecia, and in a roundabout way traces them directly or indirectly to improper intestinal function. Consequently he assails the principle of external local medication, dilates upon the futility of internal medication in these cases, and wants to see the evil eradicated by the root—the intestines. He does not demand in precise terms a typical short-circuiting operation for every pimple in the face but he asks the question: "Is it possible that we should ever advise laparotomy for such a trivial thing as acne? Is acne such a trivial affliction?" And he furnishes the answer: "Many times, yes; many times, no."

In hyperidrosis he advises at least to resort to roentgenography to settle any doubt whether the intestines are at the bottom of the "cess-pool," and probably he would not object to this method being invoked before he decided to anastomose the ileum with the rectum in order to grow hair on a bald head. So there is hope for a fair expansion of the roentgenologist's occupation.

DIXON, GEORGE SLOAN. Roentgenography of the Eye and Orbit. (*New York State Jour. Med.*, Vol. XVII, No. 2, Feb., 1917, p. 67.)

In an article which once more calls attention to his apparatus for the location of foreign bodies in the eye, as last described by John E. Weeks in his textbook on "Diseases of the Eye," Dixon gives an interesting survey over the possibilities of foreign bodies entering the various parts of the eye. He strongly advocates a roentgen examination in every accident case in which the eye is involved, and believes it would astonish those not in the habit of employing this method of examination as routine to learn of the frequency with which foreign bodies are found where nearly every other diagnostic point is against it. In the author's experience the smallest particles of iron or steel, lead, copper or brass, in fact all metals except small pieces of aluminum, can easily be shown and there is no excuse for missing them. Stones and glass are also easily shown, but small or even moderately large pieces of wood can not be detected unless they happen to be painted. Lead and iron always yield strong shadows no matter how small they are, but glass throws a weak shadow, so that in a search for the latter substance the tube should be much lower than one used for iron. Calcareous degeneration of the crystalline lens and bone deposits in the choroid are clearly shown.

A single plate should never be wholly relied upon, as a defect in the plate might simulate a foreign body which would not appear on a second plate. Again, certain objects might cast a shadow in one direction and not in another. Failure to find a wound of entrance is no proof that the globe does not harbor a foreign body. Siderosis should not be overlooked as a possible evidence of the presence of a particle of iron.

The statements of patients can not always be relied upon, although they should be taken into consideration. Thus, cataract in a young individual may be found to be due to a foreign body, while the patient may be wholly unconscious of any accident responsible for its presence.

Failure to secure a shadow is no proof of absence. On the other hand, an object of fair intensity and good form may be simulated on the plate, while the picture may be only the shadow of iron rust. Other possibilities of failure to visualize foreign bodies are explained, including non-observance of the necessity of fixing the vision during exposure.

The author explains that in his long experience at the New York Eye and Ear Infirmary and other practice he has not been able to show intraocular tumors by means of the roentgen ray, while a fair idea of the size and location of orbital tumors can be obtained.

In summing up, the author feels sure that if the ophthalmic surgeon would obtain the best results, it is imperative for him to have recourse to the roentgen ray in the majority of cases, and that with better technic it may perhaps soon be possible to obtain information involving the optic foramina which is now largely conjectural.

DAVEY, WHEELER P. The Effect of X-Rays on the Length of Life of Tribolium Confusum. (*Jour. Exp. Zool.*, Vol. 22, No. 3, April 5, 1917, p. 573.)

Numerous experiments have led the author to formulate the following summary of his observations.

1. It has been shown that the lethal effect noticed on tribolium confusum beetles after being subjected to the roentgen rays is really due to the latter and not to some accidental circumstance.

2. A method has been developed which eliminates the error due to idiosyncrasy, thus making it possible to obtain biophysical data of a considerable degree of precision.

3. It has been shown that the lethal effect of the roentgen rays on tribolium confusum bears a definite mathematical relation to the logarithm of the total roentgen dose.

4. An extension of the psychophysic law gives a theoretical explanation of the experimental data, if the resistance rather than the susceptibility of the organism to the rays is considered.

The author promises to take up in a later paper the effects produced by changes in voltage.

Frank, Robert T. Palliative Treatment of Inoperable Carcinoma of the Cervix by Means of Radium. (*Jour. Cancer Research*, Vol. II, No. 1, Jan., 1917, p. 85.)

Frank has found from practical experience in the Gynecological Section of the Mount Sinai Hospital, New York, that radium is the best palliative measure in inoperable carcinoma of the cervix and that far advanced cases may be so treated, with the result that not only pains, hemorrhages and discharges are rapidly relieved, but that the general health and condition are indirectly improved. Borderline or operable cases should be submitted to operation after a short preliminary application of radium and subjected to a similar treatment after operation for prophylactic purposes. The author advises preliminary irradiation extending over a period of three weeks, giving exposures of about, 2,000, 1,200 and 800 milligram hours each, followed within two or three days by hysterectomy. Earlier operation is inadvisable for bacteriological reasons. Four weeks after operation at least three radium treatments at four weeks' interval should be given.

Brass or lead is interposed to filter away the soft alpha and beta rays and produce in their stead soft secondary rays which are as destructive to the tissues as the soft primary rays but are readily absorbed by Para rubber, gauze or paper.

The application is made according to the site and size of the growth and the dimensions of the vagina. The radium tubes employed contained 83, 20, 17 and 10 mg, respectively, and the application was made as follows:

For 47 mg the naked tubes were placed in a hollow lead cup, attached to a handle. The opening was covered with a lid of brass 1 to 1.5 mm thick and fastened with a layer of adhesive plaster. The cup was enclosed in a small bag or rubber 1 mm thick.

For large cauliflower growths the 83 mg tube was enclosed in a brass capsule 1.5 mm thick. If the anterior wall is infiltrated and the recto-vaginal septum unaffected, one side of the carrier may be additionally screened by 4 to 8 thicknesses of lead foil inside the rubber filter. Similarly, the rectum may be protected from unnecessary irradiation.

In craterlike carcinoma and extending up into the cervix and involving the parametria, the long central tube was advanced 1 to 2 cm and introduced into the cervix, the three smaller tubes radiating at the same time the vaginal portion and fornices. Unless the carrier is introduced into the cervical canal, a layer of gauze, about 0.5 cm thick, is interposed. The carrier, fastened to the handle, is pushed firmly against the gauze, and the vaginal walls are separated as far as possible from the radium by tight packing with gauze. Patients who suffer pain are given liberal injections of morphine.

An application of 120 mg for 24 hours—which is about the extreme limit of time—gave the large dosage of 2,880 milligram hours, but a considerable part is absorbed by the 1.5 mm of brass or 0.5 mm of lead, the 1 to 3 mm of rubber and the gauze. The frequency of application depends upon individual conditions, but the author has found the following method the most satisfactory. The further advanced the growth, the larger the initial dose; the second treatment to follow 7 to 10 days later and the third, 14 days after the second treatment. With improvement apparent, the next two treatments are given at intervals of three weeks in diminishing dosage. For the first series 5,000 to 6,000 milligram hours are sufficient, and thereafter one treatment each month for two or more months completes the primary treatment.

The author further describes the results of the histological examinations, illustrated by excellent microphotographs. The first cellular changes are noted about ten days after the initial treatment. Rapid surface disintegration set in after three weeks. The maximum depth of the effect of 120 mg of radium upon cancer tissue was 1 to 1.5 cm even after 4 or 5 prolonged exposures. Larger quantities may perhaps exert much deeper effects in the author's opinion, but the optimum amount is generally agreed to be from 50 to 100 mg.

One of the removed uteri was cut in interrupted serial sections, and in only two minute areas were spots discovered suggestive of degenerative carcinoma cells.

In view of these facts the author is led to conclude that some additional local factor must exert a favorable effect. This, in the case of cervical carcinoma, is probably supplied by the large quantity of connective tissue (parametria) which radiates from the cervix and under the influence of the rays contracts, hardens and perhaps proliferates. As a result, the lymphatics and smaller blood-vessels are permanently blocked and the dense scar produces a condition of "starvation" of the growth. The author does not discuss the question of permanent cures, but confines his conclusions to palliative effects as actually observed.

The histories of ten cases are appended.

Shorten, J. A. and Barnard, T. W. The Suppression of Inverse Current in the Discharges from the Secondary Terminals of Induction Coils. (*Arch. Radio. and Electro.*, August, 1917, p. 65.)

The authors, who are roentgenologists to the Colaba War Hospital in Bombay, occupy a space of no less than seventeen pages of text and illustrations in attempting to describe their efforts to eliminate the inverse current trouble and incidentally simplify the use of the Coolidge tube. But in the end the method only tends to create confusion—a contingency it is always wise to avoid. It is devoid of practical value. J. S. S.

Pais, A. The Influence of Roentgen Rays on Malaria. (*Gazz. d. Osp.*, Milano, October 21, 1917. XVIII, No. 84, p. 1121.)

The author believes that the course of malaria can be essentially modified by roentgen treatment. If the treatment is administered early and in doses sufficiently small, it will induce a mild course, whereas large doses may change the cycle of the fever. The author's theory is that a new generation of parasites show increased virulence under the influence of roentgen ray treatment. Cases of chronic malaria which have been obstinate under ordinary treatment with quinine make an uncomplicated recovery under roentgen ray treatment, and the spleen is reduced to its normal size.

Gray, A. L. Roentgen Ray Diagnosis of Pyloric Stenosis. (*Va. Med. Semi-Monthly*, April 13, 1917, p. 9.)

The technic adopted by the author in the diagnosis of pyloric stenosis in infants is as nearly as possible as follows:

Administer the opaque material in warm mother's milk, if practicable; if not, in a modified milk corresponding to the age of the child. Avoid overdistention. Observe on the screen or plate the appearance of the stomach immediately following the ingestion of the meal; note carefully whether there are excessive peristaltic movements within the first half hour. Continue the examinations at intervals of one-half to one hour for the first four hours and again, if necessary, in six hours, note the progress and amount of opaque material in the small intestine. By a careful comparison of these factors with the normal, a fairly accurate conclusion may be reached.

Perhaps the most characteristic sign of pyloric stenosis is an unavailing hyperperistalsis. This, however, does not continue indefinitely, but the stomach appears to tire from its unusual effort, and a condition of rest resembling atonicity ensues. After the rest, the attempts at expulsion are repeated. Overdistention will materially impede gastric motility and will correspondingly prolong the normal emptying time. Not more than two-thirds to three-fourths of the estimated normal stomach capacity should be given, and proper allowance made therefor.

Pylorospasm and atonic gastric dilatation are liable to be mistaken roentgenographically for pyloric stenosis. In pylorospasm, the obstruction may be complete while it lasts, but there is apt to be an early escape of a small amount from the stomach before the spasm completely shuts off the passage, and if the observation extends over a considerable time, the spasm will relax, and a comparatively large amount is apt to be extruded at each ejection before the pyloric sphincter again abnormally blocks the passage. The administration of an anti-spasmodic, such as belladonna, or its alkaloid, atropine, will perhaps definitely deterine between spasm and a permanent condi-on. The entire absence of peristalsis for a rolonged period, with perhaps a slight leakage om the pylorus, would indicate atonic dilata-on, and would be determined only by frequent bservation at short intervals.

In borderline cases, where the stenosis is ncomplete, there will probably be present nore or less hyperperistalsis with an extrusion t short intervals of a relatively greatly dimin-shed amount of the stomach contents.

All things considered, the author does not hink a roentgenological diagnosis of pyloric tenosis a very difficult matter, and it should lways be resorted to in appropriate cases, as t is perhaps the only possible method of deter-nining with accuracy the condition in its par-tially developed state.

Holland, C. Thurston. Roentgen Examination of Dysentery. (*Ann. Trop. Med. and Parasit.*, Vol. X, No. 4. Ref. *Lancet*, Vol. CXCII, March 10, 1917, p. 380.)

The first article in this number of the *Annals* is a report on the roentgen examination of dysentery and other cases by Captain Holland who followed in his investigations the method of Glasson, as described in his paper on the localization of dysenteric ulcers by the roentgen ray including the administration of large doses of bismuth subnitrate for at least six days beforehand. The results, however, showed nothing which might not equally well have been seen on plates taken under similar circumstances from non-dysenteric individuals. As the author observes, "bismuth does not adhere to the raw surface of a gastric ulcer, and the diagnosis can not be made from this point of view." This statement he follows up with the question: "Why then should bismuth adhere to ulcers in the lower bowel?"

Hirsch, Seth I. Roentgen Diagnosis of Bone Tumors. (*American Journal of Electrotherapeutics and Radiology*, Vol. XXXV, No. 3, March, 1917, p. 113.)

This is a very interesting series of well illustrated articles relating to bone tumors and a credit to any journal. The work is didactic and very helpful. A little carelessness is noted in placing the cuts, two of them in the March issue being upside down, but these little criticisms are as nothing compared to the worth of the article. We take this opportunity of complimenting the *American Journal of Electrotherapeutics and Radiology* on its broadened field. It is printed on larger pages and better paper, and the roentgenological aspects of the paper are in every way creditable.

Hewer, E. E. The Direct and Indirect Effect of Roentgen Rays on the Thymus Gland and Reproductive Organs of White Rats. (*Jour. Physiol.*, Vol. L, No. 5, May, 1916. Ref. *Lancet*, Jan. 20, 1917, p. 111.)

As both thymus and reproductive organs are affected by roentgen rays, it was expected that irradiation of one organ might bring some light to the question of its relation to the other organ. Only a few of the author's results can be quoted. Direct irradiation of the thymus does not determine the appearance of Hassall's corpuscles unless the glands are simultaneously treated. Irradiation of the thymus only causes slight degeneration of the male gonads and delay of sexual maturity, but no alteration in the female. As to irradiation of the male gonads, degeneration occurs and the affected cells are set free in the lumen of the tubules by desquamation. Regeneration is possible, depending on the age of the animal and the total dose of roentgen rays. If the spermatogonia are all destroyed, no regeneration can occur. Hassall's corpuscles always appear, but disappear in time. Excessive vascularization of the suprarenal and hypertrophy of the islands of Langerhans sometimes occur. A very weak total dose accelerates sexual development. Irradiation of female gonads shows that young ova are more resistant than older, while the corpora lutea become abnormally vascular and the hypertrophy of the interstitial gland is constant and persists even after apparent regeneration of the ovary.

BOOK REVIEWS

Birth Fractures and Epiphyseal Dislocations. By Edward D. Truesdell, M.D., Assistant Attending Surgeon and Roentgenologist at The Lying-In Hospital; Associate Surgeon at the St. Mary's Free Hospital for Children, New York. Large octavo of 128 pages with 143 illustrations. Price $4.00. Paul B. Hoeber, New York, Publisher, 1917.

In the foreword the author calls attention to the meagerness of the information on the subject available in student text books. In many cases the information is misleading and creates the impression that dislocation of the epiphyses is more common than fracture of the shafts of the long bones, and that fracture, when it does occur, is of the green-stick variety. In the series studied no green-stick fracture has been observed. All fractures have been found not only to be complete, but have been associated with considerable displacement of the fragments. Evidence of dislocation of the cartilaginous epiphyses has been rarely obtained, even when the method of proving its existence has been understood and applied. Several years' experience with many cases has proved that the roentgen examination of the pregnant woman and the new-born child may be made without detrimental consequences. The cases reported were found in a series of over thirty-three thousand deliveries.

In this series, fractures of the vault of the skull have been less frequent than fractures of the humerus, clavicle or femur. The deepest asphyxia, stupor, circulatory disturbances and respiratory irregularities may all be present in the new-born, following violent and protracted labor; and a roentgen examination of the head may reveal the absence of bone injury. Four cases of fissure fracture of the cranial bones have been observed in the new-born child, one with, and three without, displacement of the fragments. In the first two cases, attention was called to the injury by a subperiosteal hæmatoma. No signs of intracranial injury were present and recovery was uncomplicated. The third case also developed a hæmatoma and had no signs of intracranial injury, other than for a very brief period. Case 4, a fissure fracture of the vault, was accompanied by a depression of the fragment. There was present large hæmatoma which delayed the propose operation for the elevation of the depresse fragment. After the first few days, there was spontaneous improvement in the depressio of the fragment, so that operation was aban doned. Eight months later, roentgen examina tion showed that evidences of the birth fractur of the skull had been almost entirely oblite ated. The author then shows the roentge plates of these cases. The serial plates tracin the process of healing are especially instructiv

The humerus is the bone most frequentl broken during delivery. Not even the clavicle i so liable to fracture. On account of the fac that fractures of the clavicle are more likel to pass unnoticed, the relative frequency of th two injuries cannot be given with precisior During this investigation thirty-nine fracture of the humerus were observed in thirty-seve infants. Fractures in infants still-born, or dyin shortly after delivery, have not been include in this series. Operative or forcible deliver has been the cause of the majority o these fractures. Twenty-four were produce during breech extraction following versior and six occurred during breech extractions i cases of breech presentation. Seven were attrib uted to difficulty with the arms at the pelvi outlet in vertex presentations; while in two in stances the cause of the fracture was never as certained. The site of the fracture has invari ably been at or near the center of the shaft The line of fracture was transverse in all case but one. This was probably due to the fac that the force producing the fracture was usu ally applied directly to the center of the hu meral shaft and at right angles to it. In one in stance, the line of fracture was somewha oblique, an element of torsion entering into it production.

Birth fracture of the humerus is accompa nied by some degree of deformity in al most all cases. Two types of deformity in the transverse plane were observed in the roent genograms. The more common was the sharp outward angulation of the fragments of the broken bone; the second (infrequent) was a lateral displacement without angula tion, with the fragments parallel but sep arated. The angular deformities were sc excessive in some instances as to be almost sensational. Often the unsatisfactory condition of the fragments was not suspected until seen in the roentgenogram. When lateral views were made, it was found that while displacement in the anteroposterior plane was less common than in the transverse, it did occur. An anterior angular deformity was found in some cases. Rotation of the lower fragments outward was also seen when the treatment of the broken bone had been neglected or was inadequately carried out. Over-riding of the fragments was unusual as compared with fractures of the femur, but was considerable in one case. Accompanying every case of birth fracture of the humerus, there has been observed some degree of musculospiral nerve paralysis, indicated by a distinct wrist drop. In cases dissected at autopsy there was no gross lesion of the nerve. The paralysis must be of traumatic origin, due either to the violence producing the fracture, or to bruising of the nerve by the ragged bone ends. The duration of the wrist-drop may be short, disappearing entirely in the first week, or it may persist for six or even eight weeks. In no case has it failed to clear up. An Erb's paralysis of the same arm has been associated with a fracture of the humerus in three cases. This is a more serious injury than the fracture. In the treatment of birth fractures of the humerus, it has been found that the simplest method is the best. These fractures are put up without splints of any sort, the arm being bandaged to the chest wall. The arm is roentgenographed through the dressing to learn the position of the fragments, and the dressing adjusted as necessary. If but a single roentgen observation can be made during the treatment of these fractures, this will be found of the greatest service at the end of the two weeks. At this time it is possible to correct deformities when noted. Deformity after firm union is not of such importance in cases of birth fracture of the humerus as in cases of fracture of the femur. Three-quarters of all cases of fracture of the humerus have shown some deformity at the end of the first month. In a few cases the external angular deformity has been excessive. These cases of residual deformity have been roentgenographed at intervals until the deformities have disappeared. The serial roentgenograms have shown in every case a progressive elimination of the deformity. Nature has been able to restore the bone to a condition that compares favorably with the uninjured humerus. Nature's ability to accomplish this is remarkable.

Between twenty-five and thirty cases of birth fracture of the clavicle have been observed. Because they have not presented so much of interest, they have not been followed so closely. The majority have been produced by more or less difficult breech extraction. The site of the fracture has been regularly near the center of the bone, the line of fracture nearly transverse. In no case has a so-called green-stick fracture been observed. These conditions of fractures of the humerus and clavicles are thoroughly demonstrated by reproductions of roentgenograms. The serial plates of birth fracture of the humerus are a most excellent demonstration of the marvelous ability of nature to restore the deformed bone to the normal condition.

During a period of six years, only thirteen cases of birth fracture of the femur have come under observation. Eight of these were incidental to breech delivery. Three were produced while extracting the child through the uterine incision during Cæsarian section. One was produced by a midwife who swung the new-born child by its leg to induce respiration. In one case, the cause of the fracture was undetermined. The site of the fracture in all cases was near or somewhat above the center of the shaft. In six cases, the line was transverse, in six oblique. One case was roentgenographed too late to show the line of fracture. The most constant deformity was an anterior angulation. There was also often present an external angulation with more or less over-riding of the fragments. Deformities uncorrected have been found to persist long after deformities of corresponding degree, and corrected, have disappeared in cases of birth fracture of the humerus. The anterior angulation is entirely overlooked if lateral views are omitted. The disinclination on the part of nature to compensate for deficiencies of treatment throws added responsibility upon the surgeon. The treatment presents many difficulties. Too much care cannot be devoted to the correction of the anterior displacement. A box splint has been evolved which provides flexion of the thigh, abduction of the leg, such traction as may be required, and the prevention of rotation. The opportunity for cleanliness is provided, and transportation of the infant is easily brought about. A large series of roentgenograms is presented, showing a most careful study of these fractures. Serial plates showing success and failure with different types of splints are especially valuable.

Dislocations of the epiphyses are more often suspected than proven to exist in the newborn. The opportunity for operative confirmation of these injuries is rare, while autopsies performed on infants still-born do not customarily include an examination of the extremities. Nor does the roentgen examination offer such direct assistance in the diagnosis of these conditions as might be hoped for, since those of the cartilaginous epiphyses, lacking a nucleus of bone within their substance at birth, do not reveal their whereabouts with precision in the roentgenogram. This nucleus is regularly present in the femoral epiphysis and is frequently present in the upper humeral epiphysis. One case of dislocation of the lower femoral epiphysis has been discovered. This was a case of breech extraction in which difficulty was had in delivering the aftercoming head. Roentgen observations, made up to the end of the seventh month, demonstrated that nature had largely restored the injured member to normal. Diagnosis of backward dislocation of the lower humeral epiphysis cannot be made earlier than the end of the first week of life. Four cases of such dislocation have been observed. These all occurred in cases of breech extraction where the arms were extended above the after-coming head. There was considerable difficulty in early roentgen diagnosis. However, by the twelfth day, roentgen confirmation of the injury should be obtainable. The roentgen diagnosis of birth dislocation of the upper humeral epiphysis was definitely made in one case. The plates reproduced show the roentgen evidence of dislocation of the lower femoral epiphysis. Serial plates show nature's repair of the injury by the formation of a new lower femoral shaft and the absorption of the old shaft. Several plates of dislocation of the lower humeral epiphysis are also shown.

The book is printed on a high quality of paper and the prints made from the roentgen plates are excellent. The volume does credit to the publisher as well as to the author. J. B. J.

Fractures of the Lower Extremity or Base of the Radius. By Lewis Stephen Pilcher, A.M., M.D., LL.D. Consulting Surgeon Bushwick, German, Jewish, St. John's and Bethany Deaconess Hospitals, Norwegian Deaconess Home and Hospital, New York Skin and Cancer Hospital, Editor of the *Annals of Surgery.* 132 illustrations. Published by J. B. Lippincott & Co., Philadelphia.

This short essay by Pilcher appears to be more the autobiographical sketch of his interest in this common wrist injury than a serious attempt to clarify and instruct. The major portion of this small book is taken up by a detailed description of certain dissecting room experiments. When one reads down to the last few pages and finds so little upon diagnosis and treatment and practically nothing upon prognosis, there is naturally some disappointment, although there is some consolation to the roentgenologist when he finds Pilcher acknowledging that "the final authority as to the character and extent of the injury is the *x*-ray, and resort to it should be made whenever practical both to confirm and correct the diagnosis and later to demonstrate the degree to which proper reposition of the fragments has been secured."

There is some fault to be found with the author's assertion that he "has rarely felt any need of such (general) anesthesia in dealing with a recent fracture of the wrist." Quite to the contrary; if inquiry is made in the cases which show bad results, it will generally be found that no anesthetic was administered to permit a proper manipulation.

It is to be regretted that the author has not undertaken to include more information upon the interpretation of the many roentgenograms which he displays with regard to diagnosis and prognosis. However, both surgeons and roentgenologists will find this volume worth while. It has a distinct value in giving us the opinions of its distinguished author on the old Colles' fracture of our student days.

E. H. S.

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PYELOSCOPY

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PYELOSCOPY is but a preliminary to pyelography, but adds, we believe, distinctly to the comfort of the patient, as well as the safety, and to the accuracy of the entire procedure.

When one reads that most excellent book on pyelography, by Braasch, he is first impressed with the fact that the author is an artist and a genius; and then he awakes to the realization that for a few dollars he has procured a monumental wealth of information and illustration. One also receives a less comforting impression, viz., that the interpretation of the pyelogram is indeed a difficult and intricate matter.

Happily, the roentgenologist is not concerned with the tedious clinical and cystoscopic studies necessary to the proper selection of cases for pyelographic study. He needs but observe the frequent difficulty with which the cystoscopist succeeds in passing the catheters, and the suffering on the part of the patient, to realize that he has by far the easier, though no less important, part of the task; for if the roentgen ray technique is at fault, then all other effort and suffering have been for naught.

Ideal conditions for such studies are rare even in our largest hospitals; that is, the cystoscopic room is at some distance from the roentgen ray room, so that the cystoscopic table can rarely be used as the radiographic table. On the other hand, the radiographic table is not at all adapted to cystoscopy, consequently the patient has to be taken from one room to another with the catheters *in situ*. We believe that the greatest disadvantage in this arrangement occurs when the catheter cannot be inserted more than a few centimeters into the ureter, for then to remove the cystoscope means almost inevitably that the catheter will also be removed from the ureter, while moving the patient with the cystoscope inserted causes continued discomfort and does not insure the retention of the catheter in the ureter in all instances. The removal of the patient from one room to another with the catheter alone inserted adds very little to his troubles. It is common practice to do this in making certain kidney function tests. To make this change with the cystoscope inserted and carefully held is almost inconsiderable as compared to the discomfort of the previous manipulation.

Since we are not, as a rule, fortunately located with special cystoscopic table and roentgen ray apparatus in the same room, let us consider to what extent we can approach the ideal by moving the patient, after catheterization, to the roentgen ray laboratory. It is essential, for the present purpose, to assume that in any hospital where pyelography is a practicable procedure, pyeloscopy also is possible, or at any rate, should be.

Fig. 1.

The horizontal fluoroscope is the place, then, to which the patient is taken from the cystoscopic room. This apparatus must be equipped with a roentgen ray tube which will permit of more or less rapid change of resistance to the high tension current and will withstand heavy discharge currents, such as the Coolidge tube, or the air-cooled hydrogen regulating tube. The latter is the tube which was used in our earlier studies, but more recently a moderately fine focus Coolidge tube has replaced this. The fluorescent screen should be very sensitive and free from lag. In short, it is the sort of combination with which we are making fluoroscopic and radiographic examinations of the gastro-intestinal tract. We do not resort to ordinary illumination of the screen with from one to three milliamperes of current at six or seven inch tube resistance, but instead use from ten to twenty, or even thirty, milliamperes with the tube resistance at from three to four inch spark gap resistance. It is by no means necessary to have the screen constantly illuminated in this manner for one to have perfect control of the process. Then, too, the eye is more sensitive to delicate shadows if the screen is alternately light and dark. The patient gets far less exposure than is given the average gastro-intestinal case, and because of the fact that there is less scattered radiation from rays of low than from those of high penetration, the operator is not assuming any unusual risk.

The tube control must be such that one can change promptly from fluoroscopic to roentgenographic adjustment, since much of the differential information is obtained in the roentgenographic records of various degrees of distention, amd these change more or less rapidly up to the point of complete distention. Our rheostat, controlling the filament current, is mounted on a brace attached to the side of the tube box, so that it is immediately accessible. The high tension current is under control by means of a foot-switch with three points of contact, each point having a definite value with relation to the rheostat of the main transformer. The roentgenogram is made with the aid of the intensifying screen and therefore requires but short exposure. The loaded cassette is placed on the abdomen and held in position by the weight of the fluorescent screen. For pyeloscopy then, we use a modern fluoroscopic table and modern tube outfit. Opaque catheters should be used, but are not essential. The opaque fluid should be injected by gravity at as slow pressure as possible. But, regardless of the kind of catheter used or the method of injection, one meets with all sorts of perversities which lead to disappointment when not checked up by means of the fluoroscope.

When the catheter is opaque, it is very clearly seen on the screen, revealing at nce the line of the ureter and the extent o which the catheter is inserted. After he injection of from one to two c.c. of he opaque solution, one sees the relation f the catheter end to the pelvis or calyces nd can withdraw it to the desired point the solution being temporarily stopped. If the pelvic shadow appears normal on the screen the process is discontinued; but if doubt exists, the injection may be continued cautiously until some definite shape appears, or the size of the shapeless shadow

Fig. 2.

if it is inserted too far. The tip of the catheter should not be higher than the ureteropelvic junction, for the kidney moves downward perceptibly in many cases during inspiration or straining, while the catheter remains more or less stationary, and thus the pelvic lining may be injured. Occasionally the solution does not flow until after the catheter has been withdrawn slightly. The transparent catheter does not of itself cast a shadow but can be seen when its lumen is filled with the opaque solution.

Once the pelvis is located the tube containing the solution can be lowered so that there will be a very slow-filling process, which causes much less pain than a rapid filling with the same degree of distention. As soon as the pelvic shadow assumes shape, an intensifying screen with plate is placed under the fluorescent screen and an instantaneous exposure made through a small diaphragm opening, the flow of becomes so large as to indicate gross pathology, and then another exposure is made. The normal kidney pelvis is readily recognized before it becomes over-distended. One must always respect the patient's sensations, but it frequently happens that pain will be complained of when the pelvis is not distended. On the other hand, we have slides to show that in one case the opaque solution passed into the tubules of the kidney to a great extent without the patient having complained of pain. In this instance, however, the fluorescent screen was not used. Serious damage might have been caused by this over-distention. (Fig. 1.)

The solution sometimes regurgitates so rapidly along the catheter that alarming amounts are necessary to distend the pelvis. This, too, one can recognize on the screen, and adjust the flow to compensate. When both kidneys are being injected it is very important that the filling process

Fig. 3.

of the two sides be controlled independently, the flow being checked in one while it is progressing less rapidly in the other, or while some difficulty is being overcome. When there is no contraindication to immediate removal of the catheter, the catheter may be gradually withdrawn so that the ureter may be distended throughout its length. (Fig. 2.)

When a stone shadow is clearly seen on the roentgenogram, is found to be in the kidney area, is associated with renal colic, or with pain and blood in the urine, and further, if the stone shadow be of irregular outline conforming to the shape of some portion of the kidney pelvis or calyx, then the diagnosis is reasonably positive as to the presence of stone in some portion of the kidney. But this is by no means as complete a diagnosis as is possible, unless the stones be of such size or number as to demand the removal of the entire kidney without question. (Fig. 3.)

It is seldom that the entire outline of the kidney is shown on the roentgenogram. The lower pole, however, frequently casts a distinguishable shadow, so that the kidney area is not always clearly defined, especially on the right side. Occasionally a kidney stone may be round or nearly so, and also occasionally a single gall-stone, which is usually round, may be phosphatic and therefore cast a dense shadow. In the case shown in Fig. 4, the symptoms and signs, even to the presence of albumen and blood in the urine, were referable to the right kidney. The surgeon was so impressed with the clinical picture, and was so lacking in confidence in our opinion that the stone was too high for the kidney and was in the gall-bladder, that he operated for the removal of a kidney stone. Having exposed the kidney, thoroughly explored it and failed to find the stone, he made a small incision in the peritoneum posteriorly, palpated the gall-bladder, felt the stone and then removed it through an incision anteriorly, after closing the wound on the back. Neither pyeloscopy nor pyelography were practiced in this case; or in other words, the differential diagnosis was incomplete.

Then, there are many cases in which the clinical diagnosis is of a positive character but the roentgenogram fails to reveal

Fig. 4.

stone shadow in any portion of the uriary tract. In some of these the symptoms lue to the passage of minute particles of and enmeshed with cell detritus, leukoytes, red blood cells, etc., making a mass of sufficient size and firmness to actually block and scratch the ureter. When such a mass reaches the bladder it will readily pass through the urethra and be called a stone or fragment of a stone. If this is allowed to become dry, it will retain its shape, have a rough, gritty and pitted surface, but a very low specific gravity. When first passed, and before it becomes dry, such a mass may be spread out between the thumb and forefinger, and the sense of touch may reveal roughness due to minute calcareous particles. The roentgenogram will not record such a foreign body, and in fact, neither pyeloscopy nor pyelography will be of assistance unless the ureter be completely blocked, or the kidney pelvis be dilated from repeated attacks of ureteral obstruction.

Fig. 5 shows the presence of three small dense shadows falling within the outline of the lower pole of the right kidney. These shadows have been cast by three calculi in the kidney, as proven finally by operation. But, in what portion of the kidney are they? They are small and might be difficult to find. To what extent must the kidney be damaged in their removal? This depends on their location and the necessary route of operation. The kidney outline is of abnormal size. Does this indicate an otherwise diseased kidney demanding nephrectomy? These are the questions in this case to be answered by pyeloscopy and pyelography.

Fig. 6.

Fig. 5.

Fig. 6 shows an opaque ureteral catheter projecting far above the level of the stone shadows, so far that one would suspect it of being at the apex of the upper calyx. This is the first important observation on the fluoroscope. The catheter seems to be high enough to injure the kidney, if the patient should take a long breath; for the catheter does not move up and down

Fig. 7.

the tip of the catheter without indicating the presence of a true pelvis, but upon resuming the injection we found that the ureter bifurcated and that there were really two pelves. Fig. 8 was made at this point and demonstrates the further very important fact that, except for the presence of the three stones, the pelves and calyces are entirely normal. We now have, in addition to the positive diagnosis, the exact location, definite indication for surgical procedure, an explanation of the abnormal size, and a favorable prognosis.

Fig. 9 represents an unusual point in differential diagnosis—a mass presented in the right upper abdomen. It had about the size, shape and firmness of a kidney. Many of the symptoms were related to the kidney, especially pain and tenderness in the loin. With one hand on the abdomen and the other on the back the mass could be felt by both hands and it was rather freely movable. A definite shadow ap-

with the kidney during respiration, and the tip of the catheter is not very soft. Both the outline of this kidney and the stones could be clearly seen on the fluoroscope. Before any opaque solution was injected the cystoscopist was asked to withdraw the catheter until its tip was seen to be at or near the ureteropelvic junction. Then with a small amount of the solution injected it was found that the outline of the stone shadows became obscured, and, further, that new shadows appeared to a considerable distance above the stones. It was also noted that the stone shadows moved with the opaque fluid shadow during respiration. Fig. 7 was made at this point. The detail apparent here indicates that a small amount of the opaque solution not only surrounds the stones but that there is a more delicate line of shadow connecting these, permitting the conclusion that the stones are in the lower calyx. The ureter seemed to continue upward from

Fig. 8.

peared on the roentgenogram, with a shape similar to that of the lower pole of a kidney, but perhaps more dense. During the pyeloscopic examination the mass could be felt and its shadow could be seen on the screen, so that with an opaque solution in the renal pelvis visualizing the kidney it was possible to observe the mobility of the mass in question and also that of the kidney pelvis. The kidney could not be displaced by palpation, whereas the mass could be moved more or less freely. It was clearly on a plane anterior to that of the kidney; also it moved toward the median line to such an extent that the outermost point of the kidney calyces appeared beyond the mass. The last mentioned observation is clearly demonstrated. At operation a pendulous and greatly distended gall-bladder was found.

FIG. 9.

FIG. 10.

This briefly is the course pursued in every case that is suitable for pyelographic study. The procedure is especially interesting in studying the pelvic condition of movable kidney, for one can observe not only the extent of motion but the manner of it as well. It is entirely practicable to manipulate the kidney much as one manipulates the stomach or colon under fluoro-

FIG. 11.

FIG. 12.

FIG. 14.

FIG. 13.

FIG. 15.

copic observation. In this way it is possible to determine whether or not the kidney rotates and the extent and manner of its rotation. Fig. 10 shows a rotated kidney. Figs. 11 and 12 demonstrate two positions of a hydronephrotic kidney with a duplicated pelvis.

When the kidney pelvis is partly destroyed by infection it is important to avoid complete filling for obvious reasons. With the aid of the fluoroscope one is able to control the degree of distention, when it is clear that the pelvis and calyces are not normal in shape or size. This is particularly true in the case of pyonephrosis. Fig. 13 is of a pyonephrotic kidney. Note incomplete filling of cavity in the upper pole of the kidney.

Figs. 14 and 15 illustrate two stages in the injection of a pyonephrotic kidney having two stones in the pelvis. The pus cavities are incompletely distended with thorium solution.

Pyeloscopy is not entirely satisfactory if the patient is very stout, but even then it serves to control the position of the catheter when it is opaque to the rays, and to show whether the solution is actually going into the kidney pelvis or regurgitating into the bladder.

The roentgenographic record is, of course, more valuable in determining the finer points of pelvic diagnosis, and when made after the above-described technique is quite as reliable as when it is made with the plate on the back after the usual manner.

Since by means of the fluoroscope one has control of pelvic over-distention there is no reason why the whole operation should not be performed under general anæsthesia.

THE MEDICOLEGAL STATUS OF THE ROENTGENOLOGIST*

BY ALBERT SOILAND, M.D.

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LOS ANGELES, CAL.

ONE of the most annoying and at the same time important situations confronting the roentgenologist today is the constantly increasing demand made upon him to attend court. You all know that it is no uncommon occurrence to have thrust upon us three or four legal summons during the week to appear at court and testify as to certain injuries, or to verify the authenticity of our plates. Our present laws are so enacted that any legal luminary can, over the most trifling conceivable case, compel us to attend court by the hour or day usually at the munificent fee of $2.00. It matters little to the average lawyer handling such a case whether you are losing $100.00 or more per day, whether you are interrupted in the pursuit of your studies, or are intercepted in the supervision of a vital case which needs your immediate and personal attention.

Only last week no less than three subpœnas were served upon me in one day, two in person, and one with a check for $2.00 attached, handed in to the office attendant in the reception room. Had the attorney who prepared the summons in this latter instance been considerate enough to acquaint me with the status of the case, much annoyance and ill feeling would easily have been spared. As it was, this particular case had been roentgenographed by an assistant at the bedside with portable apparatus. This assistant had in the interval gone east and joined the army. The trial was set for ten o'clock in the Superior

*Read at the December Meeting of the Pacific Coast Roentgen Ray Society, Los Angeles, December 15, 1917.

Court in the morning following the summons. Prior to this hour, I made many efforts to get into communication with the attorney, but was unable to locate him. It therefore became necesssary for me to appear in court at the stated hour in order to escape being fined for contempt. On this particular day, I was engaged in making serial examinations upon two gastro-intestinal cases. One of these patients, quite ill, had been sent in from a distant city, and had been prepared for examination at the hour I was due in court. As this was an individual who could not well be passed to an assistant for diagnosis, I was compelled to keep him over another day in order to make a proper study of his condition. This was not only detrimental to the patient's comfort, but added materially to his expense, and as acute obstruction was found to exist, postponed by twenty-four hours a necessary operation, the delay of which might at any moment have cost the patient his life. To make matters more exasperating, upon arrival at court on the morning in question, the elusive lawyer greeted me with a smile and calmly informed me that the case had been adjourned until the following morning.

I have taken the liberty to cite this extreme case at length to illustrate one of the many unreasonable situations which we as roentgenologists have to endure. I do not mean to infer that all attorneys are as thoughtless or illogical as one might surmise from the example related. I have many friends among our leading judiciary, and am usually treated with both courtesy and consideration.

The large majority of court cases for which we are subpœnaed are the damage suits instituted and founded largely upon the roentgen appearance of certain fractures, dislocations, and injuries to bones and joints. These are the numerous petty and pesky cases wherein you have seen the patient once only for a roentgen examination. It is usually an epoch of the past, and you have forgotten all the circumstances. The event is suddenly called to mind by a subpœna accompanied by $2.00 cash for your appearance in court. You are assured that it is merely for the purpose of identifying your plates, that it will take only five minutes of your time, and that your testimony will be very much appreciated, and so forth. If this was all true, we could perhaps forgive many lawyers and support them in their stern efforts to separate from the soulless corporation, insurance company, or luckless individual a certain amount of filthy lucre to be cleverly divided between themselves and their clients. Unfortunately, however, when they get you on the stand, the five minutes are usually transformed into hours, and not only are you asked to give expert testimony for the original $2.00, but very frequently the lawyer expects to win his case entirely upon your evidence. Under these circumstances, a reasonable fee commensurate with the value of your evidence is not only proper, but its demand should be recognized legally. Even the occasional fee of $25.00 or $50.00 for one appearance does not as a rule intrinsically recompense one for time lost from routine work or private practice. Many of the Superior Court judges in our own city recognize the importance of competent roentgenologic interpretation in the trials and show a disposition to encourage our efforts. In only one instance, and that was quite recent, did a Superior Court judge refuse to allow me to interpret one of my own plates, which had already been admitted as evidence in his court. I mention this in passing as it is the only time during fifteen years of more or less court experience that any such autocratic discourtesy has been shown me.

In regard to the legal status of the roentgen plate, I believe that this belongs primarily to the roentgenologist, that the latter is obliged, if requested, to furnish a print, a copy, or a written report. If an opinion is desired as to prognosis or treatment, then, in my opinion, the roentgenologist becomes a consultant and is privileged to exact a professional charge consistent with the exigencies of the case in hand.

The power to administer justice vested in our judiciary by the people and for the benefit of the people miscarries when it causes, as in many of these suits, a greater loss of time or money than the damage claimed. This is lack of vision on the part of the law. The purpose of this plea is to seek a remedy, and I trust that at this meeting a sufficient impression will be made upon our members so that proper steps may be taken to modify these unjust medicolegal demands.

OPAQUE ROENTGEN RAY MEALS AND ENEMAS

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OPAQUE ROENTGEN RAY MEALS

THE USE of the bismuth salts in the food to outline the various viscera dates from the experiments of Cannon (6) at Harvard in 1896. His aim, when beginning the experiments, was to establish the fact that the esophagus had peristaltic movements. In these experiments he fed bismuth-filled capsules to a goose and later fed cats on bismuth-impregnated meat and bread and milk. In 1899 Williams and Cannon in America gave large doses of bismuth subnitrate with food to human beings and made screen observations and plates of the alimentary tract. Five years later Rieder published his famous paper. Bismuth subnitrate was used for this work, but on account of its toxicity by deterioration in the gastro-intestinal tract, it has been almost wholly superseded by the subcarbonate and oxychlorid of bismuth and barium sulphate. Of these, barium sulphate is now the salt almost exclusively used on account of its cheapness.

Bismuth subcarbonate, the second salt to be used, is good but expensive. Jordan (2) advocates this salt, claiming that it (1) neutralizes any hyperacidity, thus decreasing pylorospasm and allowing better filling of the duodenal cap, and (2) does not decrease peristalsis. His meal is bismuth subcarbonate 4 oz., sugar of milk ½ oz. and enough water to make an emulsion that is not too thick—the whole being less than a tumblerful. He uses slightly larger amounts in proportion to the size of the patients. The values he attributes to the sugar of milk are: (1) it assists in making a satisfactory emulsion; (2) it increases the bulk of the meal; (3) it makes the meal pleasant and (4) is slightly laxative, thus overcoming the constipating effect of the bismuth and preventing caking in the colon. This bismuth subcarbonate mixture is expelled from the stomach more rapidly than the oxychlorid and barium sulphate mixtures, hence a six-hour residue means considerable delay at the pylorus. Jordan believes that the six-hour residue has no diagnostic significance, hence he feels that this is no drawback to his meal.

Bismuth oxychlorid is lighter than the subcarbonate, hence more easily held in suspension; it is not alkaline, hence does not interfere with peristalsis.

Barium sulphate is the salt most universally used in this country. Its greatest advantage is its cheapness. It must be used in slightly larger amounts than either of the preceding salts. One must be sure that the barium supplied is that prepared especially for roentgen ray work, as the commercial variety may contain soluble barium salts which are toxic. In this paper, whereever a formula is given for a bismuth meal, barium sulphate may be substituted by increasing the amount of barium about one fourth.

The menstruums used for carrying the bismuth or barium are many and varied, each author using from one to three, but each recommending his particular pet. A few of them are: farina porridge; cream of wheat; wheat hearts; corn meal mush; bread and milk; cornstarch pap; mashed potatoes; mucilage of acacia; malted milk; buttermilk; fermented or clotted milk, known under various trade names as kefir, lactose, yogurt, fermolac, brolactly, koumiss; sweet milk; sugar of milk emulsions; potato-starch pap: spinach; rice; meat; chicken soup; and so forth.

Carman (7) gives the following requirements for a good barium meal. It should be (1) more or less palatable; (2) thick enough to hold the salts in suspension; (3) thin ~~enough to~~ fill all recesses; (4) not stimulative of gastric secretion; (6) not productive of early pyloric closure; (7) not lumpy, that is, an even smooth emulsion; (8) of definite composition; and (9) easily and quickly prepared.

The meals of gruel, cream of wheat and such, when mixed with the bismuth or barium, are often too gritty and are very flat. They are usually flavored with some fruit syrup or milk (not cream, as the fat here inhibits digestion and lengthens the emptying time) and sugar. Jordan's sugar of milk emulsion is said to be very palatable. The various starch mixtures are fairly good, as the boiling they receive usually converts part of the starch to sugar. The acacia mixtures usually require some flavoring. The fermented and buttermilk mixtures are very good. Pfahler (9) of Philadelphia in 1906 made tests with milk, mucilage of acacia, pure and dilute, and kefir. A definite amount of bismuth was placed in each of four test tubes, the tubes filled with the above mixtures and the whole thoroughly shaken. In one hour the bismuth had sedimented completely in the milk and diluted mucilage of acacia, and had nearly sedimented in the pure mucilage but was well suspended in the kefir mixture sixteen hours later. Satterlee and Le Wald (1) repeated and confirmed Pfahler's experiments finding, however, that the second best menstruum was thick chicken soup.

These experiments proved conclusively that fermented milk was by far the best medium for holding the opaque salt in suspension. It conforms to all of Carman's requirements and is the one most used in the United States to-day.

It seems that every man has his pet meal and his own method of preparing and giving the same. I will here give you a few of the formulæ, as some of them may have to be substituted for the usual meal. Let me here warn you not to expect the same results as some other man, unless you follow his technique exactly.

George (24) gives the following as the original and standard Reider meal: 40 gms. of bismuth subnitrate, or subcarbonate, in 300 c.c. of cooked gruel. Carman gives the following directions for preparing the cornstarch pap. Nine ounces of cornstarch dissolved in 14 ounces of cold water is poured into 6 quarts of boiling water. Forty-five ounces of barium sulphate is stirred into a thin paste with 20 ounces of hot water, allowed to boil for three or four minutes, and is then added to the starch pap. The whole mixture is stirred well and allowed to boil for five minutes slowly. After cooling, one-half ounce of vanilla extract is added. Syrup of raspberry in larger quantity, or other flavoring, can be used as desired. The mixture will keep well on ice for two or three days. On standing a scum may collect and this must be removed. The customary portion for each patient is twelve ounces of the mixture, which contains about three ounces of barium.

Potato-starch pap is prepared in much the same way. The following is given as a good palatable meal: barium sulphate 3 to 5 oz., agar-agar 1 to 2 oz., sugar 1½ oz., cocoa 1 oz., water 17 oz., all to be boiled up together. Cream of wheat, wheat hearts, etc., are prepared by cooking until a rather thick paste results. The barium or bismuth is added after cooking. The fermented milk can usually be purchased already prepared or can be made by adding the lactic acid bacilli tablets to whole milk. Ordinary buttermilk is often used, but care must be taken that there are no chunks of butter in it as they will interfere with the proper emptying of the stomach. The main objection to ordinary buttermilk is that too much of the fat has been removed, hence it does not hold the barium in suspension as well as the fermented milk.

Most of the American roentgenologists use the six hour or double meal as outlined by Haudek. This is carried out by giving a barium meal in the morning and examining the patient six hours later to determine the amount of residue left in the stomach. The second meal given six hours after the preliminary meal is usually divided into two or three glasses. The first contains 4 to 6 oz. of water with $\frac{1}{2}$ to 2 oz. of barium. This passes through the pylorus easily and quickly fills the duodenum. It also quickly outlines the gastric contour showing all irregularities, as it will run into the various pockets very easily. The next two glasses, containing each 8 oz. of fermented milk, potato pap and so forth, with from 1 to 3 oz. of barium to the glass, are given quickly to completely fill the stomach and allow of a more accurate study of its size, location, irregularities, peristalsis, and so forth. Case (8) recommends giving the barium during the regular breakfast as this will give a better idea of the retention with the usual food, but most men use some regular mixture for this preliminary meal. Case advises that if a special meal is to be used, farina mush gives a more accurate idea of the retention than do the more liquid meals. Jordan (4) advises doubling the amount of bismuth if it is desirable to study the terminal ileum and, in cases of duodenal obstruction, thickening the emulsion with corn meal.

Various unique methods have been advanced for special purposes and while of no great value are of interest as showing the inventiveness of some roentgenologists. I will outline two of them. Swartz's capsules as described by Pfahler (9) are made of goldbeater's skin and contain bismuth and pepsin. These are placed in various solutions of hydrochloric acid and then in the incubator. The length of time required to digest the membrane and release the bismuth is noted. He then has the patient swallow similar capsules and notes, in front of the fluoroscope, the length of time required to release the bismuth in the stomach. By this method he determines the amount of HCl in the stomach. Carman describes Kaestle's capsules which are of two kinds — sinking and swimming — both being filled with bismuth. By the use of these he can show the point of the lower border of the stomach and also the amount of retained secretion or, if the patient is allowed to chew but not swallow appetizing food, they will show the amount of secretion poured out. Another value is that they will show the amount of non-opaque fluid in the stomach above the level of the opaque meal, that is, how much of the magenblase is fluid and how much air.

There is quite a divergence of opinion as to the preliminary preparation of the patient. Many men recommend preliminary catharsis with no breakfast. Others, and I believe the majority, advise no preparation at all except the omission of breakfast on the morning of the examination. Smithies (21) goes much too far in his preparation it seems to me. He washes the stomach and gives a purgative the day before the examination and then keeps his patient on a liquid diet for from eight to twelve hours. Purgatives and stomach washings always disarrange the usual functional activities, whether they be normal or pathological, and cause the patient annoyance. They always make the patient more or less nervous, and may give false findings.

The use of drugs during the examination is sometimes indicated, especially if there is an incisura in the stomach. Some antispasmodic can be given and, if the phenomenon is due to a reflex, it will disappear, but if due to ulcer, it will be unaffected. Belladonna is the drug most used. The tincture may be given to tolerance and then the examination repeated, or the patient may be given one one-hundredth grain of atropine hypodermatically at the time of the examination.

It will be found for practical purposes that the amount of barium in the opaque meals will have to vary with the size of the individual to be examined. For instance, it would be foolish to give the same amount of barium to a child as to an adult. Also, smaller amounts are required for thin persons than for those with large fat abdomens. After a time you will size up the patient quickly, and will be able to judge the amount necessary to give a good working shadow. For the adult, you will have a standard formula and will increase or decrease this as the patient varies from the average. The usual proportion is three heaping tablespoonsful of barium to the pint of fermented milk or buttermilk and you will add or subtract, depending on the size and build of the patient.

Now, just a few points of warning: (1) Always see that you have a smooth even mixture free from lump; (2) gauge the opaque salt by the size of the abdomen of the individual to be examined; (3) have your patients drink the mixture rapidly, as in taking it in sips, they are liable to carry down air, and you will have what looks like a small stomach, or a very large magenblase; (4) remember, to increase the amount of barium in a mixture, if you are making it according to a formula which calls for bismuth.

Esophageal Examination

The same problems had to be solved in finding the opaque media which would outline the esophagus, as in the case of the stomach, with the additional difficulty that food was rapidly emptied from this organ into the stomach.

From the historical viewpoint, the esophagus is the first of the organs to be studied during life by means of opaque salts given to the living animal. The study of the peristalsis of the esophagus was what started Cannon on his investigation, and the study of the bismuth-filled stomach came as a later and secondary subject.

Many methods have been used to determine the size, peristalsis and patency of the esophagus. The giving of bismuth-filled capsules, or wafers, is recommended by Lange (12) and Pfahler (9), but the consensus of opinion is that they act as foreign bodies and may cause cardiospasm, or remain in the healthy normal esophagus for many minutes. The capsule method of examination has hence fallen into disrepute.

A unique method of getting the esophagus on roentgenograms has been marked out by Bassler (22) and is also described by Niles (18). He uses a four-foot length of 4 mm. rubber tubing, to which is attached a small silk covered rubber bag, which has at its lower end a brass tip. In the upper part of the tube is a stopcock. The patient swallows the bag and tube until the bag is in the stomach. The bag is then filled with water and the stopcock turned off. The bag is now pulled firmly into the cardiac end of the stomach, thus closing the cardia completely. Now, with a catheter passed into the pharynx, or the esophagus, a mixture of barium, acacia, and water is poured into the esophagus until the barium mixture runs out of the patient's mouth. Pictures are then taken and the stopcock opened, allowing the tube to empty and the barium to run into the stomach.

Various media, similar to those used in the examination of the stomach, have been used in this work, as bread and milk, kumis, starch pap, corn meal, apple sauce, cream of wheat, potatoes, etc. Dr. Rush, a recent graduate of this school, following Prince, I believe, recommends grated pineapple as a menstruum, as it makes a thick paste and is agreeable to the patient.

The meal for an esophageal examination most used today is that outlined by Hirsh (20) and recommended by Plummer (17) as holding the barium in good suspension, adhering well to the esophageal wall, being easily washed out and quickly and easily prepared. Hirsh's original formula was a heaping tablespoonful of bismuth subnitrate, or subcarbonate, to one teaspoonful of mucilage of acacia, stirred for about ten minutes, until a syrupy fluid results. Carman (19) uses four parts of barium sulphate to one of freshly prepared mucilage of acacia instead of the bismuth mixture. When made properly, it is about the consistency of cold molasses, and must be fed to the patient from a spoon. This mixture will adhere closely to the whole esophageal wall, but will outline any irregularity in the wall especially well, as the normal mucous membrane quickly throws it off, leaving the ulcerations standing out in clear relief. This meal should be taken in small amounts, at frequent intervals, as this method gives the best idea of function.

In order to obtain the best view of the cardiac portion of the esophagus, the stomach should be distended with gas, thus raising the left lobe of the liver out of the way.

If a diverticulum is shown by the acacia meal, the pocket or pouch is best filled by using some one of the stomach test meals, as they are more quickly and easily taken.

OPAQUE ENEMAS

The treatment of the bowel, preparatory to giving the opaque enema, still varies considerably. Many men give a thorough purgation the night before the examination, with enemas on the morning of the examination. Others condemn any form of preparation, claiming that it will interfere with the usual function and relations of the colon, and that it really increases, rather than diminishes, the amount of gas in the colon. Violent purgation always leaves the musculature of the colon more or less weakened, which fact makes it impossible to study the deviations from the normal as they occurred before the medication. Personally, I have followed Case's (8) technique. He advises no laxatives, but, at least two hours before the examination, three small enemas of warm salt solution are given at fifteen minute intervals. These cleanse the bowel as well as high enemas could, and if any of the salt solution is left in the colon, it will be absorbed by the time of the examination.

Carman outlines the following requirements of any opaque enema: It shall be (1) non-irritating to the bowels, (2) large enough to fill the whole colon, (3) thick enough to hold the barium in suspension and (4) thin enough to fill all recesses.

As many or more formulæ for opaque enemas are in existence as for opaque meals, but the three which seem to me to be the best are, (1) barium sulphate 3 oz., alcohol 2 drams, gum tragacanth 140 grains, water 2 pints (Case's Formula); (2) six oz. of barium sulphate in one pint of acacia, and three pints of condensed milk; (3) three oz. of barium sulphate in two pints of buttermilk. Also the residue from the opaque meals may be saved, kept on ice and used for the opaque enema.

The mixture should be as warm as body temperature, or slightly above, and should be given by gravity. It is best to have a bulb in the enema tube so that the lumps may be forced through the tip, and also to aid in forcing the enema past some obstruction. Endeavor not to have lumps in the mixture.

It is not necessary to use a colon tube, as a short flaring hard rubber tip reaching just past the internal sphincter will do the same work. Do not be in too big a hurry for the colon to fill; remember you are working against peristalsis. The knee-chest and other grotesque positions are unnecessary, the ordinary position being the best and most comfortable.

Preparation and Use of Bismuth Paste.—Beck's Bismuth Paste, composed of bismuth subnitrate one part and yellow vasoline two parts, should be heated until liquid. While hot it should be thoroughly stirred to mix the bismuth, drawn into a long glass-tipped syringe and injected as hot as possible. After the withdrawal of the syringe a pad should be placed over the opening of the sinus and an ice bag laid on the pad. This hastens the hardening of the paste and less of it is lost. Should any toxic symptoms result, flush the sinus several times with warm olive oil.

(PRINTED DIRECTIONS GIVEN TO PATIENTS BY DR. CASE.)

No. 1. Take no laxatives or enemas (except by special instructions) for at least 24 hours before the barium meal, nor at any time while the observations are in progress.

No. 2. Do not take any food, drink or medicine on the morning of the examination before the barium meal has been given in the roentgen ray room.

No. 3. Avoid eating or drinking (except perhaps as small an amount of water as may be necessary to allay thirst) after the barium meal, until the stomach has expelled the same. This usually occurs by noon, but exact information will be given in each case.

No. 4. Do not take any laxatives, enemas or bowel treatments (except by special arrangement) during the first two days of the barium test.

No. 5. Women patients will save inconvenience by wearing kimonos.

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ROENTGENOLOGICAL EXAMINATION OF THE MEDIASTINUM*

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IN presenting this paper it is my desire to discuss briefly some of the conditions one is apt to find in roentgenological examinations of the mediastinum.

As all the viscera within the thoracic cavity, with the exception of the lungs and pleuræ, are contained within this comparatively small and inaccessible space, a great variety of conditions may arise which are often exceedingly difficult to diagnose.

A thorough knowledge of the anatomy of this region is, of course, of first importance. The short broad chest with the high diaphragm and transverse type of heart of the stout individual, is entirely different from the long narrow chest with the pendulous heart of the thin person; yet both may be perfectly normal chests. It is only by a careful study of the various types that we can correctly differentiate the normal from the abnormal. Most roentgenologists have neither the time nor the opportunity to study the clinical side of the various cases, and their reports are based solely upon the variations from the normal shadows produced upon the fluoroscopic screen and the roentgen ray negative. A thorough understanding of the gross pathology and general characteristics of the various conditions that may involve these parts will materi-

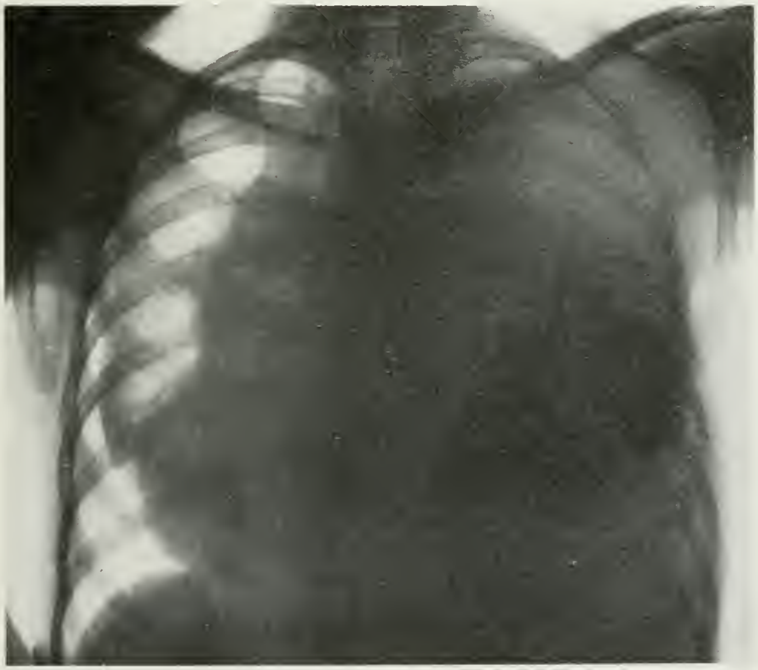

FIG. 1. SARCOMA.
Showing marked displacement of the heart, vessels and trachea to the right.

*Read before the Baltimore Roentgenological Society, April 27, 1917.

ally aid in determining the correct diagnosis.

With the exception of aneurysms which produce definite and unmistakable roentgenological signs, growths in this region are by far the most common of all conditions with which we have to deal. These growths may be of a malignant or benign nature. The malignant tumors comprise the sarcomata and carcinomata; under the benign tumors are included lymphomata, fibromata, myomata, lipomata, chondromata, osteochondromata, simple cysts, dermoid cysts, hydatid cysts and teratomata. The malignant growths are by far the most common of mediastinal tumors. Sir Richard Douglas Powell of London, in *The Practitioner*, states that 90 per cent. of intrathoracic growths are malignant.

Sarcoma.—A majority of the mediastinal tumors are sarcomatous in origin. They arise, as a rule, in the connective tissue and in the lymph nodes abounding in this locality. They may occur at almost any age, a number of cases in children having been reported; but generally they appear between the ages of 20 and 50. They may be divided structurally into two classes, the spindle-celled sarcomata, and the lymphosarcomata. The latter are by far the most common, and, as a rule, are irregular growths with sharply defined outlines, often somewhat nodular in shape, and extending far beyond the limits of the mediastinum. These tumors do not tend to invade or infiltrate the surrounding tissues, but often cause marked displacement of the viscera. Fluoroscopically, a slight movement of the mass may occasionally be noticed, due to pressure upon the aorta, but there is an absence of expansion. The spindle-celled sarcomata are generally invasive in character; they have indefinite outlines, and extend, as a rule, equally in all directions.

Fig. 2. Carcinoma.
Mediastinal involvement with metastasis in the lungs. Characteristic irregular splotches with indefinite outlines.

Carcinoma.—Primary carcinoma in the mediastinum is a comparatively rare condition. When present, it originates in the esophagus, the larger air-passages or the thymus. Its characteristic method of growth is by invasion of the tissues. These become infiltrated and thickened and are represented on the screen or plate by areas of irregular density, often extending beyond the limits of the mediastinum and into the lungs. The mass is not walled off, its edges gradually blending with the surrounding tissues. When the esophagus is the primary seat of the growth, the use of the opaque meal will often be an aid in determining the location and extent of the lesion. Secondary carcinoma is more common than primary, and its appearance from a roentgenological point of view is the same. It must be remembered that tuberculosis of the lungs and carcinoma may occur at the same time.

Dermoid cysts.—Of the benign tumors, dermoids are probably the most common. These are usually situated in the upper part of the mediastinum near the anterior chest wall, and generally extend either to the right or left of the median line, and are seldom centrally located. They have well-defined outlines and are sometimes very difficult to differentiate from aneurysms, since not infrequently they pulsate, owing

FIG. 3. TERATOMA.

Note the sharp outlines in comparison with the heart shadow.

FIG. 4. ANEURYSM.

Descending aorta. The lack of sharply defined edges indicates pulsation.

to their proximity to large vessels, and it is only by a careful fluoroscopic study, the mass being viewed from different angles, that it is possible to differentiate between the two conditions. Occasionally, opaque shadows of bones or teeth may be seen in the tumor mass, and such a finding, of course, at once determines the diagnosis.

Teratomata.—These resemble dermoid cysts in their location and general characteristics. They are usually flattened out against the anterior chest wall, and, according to Christian in Osler's "Modern Medi-

Fig. 5. Hodgkin's Disease.

Enlargement of the mediastinal lymph glands. The axillary and supra-clavicular glands are also enlarged; this is especially noticeable upon the right side.

cine," expand in three directions: upward through the superior aperture of the thorax; laterally into the pleural cavity; downward between the heart and lungs.

Hyperplasia of lymph nodes.—This usually occurs in children and is generally tuberculous, the glands often containing a deposit of calcium, which is not found in malignant conditions. In adults the peribronchial lymph nodes may become enlarged and sclerosed, especially in miners and those exposed to dusty atmospheres. In other cases the hyperplasia may be the result of malignant metastasis or of Hodgkin's disease. In the latter condition, glandular enlargements may be noticed both in the axilla and in the neck; and the lungs may be infiltrated, giving the impression of a tuberculous process. In roentgenograms they are represented by shadows which are usually oval or elongated and appear either singly or massed together.

Abscesses of the mediastinum occur either in the anterior mediastinum as a result of broken-down lymph glands or caries of the sternum or ribs. In the posterior mediastinum they come from dorsal Pott's disease. When these abscesses are of long standing, they often contain calcium deposits in their walls, the pus at times becoming inspissated. The roentgenological shadows of these conditions are unmistakable. They have sharp outlines and the location can usually be determined by means of the fluoroscope.

Diverticula of the esophagus usually occur in the lower mediastinal region and can be determined by the use of the opaque meal.

Hernia in this region is a rare condition. The abdominal viscera, usually the stomach or transverse colon, are occasionally found in the posterior mediastinum, having passed through the dilated esophageal opening in the diaphragm. The opaque meal will also very readily determine this condition.

Echinococcus cysts and hematomata rarely occur in the mediastinum. They may, however, be seen at the bases of the lungs.

The mediastinal region should always be examined by the combined method; the fluoroscopic examination being checked up with stereoscopic plates, which will also serve as permanent records.

In making reports on roentgenological findings, it is better to describe, as accurately and intelligently as possible, what we see, and then supplement these data with a few remarks or suggestions as to the probable conditions present. Only in ex-

Fig. 6. Diaphragmatic Gastric Hernia.

Showing bismuth in the stomach above the right diaphragm. The gas shadow beneath the left diaphragm is transverse colon.

ceptional cases should an unequivocal diagnosis be made.

Many of the chest examinations are made for the purpose of revealing obscure conditions, the nature of which the clinician has not been able to determine, and it is unreasonable to expect the roentgenologist to arrive at a full diagnosis from his examination alone. But although one cannot differentiate a lymphadenoma from a lymphosarcoma, one can describe quite accurately the size, position and shape of the mass, and what effect it has exerted upon the surrounding structures, such as displacement of the viscera, or pressure on the lungs or bronchi, with resultant atelectasis or pleural effusion; and when all these data are weighed by the clinician in conjunction with a full history and complete physical examination of the patient, a correct diagnosis is very likely to be made. The greatest benefit can be derived, however, from a joint conference between the roentgenologist and the clinician.

Conclusions.—Aneurysmal shadows vary according to their location, and always show intrinsic pulsations. They are never nodular in form.

Sarcomata usually show clear-cut shadows, which are irregular or nodular in character. They are rarely symmetrical and often assume large proportions.

Spindle-cell sarcomata are invasive growths with indefinite outlines, extending, as a rule, equally in all directions.

Carcinomata do not have a typical roentgenological appearance. They usually metastasize by means of the lymphatics. The lungs are often involved and show signs of malignant infiltration.

Hodgkin's disease usually shows irregular and nodular shadows due to the hyperplasia of the mediastinal glands, and is generally accompanied by lung infiltration similar to that of tuberculosis. It is not uncommon to find the axillary and supraclavicular glands also enlarged. In children enlarged mediastinal glands are nearly always tuberculous, and frequently show deposits of calcium.

Dermoids and teratomata generally occur high in the mediastinal region, on either side of the median line, and show clear-cut symmetrical outlines. They may easily be mistaken for aneurysms.

Abscesses as a rule are centrally located, and if of long duration often contain calcium deposits within their walls. Their shadows are generally uniform in outline.

A characteristic sign, and often a determining factor in diagnosing mediastinal tumors, is the displacement of the trachea either to the right or left of the median line.

THE ROENTGEN DIFFERENTIATION OF CAVITIES, RETRACTIONS AND PARTIAL PNEUMOTHORACES IN THE CHEST

BY J. M. STEINER, M.D.

NEW YORK

THERE is occasionally observed in roentgenograms of the tuberculous chest large vacant areas in the normal lung fields that may appear at either the apex or base. These areas are referred to as vacant areas because there is lacking detail of any shadows which could be interpreted as either normal or pathological lung parenchyma. There are three pathological conditions which might produce such an appearance: I. Cavity; II. Retraction; III. Partial pneumothorax. There is one constantly appearing sign in all three conditions; that is, an absence of the linear bronchial tracings. I shall attempt briefly to give the roentgen characteristics of these three conditions with the idea that these characteristics may serve some purpose in the roentgen differential diagnosis.

I. Caseation cavities of very large size are frequently observed in either the apex or base of the lung. These cavities many times lie just beneath the visceral pleura, and the adherent visceral and parietal pleura may form a portion of the cavity wall. These cavities are sometimes found extending from the axillary border of the lung to the mediastinal or cardiac border, and from the extreme apex to the hilus region. Such a cavity situated at the apex is usually well drained through a large bronchial opening and there is no exudate within it to cast obscuring shadows. Such a cavity might readily be confused with a partial pneumothorax or a massive apical retraction. The general characteristics of cavities are: 1. The absence of linear bronchial tracings. 2. May be located at either the apex or base. 3. Rarely ever occupies the entire area from border to border. 4. Rarely extend to the extreme apex. 5. Thick fibroid walls are usually demonstrable. 6. When one of the walls extends to and includes the visceral pleura there is usually a marked thickening and fibrosis of the pleura which shows as a cloudy area in the roentgenogram. 7. The shape is usually of a rounded or circular character with irregularities conforming to adjacent dense tissues or viscera. Occasionally a large cavity occupying the entire apex of the lung is observed in which the pleural fibrosis is not sufficient to cast dense shadows, and my experience has taught me that this type of cavity is quite as difficult to differentiate at autopsy from a pneumothorax or lung retraction as it is in roentgen ray plates. The only final proof of such a condition lies in a microscopic examination of the upper lung margin for pleural vestiges.

II. Lung retractions due to the contraction of a fibroid parenchymal lesion usually show a characteristic roentgen appearance. The area in which there is absence of lung parenchyma is usually situated at the extreme apex, and instead of being of a general circular character as most caseation cavities are, the area is usually of a very irregular character, and usually the definite limitations and the outline of the visceral pleura are sharply shown. Apical retractions are frequently diagnosed by the clinician by physical methods of examination, but roentgenologically we are not able to confirm the presence of these retractions. With the development of the roentgen method of examination we realize that the conditions that the clinician frequently diagnosed as apical retractions are not anatomically retractions, but in the majority of instances are lesions of a fibroid, consolidated or non-aerated character situated at the extreme apex. The roentgen characteristics of apical retraction are: 1. Absence of linear bronchial tracings. 2. Location chiefly at the apex. 3. The shape is usually irregular, rarely of a rounded or circular character. 4. The outline of the visceral pleura is usually clearly shown. 5. The areas outside of the retraction are usually clear. 6. The area in which there is an absence of lung parenchyma usually extends from the axillary border to the mediastinal border.

III. The partial pneumothoraces from which the foregoing lesions must be differentiated are those usually occurring along either the axillary or mediastinal border of the lung. They are partial pneumothoraces, because adhesions prevent them from becoming complete. Occasionally these small partial pneumothoraces are formed and are shortly afterwards filled with serous exudate which in turn becomes fibrinous, forming a dense fibrosis of the visceral pleura and preventing the re-expansion of the collapsed areas. When such dense limiting walls exist it is sometimes exceedingly difficult to differentiate this type of collapse from a large cavity. The roentgen characteristics of partial pneumothorax are: 1. The absence of linear bronchial tracings. 2. The location, as a rule, is in the bases, rarely occurring at the apex. 3. The outline of the lung and visceral pleura can be usually shown. 4. The shape is always irregular, never rounded or circular. 5. Pleural adhesions can in many instances be visualized as bands or strings extending from the parietal pleura to the collapsed lung.

THE IMPORTANCE OF THE POSITION OF THE UPPER ARM IN THE DETECTION OF ROENTGENOLOGICAL SHADOWS IN THE REGION OF THE SHOULDER JOINT

BY FRANK W. GEORGE, M.D.

WORCESTER, MASS.

During the last three years it has been my good fortune to have had the opportunity of examining a great many shoulder joint lesions, and I have been very much surprised to find what a large percentage of these examinations have shown definite roentgenological shadows in the region of the subdeltoid bursa. However, not until quite recently have I found how easy it is to miss some of these small shadows on examination of plates unless stereoscopic plates or multiple positions of the shoulder joint are taken.

I have found in my experience that there is one position which has been of especial benefit to me in bringing out these shadows most clearly in the subacromial region; namely, with the patient in the recumbent posture, the affected shoulder flush on the plate, the upper arm abducted to a right angle, rotated outward, the forearm flexed at the elbow to about 45 degrees, and the opposite shoulder slightly elevated by a sandbag.

This position, although somewhat painful at times for the patient, is easily maintained if the arm be held either by an assistant or by a bandage applied around the wrist and then fastened to some part of the table. This position has proven its value to me on several occasions, and it is my practice with any question of a bursitis always to utilize it, in addition to the anteroposterior position, with arms at the sides. One roentgenogram in the prone position, with upper arm abducted, is important. These four positions I believe to be absolutely necessary if subdeltoid shadows are to be excluded, although many may prefer stereoscopic plates.

I have no doubt that a great many men are satisfied in taking simply anteroposterior plates; that is, one with the back of the shoulder, or one with the front of the shoulder next to the plate. In the majority of cases one or both views might suffice, but since I have been employing these various positions, I have been surprised to find how many times these shadows have appeared only on the plates in which I have used the abduction and rotation of the humerus, whereas in the simple anteroposterior plates nothing abnormal could be observed.

A review of the literature published during the last two years with reference to the shadows in the subacromial region has been exceedingly interesting to me, and from a roentgenological standpoint it is quite plain to see how careful we must be in formulating a diagnosis with reference to these shadows.

A year or two ago we would have had little hesitation in calling these shadows calcified subdeltoid bursæ. To-day there is no positive proof that we can rely upon as being absolute, as to whether or not these shadows are in the bursa proper, in the tendons of the spinatus muscles, or even in the capsule of the joint itself. From a surgical standpoint considerable careful work must be done at time of operation, and careful observations as to the exact location of this increased density made, followed up by a definite pathological report together with chemical analysis in order to determine whether this is a true calcification or not.

Berry in his article has very properly brought this to the attention of the surgeon, and we find that these shadows have been interpreted in various ways. Painter suggests that they are due to a thickening of the walls of the bursa; Baer to scar tissue; Beltz to fluid under pressure and hemorrhage; and again Painter, Codman, Brickner, Ely, Dunlop and others to a deposition of calcium salts. Sometimes the deposition of salts has been in the bursa proper, at other times in the wall only, and again in the tendon of the supra or infraspinatus muscle. Of course, it may not interest us or be of so great importance as to whether these shadows are in the spinatus tendon or the bursa proper, but in formulating a diagnosis which we must return to the surgeon, it would seem well to me, for a while at least, to simply content ourselves with stating that shadows are present in the subacromial region, but not to make a positive diagnosis of calcification of a subdeltoid bursa.

In following up one or two of these cases of shadows in the subacromial region after operation, I have found that occasionally not all of the foreign body has been removed, although symptoms have entirely subsided; and, as Berry has well brought out, conservative treatment sometimes shows the disappearance of these shadows after a few weeks' careful treatment.

With this in mind,—the possibility of these patients going for several months after the roentgenological examination is made,—it would seem to me quite proper for us to observe the same rule which we do with reference to renal calculi; that is, to have roentgenograms repeated within a short period of the time of proposed operation.

I have in my offices several plates which illustrate the appearance of these shadows in the subacromial region, and also plates of two cases taken in a position of abduction and external rotation of the upper arm, the only position which has brought these shadows into clear view. Two other plates in my possession show the existence of similar shadows in the region of the greater trochanter and internal condyle of the femur.

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LEAD GLASS AND LEAD RUBBER—U. S. BUREAU OF STANDARDS

BY E. B. ROSA

Acting Director

WASHINGTON, D.C.

X-ray work has recently been added to the activities of the Bureau of Standards. It is intended that this work shall ultimately include the entire field of x-ray testing and standardization. The routine determination for the general public of the effective lead content of protective materials has been successfully initiated and other lines of testing will be developed in due course. The importance of testing protective materials is indicated by the experience of the Bureau. Of a dozen pieces of lead glass purchased about a year ago in the open market two were found to offer no more protection than ordinary plate glass.

The desirability of increased protection from the x-rays was generally admitted and at the suggestion of the Bureau several manufacturers of lead glass and of lead rubber began experiments in the endeavor to increase the quality of their products, with the gratifying result that lead plate glass was produced of eighty per cent higher quality, and lead rubber of one hundred per cent higher quality than those of the materials previously upon the market.

The Bureau of Standards invites correspondence with those interested in its x-ray work.

SOME UNUSUAL STOMACH CASES

BY ALBERT M. COLE, M.D.

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CASE I. PERFORATING CARCINOMATOUS GASTRIC ULCER ON THE GREATER CURVATURE

Patient.—Mr. H. D. T. Age 34. Examined October 3, 1917.

History.—Symptoms began four months before, consisting of pain of a dull character coming on when the stomach was empty, located in the epigastrium and relieved by food. This is rather a typical duodenal ulcer history. There was no tenderness, no nausea or vomiting and appetite was good. Altogether the symptoms were mild, but on physical examination there was noted a small tumor mass about the size of an egg above the umbilicus.

Fluoroscopy, with the stomach filled with the opaque meal, showed a "filling defect" on the greater curvature near the pylorus. There was a very pronounced Haudek's niche (Fig. 1). No pyloric obstruction was noted as the stomach showed no six hour residue.

A diagnosis was made of gastric ulcer with a probable carcinomatous degeneration. On account of the depth of the ulcer crater, as shown by the extensive niche, immediate operation was advised. Three days later the patient was seized with severe abdominal pain with all the symptoms of intense shock and died four hours later. Autopsy revealed a perforation in the ulcer area and extensive metastasis of carcinomatous nature along the lower border of the liver.

The unusual features of this case are the short and mild history, the situation of the ulcer on the greater curvature and the brief duration of the symptoms following perforation (4 hours) and preceding death.

CASE II. SPASMODIC HOURGLASS STOMACH UNAFFECTED BY BELLADONNA

Patient.—J. C. H. Examined April 30, 1917.

History.—Trouble began three years ago with severe pain immediately after eating. It was located in the epigastrium and relieved by nothing. Heavy coarse food increased the pain. There was tenderness on pressure over the epigastrium. Some nausea and vomiting—vomit consisted of fluid and some food. Constipation severe. Loss of twenty-five pounds in weight. Appetite good. No stomach-contents analysis made.

FIG. 1. CARCINOMATOUS GASTRIC ULCER ON GREATER CURVATURE AT PYLORUS.

Fluoroscopy revealed a "purse string" constriction near the pylorus. It appeared not unlike a deep peristaltic wave but it was constant (Fig. 2). The real peristaltic waves ran through it. Palpation made no impression on it and pain was elicited on deep pressure over this area. A series of plates were taken and another fluoroscopic observation was made later, but the constriction still persisted. There was no six hour residue or other roentgen evidence of organic disease. Suspecting that it was

FIG. 2. SPASMODIC HOURGLASS STOMACH.

spasm the patient was given Tr. Belladonna for four days—dose 20 drops four times daily, increased to 30 drops four times a day. At the end of this time the patient returned showing the usual symptoms following the administration of belladonna. The stomach was now again filled with the opaque meal and the same findings were obtained. A diagnosis was now made of organic "hourglass" stomach, probably due to ulcer. Operation showed no stomach lesion but a diseased appendix. During the operation the surgeon noted at times that the stomach muscles showed this same constricting ring. A report from the patient several months after operation stated that there was marked improvement in the gastric pain. This case proves that there are exceptions to the rule that belladonna will relax gastric spasm that simulates "filling defects."

CASE III. ORGANIC HOURGLASS STOMACH WITH PERFORATION INTO DUODENUM

Patient.—Mrs. D. H. B. Age 35.

History.—Gastric pain had been complained of for many years. The pain came on soon after eating and at times was very intense and located at the epigastrium. There was no vomiting and no hemorrhage. The appetite was always good, but during the last year there had been considerable loss of weight.

Fluoroscopically it was noted during the injection of the barium meal that only the cardiac portion of the stomach filled. However, before the meal was all taken it was observed that the pyloric end began to fill through an apparent constriction in the pars media. At the end of the meal the stomach showed its classical "hourglass" form with the stomach divided into equal halves. There was noted a Haudek's niche on the lesser curvature opposite the constriction. A further study under the screen showed the second portion of the duodenum filled and attached to the lesser curvature and the barium passing directly from the lower portion of the upper pole of the stomach into the duodenum (Fig. 3). No pylorus could be visualized. A six hour observation showed the upper pole empty (Fig. 4), and the lower pole fully filled. A

FIG. 3. ORGANIC HOURGLASS STOMACH WITH PERFORATION INTO DUODENUM.

venty-four hour observation disclosed he lower pole still well filled.

A diagnosis was made of organic "hour-lass" stomach due to callous ulcer on the sser curvature with perforation into the uodenum.

On operation it was found as described; he pylorus and duodenum were bound by dhesions to the lesser curvature. A gastro-astrostomy and a gastrojejunostomy were

FIG. 4. SAME AS FIG. 3—SIX HOURS LATER.

done. Fig. 5 shows the result three months after operation.

FIG. 5. SAME AS FIG. 3 AFTER OPERATION.

CASE IV. DUODENAL ULCER SHOWING NO CAP DEFORMITY

Patient.—Mr. W. F. B. Age 31.

History.—For several years the patient has complained of a dull pain coming on three to four hours after eating, felt in the epigastrium and relieved by food. There were distinct periods of remission. Two attacks of hemorrhage by mouth and bowel occurred—the second attack severe with a vomitus of pure blood. There had been no loss of weight and the appetite was good. Altogether the history was quite typical of duodenal ulcer.

Two roentgen examinations were made several months apart. At neither examination were there any roentgen findings indicative of an organic lesion. A series of

FIG. 6. DUODENAL ULCER SHOWING A NORMAL CAP.

plates at both examinations gave a constant normal cap (Fig 6). Lateral plates also gave a normal cap outline.

Operation revealed a small deep ulcer on the posterior surface of the first portion of the duodenum. The bowel otherwis was in appearance perfectly normal, wit (as the surgeon expressed it) no "pucke ing" of the duodenal wall, which woul deform the outline of the cap.

PERIOSTEAL SARCOMA IN A DOG

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THE patient was a dog, six years old, of average size for a Great Dane. He was spending the summer at Long Lake in the woods and was apparently in perfect

health. About August 1, 1917, he started off on a hunt with another dog and was away twenty-four hours. On returning home, he was a little lame; this cleared up entirely. On September 15, 1917, it was noticed that there was a swelling on the dog's right front leg and that he was limping again. The swelling gradually increase in size until he walked on three legs an acted as though he were in pain.

Roentgenographic examination reveale all the characteristic shadows of a periosteal sarcoma, such as we see in the human being.

The swelling continued to grow larger and was apparently more painful until January 2, 1918, when the dog was chloroformed.

A METHOD OF OBTAINING AN ACCURATE LATERAL ROENTGENOGRAM OF THE SHOULDER JOINT

BY W. S. LAWRENCE, M.D., B.S.

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IN THE JOURNAL for April, 1916, I suggested a new position for radiographing the shoulder joint, in order to obtain a plate at right angles to the ordinary anteroposterior view. The method suggested was briefly: patient standing, arm extended, cone in axilla, ray directed upward, and plate held in position on top of shoulder and extended arm. This procedure does give a plate at right angles to the ordinary anteroposterior position and is of considerable diagnostic value in certain cases, but its limitations are many, arising chiefly from the fact that an injured or diseased shoulder will not permit the arm to be extended to a sufficient degree to render this method feasible.

To overcome this difficulty I have been using recently still another position. This third position gives a true lateral view of the shoulder joint, with all the additional information that a lateral view of any other joint will give; is applicable in almost any and every case; and subjects the patient to no pain or inconvenience whatsoever.

I have not seen this position or method of radiographing the shoulder described by any one so far, nor have I seen any published plates illustrating it. I will therefore describe briefly the method as I use it now in the examination of nearly every case of injury to the shoulder joint.

The chief point in this method of examination is the getting rid of the other shoulder, and that is accomplished in this way. Using a table with tube stand attached, the patient is placed standing laterally at the foot of the table with the injured shoulder away. The tube and cone are then revolved so as to make the central ray parallel to the long axis of the table and also to a line passing through the two shoulders of the patient. The uninjured arm is then raised well above the head, which elevates the shoulder on this side. At the same time the injured shoulder is allowed to droop as much as possible. The cone is then brought snugly into the axilla of uninjured side.

Fig. 1. Ordinary Anteroposterior View of a Fracture of the Neck of the Humerus.

From the shape of the head one might think that the shaft is driven into the head, splitting it.

The tube-bearing arm of the tube stand is then fixed and the patient requested to lean against the cone for support. It will then be found that the central ray will be passing entirely beneath the uninjured shoulder, through the easily penetrated chest between the spine and the sternum and through the head of the humerus of the injured shoulder. If this should not be the case the central ray can easily be made to take this direction by tilting the tube a little one way or the other. The plate is now held firmly against the injured shoulder at right angles to the line of direction of

FIG. 2. LATERAL VIEW OF FIG. 1, SHOWING THAT THE SHAFT IS ENTIRELY IN FRONT OF THE HEAD.

the central ray and so that the head of the humerus falls about the center of the plate.

The patient is then instructed to take a deep and full inspiration and hold it while the exposure is made. This, by increasing the bulk and practically not the weight of the lung tissue, thus rendering it more transparent, and at the same time by increasing the distance between the sternum and spine, is of considerable service. For a patient of average size I use an intensifying screen to shorten the time of exposure, but for small adults and children this is unnecessary. The time of exposure, however, is relatively long owing chiefly to the distance the tube is thrown from the plate.

Plates made in this way are not intended to take the place of stereoscopic plates, but certainly the information they give is accurate and very easy to be understood. The accompanying plates are self explanatory.

RADIOTHERAPY OF SURGICAL TUBERCULOSIS

Van Ree gives fifty-seven double illustrations showing the condition before and after roentgen treatment, mostly of tuberculous glands in the neck. In this group of tuberculous glands a complete cure was realized in thirty-five out of forty-eight; only two failed to show marked benefit. The cases showing mere improvement to date may go on to a complete cure in time. One great advantage of the treatment is that the healing proceeds without leaving disfiguring traces. From eight to ten exposures were the average course, some cases needing very few and others requiring a whole year. The exposures were about 4 H units and the intervals about three weeks. These small doses do not modify the tissues around so as to make operative measures more difficult in case they are deemed necessary later. Tuberculous lesions in small bones healed promptly in seven of his thirteen cases of this kind. In one case of a tuberculous lesion in the sternum, the necrotic masses were excised, followed by smooth and rapid healing under the exposures. The benefit in some cases of bone and joint tuberculosis was so striking that further efforts in this line are encouraged even although this treatment failed in a certain proportion of the old cases, especially in adults. Certain experiences on record warn against exposing the larger joints of children to the roentgen rays as liable to interfere with normal growth later. (*Nederl. Tijdschr. v. Geneesk. Amst.*, Sept. 1, 1917, II, No. 9, pp. 751–830.) (Ref. *Jour. Am. M. Assn.*, Dec. 1, 1917, p. 1917.)

ROENTGENOGRAMS OF A CASE OF MYXOMA OF FEMUR

BY ALBERTUS COTTON, M.D.

and

STANDISH MC CLEARY, M.D.

BALTIMORE, MD.

[Note. The interesting cuts of myxoma of the femur, which follow, properly belong with the report of the case by Cotton and McCleary which appeared in the February, 1918, number of the JOURNAL, pages 95–97. Unfortunately the plates were received too late for insertiom in either the February or March numbers, but the importance of the case is such that with Dr. Cotton's consent we have printed the cuts so that the bound volume of the JOURNAL will contain them for the index.—Editor.]

FIG. 1. ANTEROPOSTERIOR UPPER END OF FEMUR, INCLUDING HIP-JOINT.

Taken before the first exploratory operation. Shows enlargement of shaft of bone; rarefaction of bone to and including trochanter major; irregularity of outline of cortex. Neck and head of femur and acetabulum normal.

Fig. 2. Anteroposterior View of Shaft of Femur taken before First Operation.

Same as Fig. 3. Note outline of tumor in soft tissue and new bone formation in muscle.

Fig. 3. Lateral View of Shaft of Femur taken before First Operation.

Shows enlargement of bone; rarefaction; irregularity of outline of cortex; areas of new bone formation of periosteum extending into muscles; operative wound of bone, made by first surgeon in attendance.

(*a*) The whole shaft of femur from neck to condyles was involved in the pathological process.

(*b*) There was enlargement of the bone with rarefaction and thinning of outer compact bone.

(*c*) The rarefaction was not uniform; some areas more marked than others.

(*d*) Contour of bone was irregular on all surfaces.

(*e*) At the middle of bone an area about three inches long and involving one-third circumference was shown where bone had been removed by operation.

(*f*) Along the shaft of bone, especially at site of previous operation, were numerous small projections of new bone extending outward from periosteum in different directions.

An incision was made over the soft part of the tumor in the old scar. A cystic area was found containing a serosanguinolent fluid, with wall of soft friable material like granulation tissue. The cyst extended into the bone at site of previous operation. The bone itself was rough and irregular under the periosteum, with small processes of new bone extending in different directions into surrounding muscles which were firm and hard. No tumor tissue other than the

FIG. 4. ANTEROPOSTERIOR VIEW OF FEMUR, TAKEN BEFORE AMPUTATION.

Enlargement of bone; very marked rarefaction, with thinning and irregularity of cortex; new bone formation from periosteum extending into muscle. Pathological fracture at site of old operative wound in bone.

oft friable tissue and spicule of new bone was noted in the exploration.

Tissue removed showed process of repair, granulation and fibrous tissue with new bone formation. There is no evidence of malignancy.

Sections were made of the gelatinous material contained in the loculi found in the bone. This material is composed of pure myxomatous tissue, showing the characteristic stellate cells, slight fibrillar framework, and the gelatinous ground substance. At places in the section, rather robust bands of fibrous tissue are seen traversing the ground substance.

Sections from the osseous tissue show two distinct processes taking place. Areas showing distinct resorption of bone are met with, and with these are areas in which new bone formation is actively progressing. There are present osteoblastic cells forming cartilage and the beginning of new lamellæ.

The pathologist's diagnosis of this case is not osteosarcoma but myxoma, a non-malignant tumor.

FIG. 5. LATERAL VIEW. SAME APPEARANCE AS IN FIG. 4.

Note particularly the shadow of tumor in the soft tissues and the enlargement of the thigh.

[F]IG. 6. PHOTOGRAPH OF SPECIMEN REMOVED AT OPERATION.

Showing femur split longitudinally from trochanter [t]o condyles; bone destruction and pathological frac[t]ure of middle of femur; tumor mass in medulla and [e]xtending along shaft of bone underneath the perios[t]eum, especially from center of bone to greater tro[c]hanter; tumor mass in soft tissues with cystic cavi[t]ies and areas of new bone formation.

FIG. 7. PHOTOGRAPH OF DISARTICULATED HIP AND THIGH FROM HEAD TO CONDYLES, INCLUDING BONE, SOFT TISSUES AND TUMOR.

Note circumference of thigh at middle.

REPORT OF A CONGENITAL CASE OF SYPHILIS OF THE STOMACH*

BY G. VON POSWIK, M.D.

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PATIENT was referred to me on May 8, 1915. He was 28 years old, married 6 [y]ears, had one healthy child and his wife [h]ad had no abortions. At the time of examination the patient weighed about 118 lbs. He was weak; appetite was good; [b]owels would not move unless medicine was administered, but always normal in consistency, no mucus or blood.

Patient slept well, had never been sick and denied all kind of infection. I was particularly careful in regard to that part of the history. His main symptoms were pain below the ensiform, increased on pressure, and vomiting after eating. After partaking of food he belched and had a nasty, sour taste in his mouth. His vomitus often contained food from the day previous with a

*Read at the Eighteenth Annual Meeting of The American Roentgen Ray Society, New York City, September 20 to 22, 1917.

great deal of bile. He stated he had lost 43 pounds within a year. The gastric contents showed retention and absence of hydrochloric acid.

ROENTGEN EXAMINATION

In the fluoroscope the diaphragm was perfectly normal. There was a great hypotonicity of the cardiac end. The entire stomach was no larger than a medium-sized grapefruit and had a funnel-like shape. Neither pylorus nor duodenum could be demonstrated, but in the plate a slight residue was seen near the pylorus. It was evident that the entire fundus and pylorus were infiltrated and food could not pass readily. The patient could not take the entire barium meal. Although the food could not be observed passing the pylorus, the stomach emptied at the normal time. The food had entered the colon to the splenic flexure and a normal residue was found in the small intestines at the fifth hour. In 10 hours' time the small intestines were empty and the entire colon filled. After two days had elapsed I gave the patient a second test meal with the administration of a hypodermic of atropine. The patient after this administration could not retain the food as readily as at the previous test. Vigorous peristalsis was noticeable in the anterior wall of the small portion of the stomach that was not infiltrated. The patient felt very much nauseated. The stomach had the same shape as during the first examination. I would not give a definite diagnosis, but described the actual findings. An anterior gastro-enterostomy was advised. The patient consented within two days to have it done.

L. R.

Fig. 1. Condition of Stomach at Time of First Examination.

R. L.

Fig. 2. Condition of Stomach at Time of Second Examination.

The operation disclosed the fact that the entire stomach except the cardiac end was heavily infiltrated. Where the peristalsis had shown, during the roentgen examination, way up in the cardiac end, there was some tissue through which an anterior gastro-enterostomy could be made with great difficulty. No glandular enlargement was found and the surgeon and his assistant diagnosed the case syphilis. A Wassermann was made and found 4 plus. The patient made an uneventful recovery and left the hospital in 10 days. He is still receiving vigorous specific treatment. On August 25, 1917, the patient returned at my request to the laboratory. I hardly recognized him. He weighs 150 pounds, feels well and does the hardest work in the mines, laying rails, which requires much bending and lifting. Upon questioning him found that since his operation he had scovered that his father had syphilis. is mother has good health.

But note the sequence in which con- enital infection was carried:

No. 1. He is the oldest and has syphilis the stomach.

No. 2. His younger brother is apparently ell.

No. 3. His sister had a great deal of roat trouble and recovered under specific reatment; apparently well now.

No. 4. Another brother has a keratitis.

The latest roentgen findings of my patient show the stomach has not increased or changed in size. The gastro-enterostomy is working satisfactorily. The food does not remain any length of time in the stomach, which is still funnel-shaped, the gastro-enterostomy completing the funnel action. The stomach has not regained, under treatment, its normal elasticity. I wish to state in conclusion that in cases of syphilis I have found that a hypodermic of atropine will make the patient very uncomfortable, with symptoms of vomiting, nausea and depression, which helps me in making a differential diagnosis.

ROENTGENOTHERAPY IN GYNECOLOGY

Kouwer warns that roentgenotherapy for fibroma of the uterus is still in the tentative stage. Opinions are still divided as to whether the fibroma itself or the ovaries should be exposed. He warns further that our assumption as to the two separate functions of the ovary—the production of the ovum and of the internal secretion—is still purely hypothetical. But we have reason to assume that roentgen exposures carried far enough are equivalent to castration, and we do not know the damage that may be wrought by the exposures even stopping considerably short of this. Instances have come to his knowledge in which roentgenotherapy has been applied to young women to relieve dysmenorrhea, and even women who are thirty-five and forty years of age are not entirely excluded from roentgenotherapy by those who fail to appreciate the power of the roentgen rays acting in this region. The gynecologists have not failed to warn of the dangers from operations, and the majority refrain on principle from operating for uterine fibroma unless very serious indications call for it. But, he adds, the roentgenologists are not equally frank in regard to dangers from roentgenotherapy. The medical literature in the Netherlands has no reports of injury of patients from roentgen treatment. He knows that such cases exist, but where are the reports of them? In referring to the Freiburg method of abrupt and very powerful application of the rays, he says that it is not difficult to learn from the very reports of their 1,395 cases sent out by the Freiburg clinic the harm done in this or that case. "How does it happen," he exclaims, "that Freiburg is deaf and blind to them? How can it be explained that, nevertheless, the statements of König and Gauss are accepted by many as absolute authority?" (*Nederl. Tijdschr. v. Geneesk. Amst.*) (Ref. *Jour. Am. M. Assn.*, Dec. 8, 1917, p. 2008.)

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THE PRACTICE OF ROENTGENOLOGY BY LAYMEN

Considerable discussion among medical men has been aroused over the practice of roentgenology by laymen. It is unfortunately true that many leading medical and surgical institutions today place their main reliance in roentgenology upon the work of laymen, whose only qualification for the work they assume is a more or less special training in photography or electricity. Just as in the domain of physiology there are notable exceptions, some of our most prominent contributors to medical knowledge being men without medical degrees, so there are also in the roentgen ray field two or three instances where scientifically trained laymen, though lacking medical degrees, have made important and stable additions to roentgenological progress; but the exceptions in both classes of cases have been men with highly specialized training. It may be stated as a general proposition that diagnostic and therapeutic roentgen ray work can be safely intrusted only to men and women with medical qualifications. As has been repeatedly claimed in the pages of this journal, the real roentgenologic practice does not consist in the making of so-called "roentgen ray pictures," or even in the necessary electrical manœuvres to keep the fluoroscopic screen properly lighted up, but in the interpretation of the findings obtained by these means. In other words the real work of the physician practicing roentgenology begins where the technical work ends, and can only be performed by an individual with medical training.

Our British friends have been deeply interested in the matter of "lay radiographers and electro-therapeutists," as shown by the fact that the *British Medical Journal* has contained letters and editorial notes on the subject in almost every number for several weeks. The Medico-Political Committee of the British Medical Association has taken up the subject and has recommended that "the practice of radiography (the term used by the *British Medical Journal*, corresponding to 'roentgenology' in the pages of this journal) by unqualified persons ought not to be encouraged." Some would go even further and make the practice of roentgenology by laymen a penal offense, and they urge that laws be passed rendering it impossible for the practice of roentgenology to be carried out by other than skilled and trained medical experts.

On account of the necessities of the war the military establishment has been obliged to employ hundreds of lay assistants in the roentgen ray departments of the numerous military hospitals. Many, if not most, of these possessed no knowledge whatever of roentgen ray technique prior to their entry into the army training schools. After the war no doubt many of these laymen will try to establish roentgen ray "practices" on their own account. As a British writer on this subject has said, these persons will serve a useful purpose as assistants to roentgenologists and electro-therapeutists, but they should be made to understand clearly that their training and experience as assistants in roentgen ray departments no more qualifies them to undertake the diagnostic and therapeutic phases of the work than the experience gained during the war by a private in an engineering regiment warrants him in setting himself up as a consulting engineer. It should be constantly borne in mind that in the roentgen rays we deal with a potent means capable of doing great damage when unskillfully employed. Our contemporary believes the fact that sterility can be brought about by their agency is sufficient in itself to warrant the passage of laws preventing their use except by qualified persons.

The sentiments voiced by our friends across the water find a responsive chord in the hearts of many American roentgenologists, who have been idle witnesses of the growth of a rather wide-spread evil, the commercial roentgen ray laboratory, previously commented upon in these columns. The editor believes that the increasing familiarity of the best physicians and surgeons of this country with the value of roentgen ray work, has created a strong disposition in favor of scientific roentgenology. But this disposition is not universal and is not alone sufficient to solve the problem just presented. The trained medical roentgenologist needs the protection of wise legislation no less than does the physician or surgeon. Even veterinarians and barbers are, in many states, legally protected against the exercise of their professions by untrained men. Surely medical men trained in roentgenology and engaged in one of the most highly specialized branches of scientific work should be adequately protected by law. The protection of such men is the protection of the sick public from both ignorance and deception and from unnecessary or harmful operations, or other treatment, which rest upon mistaken diagnoses.

The American Roentgen Ray Society will doubtless have the aid of the Medicolegal Committee of the American Medical Association in the effort to secure proper laws regulating the practice of roentgenology in the United States.

J. T. C.

Group-Study Valuation of the Roentgen Ray

Two years ago, the diagnostic section of St. Luke's Hospital, San Francisco, established what is termed the group-study method for clinical investigation. Patients who are chronically ill and have shown no tendency toward spontaneous improvement are sent to the hospital by their own physicians for investigation. They are then examined by twelve clinicians representing the following departments: pathology, bacteriology, roentgenology, eye, ear, nose and throat, cardiovascular diseases, respiratory diseases, gastro-enterology, urologic surgery, neurology, orthopedic surgery, general surgery and general medicine.

In the December, 1917, number of the Journal will be found a notable article by Walter Howard Hill, M.D., giving the results of this group-study in "The Analysis of the Cases in Four Hundred Dyspeptic Patients Especially from a Roentgenologic Standpoint." Dr. R. L. Ochsner,[1] in *Medicine and Surgery*, St. Louis, similarly has

[1] "Relative Value of Five Diagnostic Procedures in Four Hundred Consecutive Cases Investigated by the Group-Study Method for Pulmonary Tuberculosis." *Medicine and Surgery*, St. Louis, Nov. 1, 1917. No. 9.

given the results of this same group-study applied to cases of pulmonary tuberculosis. He gives first place to the physical examination, second to the history of the case, third to the tuberculin reaction, fourth to the roentgen ray and fifth to the examination of the sputum. He states that the roentgen ray gives no positive data in nearly 50% of the cases, is of less value than the tuberculin test and is useless excepting in a negative sense until extensive pathologic changes have taken place, long after the symptomatology and the physical signs are well marked.

This plan of group study is splendidly conceived and it is clear that the published results will exert a far-reaching influence on the medical profession. It is no less clear that an able, aggressive and biased clinician in one department, as for example that of the respiratory diseases, may completely upset true relative values. To classify the roentgen ray examination of the chest as inferior to the tuberculin reaction is too much of a joke to be seriously argued.

Roentgen ray battles that have been fought and won must, it seems, be fought and won many times over before our true place in clinical medicine is universally acknowledged.

A. W. C.

The Liberty Loan

Roentgenologists are a deeply patriotic class as shown by the large proportion in uniform. Those who have not volunteered are withheld, almost without exception, by reasons of family dependencies. They are as a class no less patriotic than their *confrères* with bars or oak leaves on their shoulders. If they cannot mobilize in person they can and will mobilize their dollars. If they cannot serve in the first line of defense they can and must form the reserve from which later armies will be supplied when still greater sacrifices are required. In the interim they are in many cases serving their country without rank or pay on Medical Advisory Boards in helping to recruit an army that will be first in health, first in strength and first in the hearts of their countrymen.

The Liberty Loan is an investment, not a sacrifice. It places your money directly in the hands of your Government to be used in your defense and to be paid back with liberal interest. There is no possibility of loss, because this country can never be conquered.

The empire of the Cæsars held the world in yoke for a thousand years. Generations lived and died in what they thought was the permanent government of mankind. We have dedicated, as a nation, all that we have and all that we are to the unswerving purpose of preventing the German Kaisers from fastening the yoke of a similar empire upon a prostrate world. If we are to make good as a nation we must as individuals be ready to give our lives and our fortunes to this cause. But we are asked merely to loan a certain proportion of our income—in other words to buy Liberty Bonds—a test of patriotism to which even the weakest can respond in some measure, and yet in the aggregate a test of such tremendous importance that the fortunes of the world's war hang in the balance.

But we cannot fail. McAdoo like Hamilton twice smote the rock of public credit and abundant revenues gushed forth. The springs of national confidence are exhaustless and again full measure is assured; Every cent of these loans is a bulwark of national security and a safeguard for generations yet unborn. It is no less true today than in the days of Franklin that we must hang together or we will hang separately. When democracy shall have been made safe among the nations of the earth then and not till then let the last loan be written.

A. W. C.

TRANSLATIONS & ABSTRACTS

Lindsey, John H. Roentgenological Control after Pylorectomy for Ulcer. (*Boston Med. and Surg. Jour.*, Vol. CLXXVI, No. 31, Jan. 18, 1917, p. 80.)

Lindsey presents a series of 18 roentgenograms made at varying periods after pylorectomy for ulcer, performed in the Truesdale Clinic. He believes these plates to have intrinsic merit and also to be of special importance as representing a roentgenological follow-up of patients for long periods after operation.

While it is difficult to standardize the condition of patients at repeated gastric roentgen examinations, there is *prima facie* evidence in this series of plates that the stomach, after pylorectomy, tends to enlarge or dilate, and thus compensates for the part removed at operation. In some cases, where a wide resection had been performed, the stomach does not seem to have much opportunity to dilate. In one case, for instance, a very rapid emptying of the stomach is shown. This plate was made soon after the administration of barium buttermilk. The stomach in this case acts very much like a funnel which merely directs the liquid meal into the intestine. The meal does not stay in the stomach long enough to produce a tension which would cause dilatation.

From the clinical information given the roentgenologist, all of these patients with the exception of two seemed in good condition. In general, the efficient manner in which these stomachs have performed their function at long periods after operation testifies to the essential conservatism of an apparently radical operation.

Warnekros. Value of the Roentgen Ray in the Prevention of Recurrence after Cancer Operation. (*Zentralbl. f. Gyn.*, Nov. 4, 1916. Ref. *Med. Rec.*, Jan. 6, 1917, p. 26.)

Warnekros places on record the work of four years in the Berlin Clinic. During the period from 1911 to 1914, 174 cases of cancer of the uterus were temporarily arrested or actually cured with the knife. Of this number 119 patients were not submitted to post-operative raying and 66 of these died of recurrence, while 2 others have disappeared. The remaining 55 have thus far been free from recurrence, but the interval is much too brief to speak of end results. It may therefore simply be stated that the recurrences amount to 55.4 per cent. There were 55 women who have been systematically rayed since operation, and of this number but 11 died of recurrence, while 44 are alive and well. Deaths from recurrence are but 18.5 per cent or almost one-third of the corresponding figure in the first series. Of the 55 women who were roentgenized after operation, 31 received radium in addition. This was applied in the vaginal stump and at times in the rectum. The rays were used both percutaneously and vaginally. In the entire material treated there were but ten cases of cancer of the uterine body.

Jackson, Chevalier. Bronchiectasis and Bronchiectatic Symptoms Due to Foreign Bodies. (*Pennsylvania Med. Jour.*, Aug., 1915.)

While admitting he may be biased, the author can not but feel that the relatively minor place attributed by medical literature to foreign bodies as a cause of bronchiectasis is an error. Be this as it may, he cites a number of cases which prove conclusively that no case of bronchiectasis should be treated without considering the possibility of the presence of a foreign body.

Undoubtedly bronchial stenosis from whatever cause it may arise may produce a bronchiectasis and there are a few cases recorded that seem to prove that the bronchoscopic dilatation of a stenosis may cure a bronchiectasis. On this point further observation is required. At any rate the cases cited will indicate the necessity for bronchoscopy and roentgenography in all cases with symptoms of bronchiectasis.

The author expresses appreciation of roentgenological help rendered by Dr. George C. Johnston, and concludes by urging that every case of bronchiectasis, chronic bronchitis, pulmonary tuberculosis, pulmonary abscess, and chronic cough should have a roentgenogram taken, regardless of how certain we may be of our diagnosis. In all cases with a foreign body history, in which the foreign body is one not dense to the ray, roentgenograms should be made anyway, and in most cases a bronchoscopy should be done also.

Fischer, J. F., and Knudsen, K. A. The Shape of the Vertebral Column in Different Positions, Illustrated by Roentgenograms. (*Nord. Med. Arkiv*, 1916, XLIX (Kirurgi), Afd., h. 4, S. 1–19 (29 figs.). Ref. *Review of Neurology & Psychiatry*, January, 1917.)

The movements of the vertebral column that carry the head from a good carriage of the body to a bad one, and vice versa, take place above all in the thoracic part, and especially in its central portion. As it is not possible, by asking people to contract the extensors of their backs, to give them an idea of what they are to do, and as the request that they should straighten their backs will only result in a carrying of the upper part of the trunk backward by bending the loin, it is important to realize that by asking them to lift their heads with the chin drawn in, the thoracic part of the vertebral column will be straightened.

The intercostal spaces are increased when the bending of the thoracic part of the vertebral column is diminished. The thoracic part of the vertebral column is relatively movable when it is a question of the increase of the convexity backward from the normal position, but very slightly movable when it comes to diminishing this convexity, especially in the central portion.

Voluntary bending sideways of the thoracic part of the vertebral column is possible. The ribs are lifted when the arms are carried in extended position backward, which, no doubt, is due to the fact that the pectoral muscles are greatly stretched by this position.

Simpson, Frank E. Radium in the Treatment of Cancer and Various Other Diseases of the Skin. (*Jour. Am. Med. Assn.*, Vol. LXVII, No. 21, Nov. 18, 1916, p. 1508.)

Roentgen rays are described by the author as a splendid "selective" but, in general, a poor "destructive" agent when good cosmetic effects are desired, because of the dangers and uncertainties of the repair of the tissues. Radium, on the other hand, is not only a useful "selective" but also a "destructive" agent, and it is the latter property that constitutes one of its important uses because of the ease of its employment and the elegance of the reparative tissue. But it requires long experience before the full value of the destructive effects can be utilized.

In certain diseases, radium and roentgen rays may be regarded as alternative agents, while often the combination of both is desirable. In some diseases, roentgen rays are much more convenient and efficient, while in a certain restricted and peculiar field of dermatology radium holds an absolutely unique position.

Among the diseases in which radium has been found of value are: cancer of the skin, cancer of the mucous membranes, vascular nevi (birth marks), keloid, verrucous tuberculosis of the skin, lupus erythematosus, sycosis vulgaris, lichen of the skin, pruritus.

The author has treated over 200 cases of cancer of the skin, and failure to bring about recovery has been rare. Failure occurs, as a rule, only in the very extensive cases. When these, as is often the case, have been previously treated by other methods, the loss of tissue is so extensive that repair is almost impossible. Depending upon the disposition of the radium tubes (50 milligram or more) and the screening employed, healing of very sensitive epithelioma may be brought about in from three to twenty or more hours. With larger quantities of radium, however, it is very important not to produce severe reactions or burns, as these are likely to be very painful and slow of healing.

In the radium treatment of epithelioma of the mucous membranes, the results range from brilliant to disappointing. Metastases are a great source of trouble, and there is also the technical difficulty of holding the tubes in place. The author has devised a number of simple appliances for the purpose of meeting this difficulty.

In certain types of vascular nevi, radium treatment is far in advance of other methods. The application is painless, and the cosmetic appearance often excellent. At the same time, the author admits that in selected cases radium may with advantage be replaced or supplemented by electrolysis, carbon dioxid snow or the Kromayer lamp.

In the treatment of keloid, radium yields excellent results, while for lupus the caustic effect of radium must be evoked. In verrucous tuberculosis of the skin the destructive action of radium is usually excellent. In lupus erythematosus, relapses may occur, but with persistent treatment the final result is often favorable. Radium here often succeeds in cases where other measures have failed. The same remark refers to sycosis, but the author emphasizes the necessity of very careful handling. Lichen usually yields to several ten-minute exposures with unscreened quarter strength. Localized pruritus (of the anus, etc.) is often relieved by radium, especially where no local lesions can be found to invite other treatment. In external location of pruritus ani, five to ten-minute exposures with the unscreened varnish apparatus are often successful, while within the anus the author employs 25 to 50 milligram tubes, screened with 0.5 mm of silver, three or four exposures being given of fifteen to twenty minutes' duration—usually with great relief and sometimes with recovery after one or two courses of treatment.

Ordway, Thomas. Remissions in Leukemia Produced by Radium in Cases Completely Resistant to *X*-Ray and Benzol Treatment. (*Boston Medical and Surgical Journal*, Vol. CLXXVI, No. 14, April 5, 1917, p. 490.)

Those who have had extensive personal experience with and opportunity for intensive study of leukemia recognize that there have been cases which did not respond to treatment by the roentgen ray or benzol. Indeed, following the use of benzol, serious, even fatal, results have been reported, and toxic symptoms also may occur after the use of the roentgen ray. In certain instances benzol may cause a short period of temporary improvement, followed by rapid fatal termination. Such termination may also occur with other forms of treatment or without treatment. With the more recent improvements in roentgen apparatus by Coolidge and his co-workers, and by perfection in the technic of clinical application, it is probable that the number of cases which are refractory to the *x*-rays will be considerably lessened.

Renon, Degrais and Tournemelle in an admirable article add a sixth case of leukemia to the five already reported by them. They also refer to the French series of twelve cases of leukemia in which marked improvement resulted from the surface application of radium over the enlarged spleen. Eight of these had already been treated with roentgen rays with no advantage or only with temporary improvement. Pinch, of the Radium Institute of London, also makes reference to a case of myelogenous leukemia in which the results of radium treatment were excellent. Van Noorden and Falta did not obtain any favorable results in leukemia by the use of radium emanation even by prolonged treatment in the emanatorium. Falta, Kriser and Zehner, however, produced remissions in leukemia by the injection of the thorium-X. In the small series of cases reported by them, the immediate results were good, but the cases had been followed only a very short time, so that they did not draw any conclusions regarding end results of this treatment. German investigators have reported conflicting results from treatment of leukemia by thorium-X.

The principles of cross-fire as well as roentgenotherapy are made use of in the treatment of leukemia by surface applications of radium. The technic of such radium therapy may be illustrated by the striking effect of radium when applied in the proper manner to the surface over the enlarged spleen in cases of myelogenous leukemia. For this the following details have been elaborated:

The area of the enlarged spleen is carefully and plainly marked out with skin pencil or grease paint (of red or black color), the outline being obtained by percussion and palpation. The various landma ks, such as costal margins, anterior superior spine and crest of the ilia, the symphysis pubis and the umbilicus are marked. The patient is photographed in an erect position in both front and side views. A series of small squares 3 cm in diameter, when the radium applicator is 2 cm in diameter, are marked over the area of the enlarged spleen. It is important not to have the successive application areas too near together, or the skin between them will be "burned" by the double dose. The squares thus marked out are numbered serially. A swath of thin cotton cloth is carefully fitted to the abdomen, and the outline of the spleen, bony landmarks and small squares is traced upon it. This swath must be smoothly and accurately fitted and kept in accurate position by means of the landmarks above mentioned, for it is left in place during each single series of treatments. The purpose of this swath is to avoid the irritation of repeatedly applying and removing the adhesive plaster which holds the radium applicator in place, for it has been found that the area which is being, or has been, radiated is particularly sensitive to injury from the repeated application and removing of adhesive plaster. Indeed, such added irritation may induce vesiculation or even superficial ulceration of the skin. Tracings of the areas and landmarks marked on the swath are now made on tracing cloth, which serves as a chart for guidance in the following series of treatments. With the chart as a guide, the radium applicator, screened with 2 or 3 millimeters of lead, 15 to 20 thicknesses of filter paper, and wrapped in gauze, is now applied to each of the squares in the order indicated. It is necessary also to add at least as much filtration and protection to the external side of the applicator, for the patient may inadvertently rest the arm or leg on the applicator during sleep, and a severe burn may thus result. The filter paper is applied to avoid the irritating effect of the secondary rays from the lead, and the gauze adds to the comfort of the patient.

After four to six weeks a second series of treatments is usually necessary, the interval between being determined by examinations of the blood and by the local condition of the skin. If the details here described are followed, however, no effect will be produced upon the skin other than very faint pigmentation after several series of radium treatments.

When from 50 to 60 milligrams of radium element or millicuries of radium emanation are employed, evenly distributed over a surface applicator 2 x 2 cm in diameter, and the filtration and protection above mentioned is used, the radium may be left in each position from 4 to 6 hours—4 hours if there are 60 milligrams, 6 hours if there are 50 milligrams and if the filtration is 3 millimeters of lead. With this amount of radium and the above technic, it is possible for complete remission in leukemia to occur with three series of treatments. Amounts of radium, however, as small as 25 milligrams, even when this is in the form of a tube, have reduced the spleen to normal size, and caused the characteristic improvement in the blood and in the general condition of the patient, but the time required is longer and the series of applications more numerous.

The author believes that in practical radiotherapy, radioactive substances will in certain instances doubtless be preferable to the use of the roentgen rays, particularly when there is a necessity for the most precise localization, especially within the body or in cavities difficult of access and also when the condition of the patient or circumstances demand portability of the therapeutic agent for convenience or ease of treatment. The disadvantage of radium is its great expense for sufficient dosage. He deems that when sufficient clinical experience has been gained in the application of the recent advances in the production of highly penetrating homogeneous roentgen rays of great volume by Coolidge and his co-workers, supplemented by careful scientific study of the physiological effects, there will be in the majority of cases very little difference in the therapeutic value of the roentgen rays and radioactive substances. It seems possible that similar results to those now produced by radioactive substances may be brought about in a much shorter time by the roentgen ray when the desired quantity and quality of the radiation may be measured in a rational manner, so that the results obtained by one man may be compared with those of others and that there may be a repetition of results from day to day. From the preceding it will be seen that each source of radiation has certain advantages, as well as disadvantages. Unless in the near future the cost of production and the selling price of radium are greatly reduced, it would seem, with the recent development in roentgen technic, that the latter will become of more general use in the treatment of many diseases.

A case report is cited at great length.

Pfender, Charles A. Roentgenotherapy in Inoperable Carcinoma. (*Medicine and Surgery*, Vol. I, No. 2, April, 1917, p. 117.)

Deep roentgen therapy, the massive administration of 10 to 50 X Kienboeck units through 1 to 4 mm of aluminum and several layers of chamois or a thick piece of leather, in the hands of an experienced roentgenologist, is, in Pfender's experience, a perfectly safe procedure, t it would be hazardous to establish a rou-ie and apply it irrespective of the case in nd. The author describes three cases of in-erable carcinoma which are usually classi-d as "hopeless," with the following results: The first patient, having an inoperable uter-e carcinoma, is entirely well to-day (after bout 18 months); the second patient, having operable secondary carcinoma of the chest ad left lung, died from exhaustion after en-ying a respite of at least three months of life ithout suffering; and the third patient, with n inoperable post-operative metastatic car-inosis of the head, chest and sacrum, was ymptomatically well for eight months with rospect of further improvement, had she con-inued treatment.

Prime, Frederick. Observations upon the Effects of Radium on Tissue Growth in Vitro. (*The Journal of Cancer Research*, Vol. II, No. 2, April, 1917, p. 107.)

During the last few years much has been written both for and against the usefulness of radium as a therapeutic agent in the treatment of malignant growths. The observations along this line have been chiefly clinical, made, that is, upon tumors in man, where it was impossible to control the results with any degree of accuracy. The employment of in vitro cultures of cells growing in plasma offers a convenient method for observing growing tissue, and this, therefore, was chosen as the most suitable means for studying the changes produced by radium upon the individual cells.

The author refers to the work of Wedd and Russ, Wassermann, Price Jones and Mottram, all of these authors having made experiments upon tissue in vitro. The author's experiments were first conducted on the embryo chick heart kept alive for a long period by the method set forth by Carrel. Hearts were removed from chicks which had been incubated for from five to seven days, cut into small pieces about 0.001 gram in weight, and some two or three dozen such fragments suspended in a hanging drop of Ringer's solution on a cover slip sealed with paraffin over a hollow slide. The cultures to be treated with radium were then covered with 0.4 mm of brass, upon which the radium tubes were placed, and thus exposed to the action of 100 mgm of radium for one-half and two hours respectively. In a previous series of experiments it had been found that the lethal point of small pieces of tissue where the unfiltered rays were concerned was twenty, fifteen, and ten minutes for 17, 83, and 100 mgm of radium, respectively. When the alpha and soft beta rays were removed by filtration with 0.4 mm of brass, three hours, one hour, and forty-five minutes, respectively, were required for 17, 83, and 100 mgm to kill; whereas when only the gamma and secondary beta rays were employed, twenty hours were necessary for 17 mgm of radium, and about seven hours for both the 83 and 100 mgm to cause death.

The two exposures to 100 mgm of radium mentioned above for one-half and two hours when both beta and gamma rays were used was therefore a sublethal and a lethal dose, respectively. After exposure, each piece of tissue was removed from the Ringer's solution, and cultures of them were made in slightly diluted chicken plasma, controls being accorded the same treatment in all cases. The cultures were all kept in an incubator at 37° C., and daily observations made as to their condition.

The author concludes the article as follows:

1. Radium in sufficiently large doses will so injure the nucleus of the cell as to prevent further mitosis.

2. This injury to the mitotic power of the cell does not, however, prevent a marked increase in the area of the culture due to an outwandering of cells.

3. This power of the radiumized cells to wander out from the main tissue is limited, extending through two or at most three generations.

4. When there is a marked outwandering of cells after radiumization, but no mitosis, the tissue will not grow when inoculated into mice.

5. Radium does not, therefore, kill the cells outright, as is shown by the persistence of beating in heart muscle cells, but injures the nucleus in such a manner as to prevent further division, which must eventually result in the death of the cell, if its energy is expended in growth and division and not in a purely mechanical function. The well-known high resistance to radium of the cells of the central nervous system, which do not divide in adult life, is presumably correlated with the survival of the heart muscle cells after lethal exposures.

6. The stimulating effects of minimal doses

of radium are shown by the profuse outwandering of the cells which occurs after sublethal exposures.

Tousey, Sinclair. Prevention and Treatment of Cancer Based Upon *X*-Ray Findings of Dental Infection and the Use of Autogenous Vaccine. (*N. Y. Med. Jour.*, Vol. CV, No. 11, March 17, 1917, p. 485.)

The title of this paper raises hopes too good to be true, and the contents bear out the apprehension that the hopes are premature and the title misleading. Dr. Tousey throws out the suggestion that defective teeth may be the underlying cause of cancer, because a number of cancer patients have been found to be so inflicted. Tentative treatment with autogenous vaccine prepared from the infected areas has also been instituted. The object of the communication is, according to Dr. Tousey's frank avowal, to put in a claim for priority in case further investigations by himself and others should bear out the correctness of his suggestions. It is just possible, however, that the profession will prefer to give credit to those men who establish facts and make a practical success of ideas rather than bestow eulogies upon claims for priority before the object is accomplished.

Ratera, J. and S. Roentgenotherapy for Tuberculous Glands. (*Siglo Medico, Madrid*, July 21, 1917. Ref. *Jour. Am. Med. Assoc.*, Sep. 8, 1917, p. 856.)

The authors have treated thirty patients with tuberculous glands by exposure to the roentgen rays and have been impressed by the prompt cures effected. They declare that it is so effectual that it can be relied upon to differentiate ordinary tuberculous glands from Hodgkin's disease, as in their five cases of the latter not the slightest benefit was apparent. It even seemed in some of the cases as if the disease had been whipped up by the exposures.

Barringer, B. S. Report of Four Cases of Carcinoma of the Bladder Locally Removed by Radium. (*Am. J. Surg.*, Vol. XXXI, No. 12, December, 1917, p. 325.)

In a large majority of cases in which the author has applied radium to bladder tumors, the hematuria has stopped two or three da[ys] after the irradiation. There is a suggestion [in] this that the primary effect of the radium [is] upon the blood vessels. If this is so it would [in] a measure explain why papillomata of t[he] bladder, rich in blood vessels, react somewh[at] more slowly to radium than true carcinoma[ta] which have poor and imperfectly develop[ed] blood vessels.

In some cases the rapidity of the action [of] radium is astonishing. In one case, which w[as] irradiated January 19th, on February 4[th], (sixteen days later) cystoscopy showed that [an] extensive carcinoma had entirely disappeare[d].

Radium burns of normal portions of t[he] bladder have occurred only in those cases [in] which carcinoma was around the bladder nec[k] and in which the radium was pulled into t[he] urethra and kept there for a long time. T[he] author has had two such cases. The burns la[st] a long time, and cause considerable irritatio[n]. Division of the radium dose into two or mo[re] tubes; use of smaller quantities; change in t[he] position of the patient during application; a[nd] a fairly long interval between irradiations—s[ix] weeks or more—ought to prevent such burns.

The four cases reported are selected fro[m] some twenty-five cases of carcinoma of t[he] bladder which have been, or are being, treate[d] by radium. The author believes them interes[t]ing because they probably all fall into th[at] class of bladder carcinomata which is mo[st] malignant.

Cole, L. G. Ileocecal Incompetency. (*Me[d.] Clin. No. Am.*, Vol. I, No. 3, Novembe[r] 1917, p. 689.)

The author discusses what he considers th[e] direct causes, constitutional symptoms an[d] clinical significance of ileocecal incompetency.

Cole considers some of the direct causes ar[e] pregnancy and its sequelæ, chronic appendicitis with adhesions, post-operative adhesions, pericolonic veils or Jackson's membrane.

The constitutional symptoms are due to th[e] ileal absorption of putrid colonic contents and a failure to repair the incompetent valv[e] ultimately forces the terminal ileum to assum[e] a colonic function. The rich lymphatic supply of the ileum makes it ill suited for this function as there will result an absorption of putrefying material.

Under symptoms, the author mentions pain resembling gallbladder or urinary colic and a tumor mass in the right iliac fossa. The constitutional symptoms are varied, sometimes evidenced by localized pains to the left of the umbilicus accompanied by flatulence and constipation. Periodicity is one of the most prevalent symptoms. The relation between ileocecal incompetency and spasmodic or other functional lesions of the stomach is mentioned.

The author has advised operative procedure for a number of his cases, the technic recommended following closely that described by Kellogg. The results have been gratifying; and subsequent roentgen ray study has shown that in very few cases where the valve was properly repaired was the valve found incompetent. He states that if the valve is properly repaired, the results are permanent.

Giffin, Herbert Z. Treatment of Myelocytic Leukemia by Radium. (*Boston M. & S. J.*, November 15, 1917, p. 686.)

The author reports a series of 30 consecutive cases which have been treated by means of surface application of radium element over the spleen.

In some instances in this series the author used 50 mg. and in others 100 mg. of the radium element in tubes. The enlarged spleen was mapped out into squares in the manner described by Ordway, and the radium exposed over each area for periods of three or four hours. The total length of time for each series of applications varied from twelve to forty-eight hours; usually, however, the time was from twenty-four to thirty-six hours. Patients remained in bed during exposure. In the early cases the protection consisted only of 2 mm. of lead beneath the radium and 2 mm. of lead over the radium. The radium was held in place by means of adhesive plaster. Superficial burns resulted, but they were never serious and healed without difficulty. As previously pointed out by Ordway, experience demonstrated that the skin formerly traumatized by adhesive plaster was especially susceptible to burn. After adding 1.2 inch of wool beneath the 2 mm. of lead equally satisfactory results were obtained, with only occasionally a slight burn. The radium may be raised so far from the skin by means of gauze that little result is obtained from the exposures. When a satisfactory response does not occur, one should reduce the protection, even to the point of burning the patient.

Dr. W. J. Tucker devised a biscuit-shaped block which has been used routinely for several months. This consists of ½ inch of wood, 2 mm. of lead, ½ inch of wood bored to receive the tubes of radium, and above this 2 mm. of lead and another ½ inch of wood. This block is held in position by means of a simple canvas belt. An endeavor is made to concentrate the fire through the most massive portions of the spleen.

A certain degree of general improvement, together with reduction of the size of the spleen and of the leukocytic count, occurred in every instance, even in the most advanced and toxic cases. Marked temporary improvement occurred in 26 patients, and a remarkable improvement in 13. It is impossible satisfactorily to discuss the subsequent histories of these cases at this time.

Hemorrhage ceased as a rule after one or two series of exposures. In two instances, hemorrhage occurred after radium exposures when it had not occurred previous to treatment. In these instances the hemorrhage seemed to be the result of over-exposure; an anemia also developed; both the hemorrhage and the anemia were successfully combated by means of transfusion.

In 25 patients there was definite improvement of the anemia concomitant with the improvement of the general condition. The reduction of the number of leukocytes was due chiefly to not only an absolute but also a striking relative fall in the myelocytes; there was a striking fall in the absolute count of polynuclears, while their relative percentage remained approximately the same. There was also a marked fall in the absolute count of small lymphocytes.

Surface exposures of radium over the spleen of myelocytic leukemia usually affect a very rapid reduction of the size of the spleen, a fall in the leukocyte count, and improvement in the general condition. Together with transfusion, they constitute at present the most effective temporary measure in the treatment of the disease.

Holland, Arthur L. Fluoroscopic Method of Diagnosis in Disease. (*Med. Clin. No. Am.*, Vol. I, No. 3, p. 767, November, 1917.)

The author holds that the fluoroscope is an instrument of medical diagnosis and that it should be used only by those who are actually engaged in clinical medicine and are experienced, or at least familiar with modern laboratory methods. The field for fluoroscopy is a large one; it overlaps that of roentgenography, but does not substitute for the latter method.

The fluoroscope in trained hands will yield information that roentgen ray plates, even in long, expensive series, cannot always disclose. This information is: A correct estimation of peristalsis or the presence of a reversed peristalsis; the effect of adhesions on the position, contour, mobility, motility and relation of the viscera; the possibility of direct dermatographic charting; the better placing of mass and pressure pain with combined palpation; and the detection and estimation of spasm. Roentgen ray plates in series may suggest these possibilities, but only when interpreted by a master roentgenologist.

On the other hand, the fluoroscope cannot compete with serial roentgenography in: The detection of obscure filling defects in the duodenal bulb, pyloric region, and the intestines; the outlining of diseased gallbladders; the detection of gall or kidney stones; and the accurate mapping out of a diseased area as an aid to the surgeon in determining his mode of procedure. Then, too, the obese patient presents a problem to the fluoroscopist which is not nearly so perplexing when plates are used.

When in routine diagnosis the fluoroscopic findings are at variance with clinical and laboratory findings and a diagnosis remains cloudy, supplementary roentgenography should be employed. Operative cases should be studied by a combination of both methods prior to operation.

This excellent article is apparently written by a man who has not had large laboratory training in roentgen ray work, if one may judge by Fig. 71, showing a patient being fluoroscoped in the horizontal position. Although the author urges that every possible protection be insisted upon, and that the roentgenologist wear a leaded rubber apron, the observer in this figure is sitting on the edge of the table on which the patient is being examined. This rather comfortable looking position reverses the logic for the use of the rubber apron. If the observer wishes to maintain this position he should *sit* on the apron instead of wearing it. This, however, is a minor detail. The author is to be complimented on the very logical and lucid discussion of the subject undertaken.

At the close of the article, the author refers to stereoscopic fluoroscopy, but no credit is given to our colleague, Dr. E. W. Caldwell of New York, the father of stereoscopic fluoroscopy, whose tireless efforts in the experimental field are alone responsible for the early prospect of realizing this "dream of roentgenologists."

Kouwer, B. J. Roentgenotherapy in Gynecology. (*Nederlandsch Tijdschrift voor Geneeskunde*, Amsterdam, Sept. 8, 1917 II, No. 10. Ref. *J. Am. Med. Ass.* Dec. 8 1917.)

Kouwer warns that roentgenotherapy for fibroma of the uterus is still in the tentative stage. Opinions are still divided as to whether the fibroma itself or the ovaries should be exposed. He warns further that our assumption as to the two separate functions of the ovary—the production of the ovum and of the internal secretion—is still purely hypothetical. But we have reason to assume that roentgen exposures carried far enough are equivalent to castration and we do not know the damage that may be wrought by the exposures even stopping considerably short of this. Instances have come to his knowledge in which roentgenotherapy has been applied to young women to relieve dysmenorrhea, and even women of 35 and 40 are not excluded from roentgenotherapy by those who fail to appreciate the power of the roentgen rays acting in this region. The gynecologists have not failed to warn of the dangers from operations, and the majority refrain on principle from operating for uterine fibroma unless very serious indications call for it. But, he adds, the roentgenologists are not equally frank in regard to dangers from roentgenotherapy. The medical literature of the Netherlands has no reports of injury of patients from roentgen treatment. He knows that such cases exist, but where are the reports of them? In referring to the Freiburg method of abrupt and very powerful application of the rays, he says that it is not difficult to learn from the very reports of their 1,395 cases sent out by the Freiburg clinic the harm done in this or that case. "How does it happen," he exclaims, "that Freiburg is deaf and blind to them? How can it be explained hat, nevertheless, the statements of Konig and Gauss are accepted by many as absolute authority?"

MacKee, Geo. M. *X*-ray and Radium in the Treatment of Skin Diseases in Children. (*Tr. N. York Acad. M.*, Section on Pediatrics, *Am. J. Obst.*, Dec., 1917.)

We quote the following remarks by Dr. MacKee on the above subject: "I am limited to a discussion of the results of the *x*-ray and radium in the treatment of dermatoses in infancy and childhood and this confines my remarks to very narrow limits as there are not very many skin diseases peculiar to infancy and not many more in children that are amenable to treatment by the *x*-ray and radium. One of the conditions frequently met with by the pediatrician and one in which roentgenology has given good results is favus or ringworm. This is a condition which has given much trouble in different parts of the world. It is much more difficult to treat in early life than when it occurs near the time of puberty. It has been almost eradicated in London and other European cities by the use of the *x*-ray, and it seems a pity that we have not employed this method more generally in the United States. Children with ringworm are not allowed to go to school but they mingle with others on the streets and are therefore a menace. As a result they never receive a school education. I believe that Dr. Fordyce's clinic is the only free institution in this city where this method of treatment is being employed, but every hospital and dispensary should be similarly equipped; it can be given by a nurse under supervision. It is possible where there is only a single lesion to treat merely the diseased area. It is not always necessary to depilate the entire scalp. When depilation occurs, care must be taken that the hairs which fall out do not become scattered and spread the infection. To avoid this among intelligent people the lesion may be covered with zinc plaster after the treatment. As the hair falls out three weeks after the treatment, by removing the plaster at that time the hair will be found adherent to it. In the treatment of this condition by the *x*-ray the dosage must be very accurately measured. It takes a certain amount of *x*-ray to make the hair come out and a very little more to prevent its ever coming in again, so that the limits of the dosage are not very wide. We have treated 300 or more cases, three different men giving the treatment, and we have had no instance of permanent alopecia. It is evident that in applying the *x*-ray to the skull all points of the skull are not equally distant from the focus, and that the oblique rays will be less powerful than the direct rays. To overcome this discrepancy Adamson devised the method of mapping the skull into five areas and applying the *x*-ray to each of these successively. We have used no protection for the scalp but have protected the face, ears and neck. It takes from one half hour to forty-five minutes to treat the entire scalp and it is not necessary to treat all on the same day or to apply a full depilitating dose at one sitting; one may give a fractional part of the dose each day until the total dose is administered. If the correct dose is given the hair falls out in three weeks. There are a few contraindications. It cannot be used in very young children, but only because they cannot be kept still. A child of two or three years, however, may be treated very easily. The *x*-ray must not be applied to the scalp for three weeks after the application of irritating chemicals and such chemicals must not be used for several weeks after the *x*-ray has been employed. If the *x*-ray has been applied at such a time a permanent depilation may result. Sometimes it is not necessary to obtain complete depilation as the diseased hairs may fall out under very small doses, and if we only get a partial depilation of the affected area we will often effect a cure.

"Blastomycosis and actinomycosis are conditions that respond well to *x*-ray treatment.

"In vascular nevi we get good results with radium, but not so good with the *x*-ray. Cavernous angiomata can be cured by the *x*-ray, but only by persistent treatment, and such persistent treatment is not advisable. It is apparently the beta rays of the radium to which the therapeutic results can probably be attributed. These are also present in the *x*-ray, but they cannot be used. The radium tube is not as satisfactory as the radium plaque because one gets a reticulate effect with the tube. The port-wine mark does not respond to *x*-ray or radium. Pigmented nevi do not do well under the *x*-ray or radium. Hairy nevi, on the other hand, respond well to the *x*-ray treatment.

"Acne likewise responds to x-ray treatment but it is not necessary nor is it advisable to resort to this unless the ordinary methods fail.

"Keloid occurs in infants and children usually as the result of burns and both x-ray and radium are very efficacious. All forms of keloid are amenable to such treatment.

"Of the different varieties of warts, the common wart, verruca vulgaris is very amenable to treatment by the x-ray or radium. One treatment with either of these agents will usually effect a cure. The small flat juvenile warts do not do so well under this form of treatment. Plantar warts, keratomata, which are not very satisfactorily treated by other methods, respond to this form of treatment and I have never known a case to relapse.

"Sarcoma in children is curable by this method if it is attacked sufficiently early. If a pigmented mole begins to develop into a sarcoma, it can be cured provided no metastasis has occurred. I have a picture of a case of melanosarcoma which was apparently cured by the x-ray five years ago. The patient had one relapse and was given further x-ray treatment, after which the cure appeared to be complete. I have had two or three other patients who have had no trouble after periods of three years.

"In speaking of eczema I do not wish to be understood as advocating the use of the x-ray as a routine method of treatment, but in squamous eczema it causes the lesion to disappear and it requires only small doses to produce this result. I would, however, use the x-ray in eczema only in obstinate cases that failed to respond to the ordinary methods of treatment.

"Psoriasis occurs frequently in children and is easy to treat by means of the x-ray and radium. Chrysarobin is, however, usually satisfactory. Radium and the x-ray are both effective but with radium one cannot treat as wide areas as with the x-ray.

"Lichen planus is a recalcitrant disease, but it usually responds to ordinary treatment. When it is limited to small areas the x-ray or radium is indicated.

"Lupus vulgaris of hypertrophic or ulcerative type yields well to treatment with the x-ray or radium. The atrophic type is very recalcitrant. The x-ray, if properly administered, gives very good results in tuberculous adenitis. Scrofuloderma may also be treated in this way successfully."

Montgomery, Douglas W., and Culver, George D. The Preoperative Reduction of Epithelioma by Roentgen Rays or Radium. (*J. Cutan. Dis.*, Vol. XXXV, No. 421, December, 1917, p. 837.)

A primary radiation with radium is now an accepted principle in the operative treatment of cancer in certain situations, as, for example, of the uterus including the cervix, of the vagina, of the rectum, of the tongue and even of the lips. This principle may be made use of in cancer of the skin, and by it in some cases the resulting scarring and deformity may be notably reduced, also cancers justly regarded as inoperable, may be brought well within the limits of more easy radiation.

The author, as an example of what may be obtained by employing the roentgen rays within the limitations in which they could be of benefit, reports an exceedingly interesting case of a man ninety-one years of age with an epitheliomatous ulcer occupying almost the entire left side of the nose.

It was impossible to curette the whole lesion as the shock would probably have killed the patient. He was first given five roentgen ray exposures of thirty minutes each, from a medium tube at 4 inches distance, spread over a period of twenty-two days, after which there was a marked reaction with flattening of the edges of the lesion. By December 14, there was decided improvement, and on this day, the authors gave him another roentgen ray exposure of thirty minutes directed into the deep portion of the ulcer near the eye.

On December 20, it was possible to curette the area nearest the tip of the nose, after which we applied roentgen rays to the raw surface for thirty minutes, then swabbed it with the acid nitrate of mercury.

On December 28, the surface nearest the eye was treated in the same manner, a procedure that previously the authors would not have thought feasible.

By January 25, everything was healed but the upper part of the ulcer. On April 4, the authors had to curette this also, and on doing so came down on uncovered bone, and beside this there was a cushion-like ridge above the edge of the ulcer which was scraped away. The raw surface was exposed to the roentgen rays for thirty minutes, and then chromic acid crystals were poured on and pressed in

The resulting crust came away the following month, and during May, June, July and August the authors gave in all 125 minutes of roentgen ray exposure in broken doses. In the meantime some small pieces of necrotic bone were exfoliated, and the lesion healed entirely, leaving a small hole leading into the nasal cavity.

At no time was the patient seriously incommoded by the treatment, and the pain occasioned by the procedures was obtunded to a bearable degree by infiltrations of weak cocaine solution.

Valuable as the roentgen rays are in the treatment of epithelioma of the skin there is also no doubt of the deceptive nature of a healing depending wholly on them. The theory of their action and of the action of radium in this disease is the same. As the young cells of the neoplasm divide, the rays strike them at this tender period of their development and kill them. When this theory is borne in mind, a prolonged moderate, rather than an intensive short, treatment with roentgen rays is preferable. It is possible that, because it is steadier and more prolonged, radium is better than roentgen rays in these forms of radiant energy, which are so alike in their therapeutic action. Nevertheless, from the very nature of things some cells may escape or be only inhibited.

Ritchie, Harry P. Duodenal Diverticula. (*J. Surg., Gynec. & Obst.*, Vol. XXV, No. 5, November, 1917, p. 485.)

The author, after reviewing the literature, finds reports of 76 cases, and in addition 10 cases reported by Case and one by Stewart as having been discovered roentgenologically. The author also refers to findings by Case, Carman and others of a sort of sacculation or pseudo-diverticulum which may arise from a duodenal ulcer scar.

The present case, which is reported in full with roentgenological, surgical and pathological findings is of special interest because the duodenal diverticulum occurred in association with duodenal ulcer.

The author reports the unusual features as follows:

1. The diverticulum was demonstrated at operation.
2. It was of unusual size, being the largest reported.
3. The position was in the first portion of the duodenum just below the pylorus.
4. It is the only case reported where a diverticulum was found in close proximity to an ulcer of the duodenal bulb.

(See case reported by Shoup, *Am. J. Roentgenol.*, November, 1917—Editor.) An extensive bibliography is quoted.

Simmons, Channing C., and Benet, George. Hodgkin's Disease with Special Reference to *X*-Ray Treatment. (*Boston M. & S. J.*, Dec. 13, 1917, p. 819.)

The authors report a series of cases observed at the Huntington Memorial Hospital in Boston in connection with the work of the Cancer Commission of Harvard University. The report covers a period of three years and includes not only Hodgkin's disease but three cases which though clinically Hodgkin's disease, were lymphosarcoma.

The roentgenotherapy was conducted under the direction of Dr. Wm. Duane. 31 cases were diagnosed and treated as Hodgkin's disease, including three which proved on microscopical examination of the glands to be lymphosarcoma. For various reasons, 11 other cases were eliminated so that the report is based on 19 cases.

The radium has been used in the form of emanation, which is collected and sealed in a capillary tube. This in turn is enclosed in a small metal jacket. Each tube represents from 10 to 250 millicuries of emanation, the strength varying with the age of the tube. The tubes are applied to the patient with a 2 mm lead and 2 or 3 cm gauze screen, and are left in position from 1 to 12 hours. In a few instances the tubes have been inserted directly into the mass of glands. In the treatment of the mediastinal and other deeply situated glands, the tubes are raised 2 to 4 cm above the skin in order to obtain a maximum dose with less danger of burning the skin. Some skin reaction is very apt to appear in from one to two weeks. There may be a marked constitutional disturbance with nausea and vomiting, prostration and some fever following treatment with either radium or roentgen ray. These symptoms appear soon after exposure.

There were but 9 cases of Hodgkin's disease that have had sufficient treatment with radium to allow of conclusions being drawn as to its value. What sufficient treatment is, is difficult to say. The cases received applications from one to three times a month over periods from three to twelve months, the usual t eatment being from 600 to 1000 or more millicurie hours. We are now using larger doses. In analyzing these nine cases, every one showed benefit by diminution in the size of the glands and improvement in the general condition. The first effects on the glands were noted in from nine days to three weeks, averaging two weeks.

There are in this series but five cases carefully treated with the roentgen ray where the dose is known. Four improved under treatment, and in all of them the improvement is noted as beginning about two weeks after the first treatment. In the fifth case there was no change noted in the size of the glands. All but one of the cases are now dead, and that one also received considerable radium.

The roentgen rays when measured were usually given at a distance of 25 cm through an aluminum filter, and with a brass cone. The voltage was 70 K. V.

The impression is that the patients improve in general condition, and that the glands treated diminish in size with the roentgen ray, but that the improvement is not as marked as with radium. The roentgen ray treatments were also directed against definite masses of glands, and no attempt was made to radiate all the lymphadenoid tissue of the body, as we believe should be done.

Stein, Otto J. A Case of Nasal Sarcoma Cured by Radium. (*N. Y. M. J.*, Vol. CVI, No. 23, Dec. 8, 1917, p. 1075.)

This article reports the case of a young man, age 20, with a diagnosis of nasal sarcoma involving the right antrum, ethmoid and nostril. Between September 25, 1916, and January 27, 1917, the patient received over 6000 milligram-hours of radium application, part of the time filtered through one to two millimeters of lead and part of the time through one millimeter of platinum and rubber.

Examination on April, 1917, gave no evidence of a tumor within the nasal pharyx. Some four or five weeks later, he was reported to be suffering from metastases and the family physician stated that the malignancy was manifested within the intestinal tract. About ten days later, the patient died. Postmortem was obtained and careful study made of the skull. No evidence of malignancy was found. Examination of the abdomen showed that death occurred from peritonitis caused by a ruptured appendix.

BOOK REVIEWS

THE MEDICAL CLINICS OF NORTH AMERICA, September, 1917, Vol. I, No. 2. Published by W. B. Saunders Co., Philadelphia.

It is satisfactory to note that the second number of this new publication has given some consideration to the claims of roentgenology upon the attention of clinicians, there being a contribution by Pancoast on the Diagnosis of Pulmonary Tuberculosis by the Roentgen Ray. There are 7 roentgen illustrations, numbered from 17 to 23, and it is a matter of speculation what has become of the preceding 16 roentgenograms. The illustrations embrace the bronchopneumonic type of pulmonary tuberculosis, hilus tuberculosis with infiltration into the lung, diffuse pneumonoconiosis, fibrosis resulting from pulmonary tuberculosis, from infection following inhalation of foreign body, from pneumonoconiosis and from "Potter's Asthma."

The complications of pulmonary tuberculosis that are subject to satisfactory roentgen study are mainly in the pleural cavity, comprising empyema and pneumothorax, and Pancoast thinks it needless to dwell upon the importance of a roentgen examination in these conditions. This is a strong standpoint which, we trust, will be duly pondered and heeded by the clinician.

The essence of Pancoast's paper is embodied in the following conclusions:

1. The characteristic roentgen feature of early pulmonary tuberculosis is the individual or conglomerate tubercle, when found in numbers. The appearance is usually typical of the disease, but not always.

2. From the roentgenologic standpoint early pulmonary tuberculosis may manifest itself in three ways, depending upon the anatomic distribution—the hilus region, peribronchial infiltration along the larger trunks, or infiltration in the parenchyma further remote from the larger subdivisions of the bronchial tree.

3. Fibrosis may result from tuberculosis, but when seen does not necessarily imply a tuberculous process.

4. A roentgenologic study of every case is not essential. Its greatest value is to determine the exact nature amd extent of the lesion when the diagnosis is certain and to assist in the diagnosis of doubtful cases.

5. The policy of treatment is largely to be determined clinically when the diagnosis is assured, although the frequent aid of the roentgen examination is not to be denied.

6. The best interests of the patients are served by coöperation between a competent clinician and roentgenologist.

RADIOGRAPHY AND RADIO-THERAPEUTICS. By Robert Knox, M.D. (Edin.), M.R.C.S. (Eng.), L.R.C.P. (Lond.), Consulting radiologist, Great Northern Central Hospital, London; Hon. Radiographer, King's College Hospital, London; Director, Electrical and Radio-therapeutic Department, Cancer Hospital, London; Captain, R.A.-M.C. (T.) 4th London General Hospital (in charge of x-Ray Department). Part I. Radiography. With seventy-eight plates (one in color) and three hundred and thirty-seven illustrations in the text. New York: The Macmillan Company. London: A. & C. Black, Ltd. 1917. Pp. 382. Price, cloth, $9.00.

The very favorable impression made everywhere by the appearance of the first edition of this work is only accentuated by the second edition before us. This is the most comprehensive, understandable and generally reliable work on radiology which has appeared in the English language, and, as such, it should excite a feeling of pride in every member of our profession.

The author has taken advantage of the opportunities offered for a new edition to add much material of a military nature, such as ought to be very helpful to others at the present time. Twenty-four plates and one hundred and fifty illustrations have been added in the text, and the entire work revised and enlarged so that it is now being issued in two volumes, the first of which is before us.

Aside from very complete and authoritative discussions relating to the physical considerations of roentgen ray work, apparatus, and installations, and the diagnostic features of bone and joint work, there are comprehensive chapters on the examination of the thorax, the examination of the alimentary system, the study of the urinary tract, and a final chapter on congenital malformations.

The new material which especially interests us at the present time is that relating to the installation of military radiographic outfits and the methods employed in the localization and extraction of foreign bodies. The author combines his experience with that of his colleagues in the military service, and describes their ideal of equipments for base hospital work, the roentgen ray mobile outfit, the outfit for the collecting hospital or clearing station, and the field outfit.

The roentgen ray mobile outfit is a 2 or 3 ton lorry which has a 3 K.W. dynamo having an output of 20 amperes at 150 volts. The dynamo is driven from the main gear-box and is so arranged that it gives this output when running at normal engine speed. Behind the driver's seat is situated the photographic dark room, which is arranged with a seat for the operator, a developing tank on one side, and a printing desk on the other; it is also provided with ample water supply, with hot drying cupboard, ventilator, lead-lined cupboard, dark-room lamps and all the necessary fittings. Behind the dark room the remainder of the body is converted into either a store-room for apparatus (during transportation) to be used in the tent outside, or into a permanent dark room. This mobile outfit provides for a plant with a tent for use as an operating room.

The field outfit calls for a small but serviceable installation fitted up in a motor transport, the engine of which can be used to drive the dynamo which generates the electricity. The whole apparatus can be fitted up in a motor ambulance wagon, a portion of which can be screened off to form a small dark room. (The French have found the plan of having the engine of the motor transport drive the dynamo which generates the electricity, very unsatisfactory, as have also some of the British workers to whom the writer has spoken, but we have learned that recently the French have again taken up the production of roentgen ray mobile units of an improved pattern, in which the dynamo is mounted on the forward part of the chassis which is extended in a very unusual form in front of the engine, the dynamo occupying a position in the line of the crankshaft, in front of the engine of the car.

We cannot refrain from making one serious criticism of the work before us. The frontispiece shows a roentgenogram of the thorax "showing early tuberculosis of the lungs." Our curiosity is great as to the points in this plate which enable the author to make the diagnosis from this single plate. No reference is made to a study of the case having been made with stereoscopic plates, without which we should hesitate to make a diagnosis of early tuberculosis in this case by roentgen ray means alone. Whether or not the author is right we do not attempt to say. We do feel that it is dangerous doctrine to print such a plate with such a diagnosis and with no more explanation than is afforded in the brief paragraph beneath it.

J. T. C.

THE AMERICAN JOURNAL OF ROENTGENOLOGY

Editor, James T. Case, M.D., Battle Creek, Mich.

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MEDICAL RESERVE CORPS

ROM: THE SURGEON GENERAL

TO: EDITOR, AMERICAN JOURNAL OF ROENTGENOLOGY,

BATTLE CREEK, MICHIGAN

1. I wish to call to the attention of the profession at large the urgent need of additional medical officers. As the war progresses the need for additional officers becomes each day more and more apparent. Although the medical profession of the country has responded as has no other profession, future response must be greater and greater. The Department has almost reached the limit of medical officers available for assignment.

2. I am, therefore, appealing to you to bring to the attention of the profession at large the necessity for additional volunteers. So far the United States has been involved only in the preparatory phase of this war. We are now about to enter upon the active, or the fighting phase, a phase which will make enormous demands upon the resources of the country. The conservation of these resources, especially that of man-power, depends entirely upon an adequate medical service. The morning papers publish a statement that by the end of the year a million and a half of men will be in France. Fifteen thousand medical officers will be required for that army alone. There are to-day on active duty 15,174 officers of the Medical Reserve Corps.

3. Within the next two or three months the second draft will be made, to be followed by other drafts, each of which will require its proportionate number of medical officers. There are at this time on the available list of the Reserve Corps, an insufficient number of officers to meet the demands of this draft.

4. I cannot emphasize too strongly the supreme demand for medical officers. Will you give the Department your assistance in obtaining these officers? It is not now a question of a few hundred medical men volunteering for service, but it is a question of the mobilization of the profession. In the large centers of population and at other convenient points as well as at all Army camps and cantonments, boards of officers have been convened for the purpose of examining candidates for commission in the Medical Reserve Corps of the Army. An applicant for the Reserve should apply to the board nearest his home.

5. The requirements for commission in the Medical Reserve Corps are that the applicant be a male citizen of the United States; a graduate of a reputable school of medicine, authorized to confer the degree of M.D.; between the ages of 22 and 55 years of age; and professionally, morally and physically qualified for service.

6. With deep appreciation of any service you may be able to render the Department, I am (Signed) W. C. GORGAS,

Surgeon General, U. S. Army

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OBSERVATIONS ON ROENTGENOSCOPY AT THE FRONT *

BY R. DESPLATS, M.D.

Major, Of the French Army Ambulance Chirurgical Automobile No. 16

THESE few pages are only a summary of our personal experience in roentgenoscopy of the wounded at the front. Their purpose is to render service to our American colleagues, by giving them the benefit of the experience gained during three years of war. We must not, therefore, expect to find in them aught but a clear, simple and brief outline.

The information furnished the surgeon by the medical roentgenologist is of such importance as to decide the indication for an operation—more or less extended, according to the size of the projectiles, their anatomical position, depth, and trajectory in the tissues; and in accordance with the bony or other lesions observed in the course of the examination. These findings justify the numerous methods of localization, of operative guidance, and of extraction, described since 1914, and encourage greater rapidity, more absolute precision, more certain extraction; such, indeed, are the desires of the surgeons at the front, whom we must satisfy, and with whom we must work as sympathetically as possible.

The experience of 18 months' practice in mobile hospitals and the criticism which we have heard from surgeons and roentgenologists themselves, have taught us that the roentgenographical methods, the compasses, and extractions under screen should be used at the front only in exceptional cases, and that a careful screen examination with an exact notation of the number and volume of the projectiles, the depth and, as far as possible, the anatomical position of those which must be found and extracted, should suffice in most cases.

There is no doubt that this method of procedure is more rapid, once we have familiarized ourselves with fluorescent screen shadows and with certain common technical procedures. In order to have an exact understanding with the surgeon, there are certain principles which must be applied, without which the screen examination is incomplete, insufficient, and often misleading.

We would like here to review these directing principles, and discuss briefly the simple, rapid and precise technique which has always been sufficient for us.

I. General Instructions for Recognizing Projectiles.—The record of the screen examination which accompanies the patient to the operating room should indicate numerically all the projectiles imbedded in the tissues and describe them briefly, according to their volume (metallic dust, bean-size, pea-size, etc.); somewhat according to their form (round, cubical, elongated, sharp-edged splinter); always according to their position (external posterior aspect of the leg, dorsal aspect of the third metatarsal near its middle, etc.).

It is the result, more or less approximate, of a first examination that the roentgenologist registers in his record. Without this record, the surgeon might be led to believe there was an omission, if he observes that no projectiles have been recorded for a certain part of the body containing one or more wounds. It is enough to say that a negative examination of a member (free from projectiles, but not free from wounds) should be specially noted on the examination card. Such is the case with the so-called "seton" wounds, which often correspond to the wounds of entry of two projectiles still remaining in the tissues.

II. Recognition of Anatomical Lesions.—The patient's card should not only record the foreign bodies but also the fractures observed, with their situation, the direction of the fracture line, the visible fragments of bone, the apparent displacements, the bloody effusions (more or less abun-

* Translation from advance sheets of a forthcoming work by Desplats and Wickham.

lant when coming from the pleura), the mmobility or mobility of the diaphragm, and when the projectile is located in the thorax or abdomen, its coincidence of movement with the diaphragm or the heartbeat. This information is of great value to the surgeon from the point of view of anatomical localization.

Insufficient in most cases, and often neglected, these details are none the less necessary. We have seen large dissections made to find a small projectile, because its size was not indicated. We have seen two enormous projectiles left in a member where they caused suppuration, because on the strength of a hasty and insufficient diagnosis of a "seton wound" made at the dressing station, a further examination of the member had not been made. We have seen projectiles in the knee not indicated on the patient's card, probably because they were considered too small. These are faults imputable to the roentgenologist. Although no one is exempt from such faults, this fact does not lessen their importance from the point of view of the patients' welfare, and the too frequent repetition of apparent errors practically takes away the surgeons' confidence in the value of the roentgen ray examination.

III. Examination for Superficial Projectiles.—Armed with a metallic instrument which serves as a probe, the roentgenologist searches rapidly among the foreign bodies for superficial ones, which he localizes easily on one side or the other; and with a dermographic pencil, he indicates them on the skin by means of a cross and a corresponding number, also making on the record sheet a notation, such as "superficial projectile under cross No. X., such and such a region." It is quite evident that the signs should be marked on the skin rather than on the dressings. Many surgeons have remarked to us that many wounded arrive in the operating room, with their dressings untouched and with numerous crosses on their dressings.

IV. Cases in Which We Can Omit Localization.—There remain the projectiles, more or less deep and more or less numerous, sometimes so numerous that the roentgenologist would hesitate at localizing them all exactly. Facts concerning position and volume must be taken into consideration here. We can only dispense with an exact localization in cases in which a small foreign body is deeply imbedded in a thick

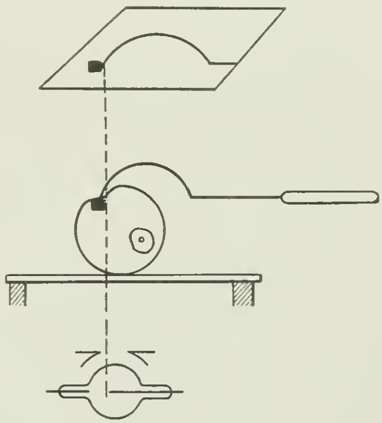

Fig. 1. Mobilization of a Superficial Projectile by the Indicator Held in the Hand of the Roentgenologist.

region outside the peritoneal cavity and far from neurovascular masses. In such cases we find it sufficient to indicate briefly on the patient's card "a projectile of the size of a lentil, in such and such a region," with the words "to be left in place."

In principle, all projectiles which are not too small or superficial should be exactly localized as to depth.

V. Methods to Be Employed Exceptionally or to Be Rejected.—We have seen many roentgenologists who insisted on using the two-axis method, which in France has come to be called the method of Debierne. According to them, this method is more acceptable to the surgeon. But it has the inconvenience of multiplying the marks on the skin, and sometimes involves an unnecessary amount of movement of the wounded man on the examining table. It seems to us that this method is not generally applicable, especially in cases of multiple wounds, or when the man is so dangerously wounded that all unnecessary movements should be avoided.

This method, however, can be employed in certain cases (projectiles in the skull for example) when the two axes cross at right angles.

Many others, who only occasionally resort to the two-axis method, indicate the position of all their projectiles in relation to only one point marked on the skin, on the side closer to the projectiles, forgetting that it is impossible to orient one's self in the depth of the tissues with this insufficient information. This faulty method of procedure is so common that we have seen surgeons surprised to observe us mark two points, corresponding to the axis on which the projectile is found, assuring us that never had they seen this procedure before.

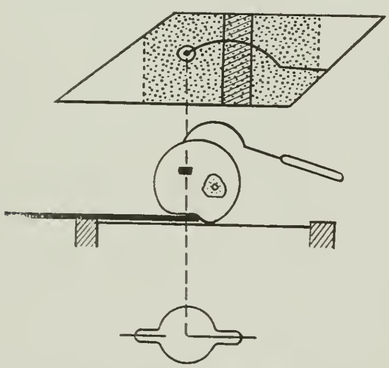

Fig. 2. Determination of the Axis by the Means of the Indicator and the Perforated Rule.

It is not surprising that under those conditions many surgeons take no notice of roentgenoscopic information and do without it so easily. They prefer to follow the direction of the wound, which guides them more surely to the projectile and in case of difficulty there is always the method of extraction under the screen to fall back on.

VI. The Importance of Indicating on the Skin the Axis of the Normal Incident Ray.—It is then necessary in principle to indicate always on the skin the point of incidence and the point of emergence of the normal incident ray (Fig. 2); in other words, the axis on which the estimation in depth has been made. The surgeon, always at liberty to look for the projectile in following the direction of the wound and during its *debridement* (cutting away soiled and bruised tissues), will continually have the opportunity of orientation in relation to this axis which he can reconstruct in space. Under these conditions (and only under these conditions) mistakes will be rare, and the roentgenologist can rest assured that these will not be charged to him.

The localization itself can be made by any method, provided it be a rapid and precise one.

VII. Localization in Reference to the Skin.—Amongst the elements of rapidity and precision, there is one which seems to us very little known. It is the marking of the skin by an opaque marker, placed tangentially to one edge of the shadow of the foreign body on the axis of the incident normal ray (on the side of the tube shift).

We usually employ a square piece of adhesive sheet lead (neotectine), or in cases where the precision is less exact, a metallic indicator in the form of a hook, whose end is flat and sufficiently opaque, which the operator must take care to hold immobile.

VIII. Exact Method of Localization in Depth.—Most of the screen methods of localization actually employed are based on the method of the double image of the projectile obtained simultaneously by a tube of double anticathode or successively by two positions of the anticathode; the calculations, the geometrical constructions, and the special apparatus permit one to infer from the separation of the shadows the distance from the projectile to the screen, and also the depth of the projectile in reference to a given point on the skin.

The method which we employ, communicated to the Academy of Sciences on the 6th of December, 1915, seems to us worthy of recommendation because of its simplicity. It is, in fact, a method of direct reading, thanks to the graphic here included, which permits measurement of the depth of the projectile from the skin, in the same manner that one would measure with a graduated rule.

If we suppose that coinciding with OP (distance from the projectile to the screen)

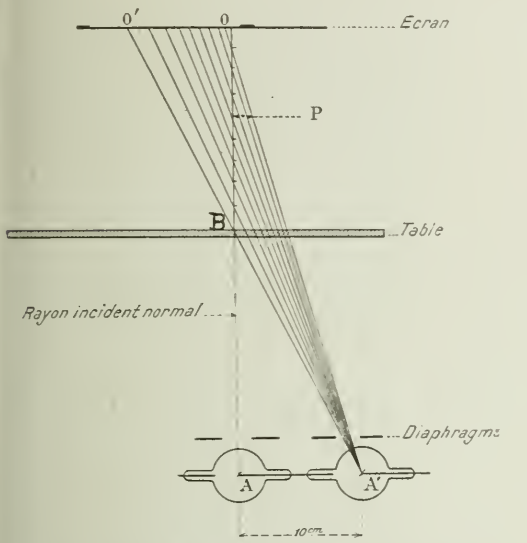

Fig. 3. Projection on the Screen of a Graduated Ruler, Placed on the Incident Normal Ray by a Pencil of Rays, Produced by the Tube After Shifting It 10 cm.

we place a ruler OB, graduated in centimeters, and that we move the tube 10 cm. from A to A′, the ruler OB would be projected on the screen at OO′ and we could read directly at what point of graduation of OB the projectile can be found; this would constitute the direct reading of the distance OP (see Fig. 3).

In practice this arrangement can not be realized, but we can for each distance, AO (anticathode-screen), project, according to A′O′, the same graduated ruler, and we will thus obtain projections corresponding to an increasing value of AO from one centimeter to another.

To represent the different graduated rulers, corresponding to the different values of AO, we have marked on the ordinate line these values (arbitrary scale), and for each ordinate line in abscissa the values of OO′ in the proper size (see graphic appended to this article).

The formula demonstrates that all points corresponding to a given value of OP will be on the same hyperbole which we construct. This will give graphically the values of OO′ for the distances OA.

The steps of the procedure are as follows:

(1) The patient is placed on the examination table in such a position that the projectile will be closest to the screen.

(2) The incident normal ray passes tangential to one side of the projectile.

(3) We place on the skin a square piece of adhesive lead in such a position that the shadow of this indicator is tangent to the shadow of the foreign body.

(4) Move the tube 10 cm. to one side of the indicator (see Figs. 4 and 5).

(5) We draw on the glass of the screen two marks corresponding to the separation of the shadows, or practically with two pointers movable on a rule, parallel to one side of the screen (see Fig. 6).

(6) The tube is brought back to its original position. This permits us to verify if the patient has moved and if the indicator has remained in its original position.

(7) We introduce under the region examined, that is, under the side towards the tube, a flat, perforated ruler, having at one extremity an opaque ring (see Fig. 2) in such a manner that the shadow of the ring on the screen encircles the

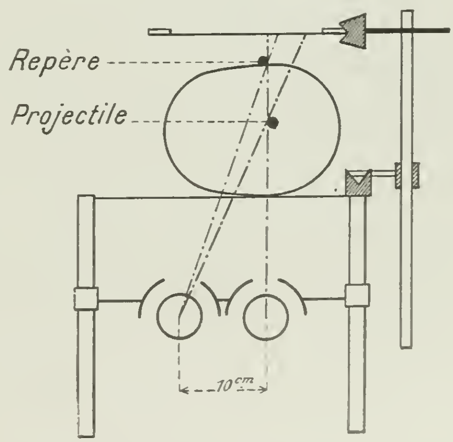

Fig. 4. Localization of a Projectile by the Anterior Face. The Indicator Is Placed on the Side of the Excursion of the Tube.

shadow of the projectile and the shadow of the indicator held in the observer's hand.

(8) Having turned on the light, we mark on the skin with an indelible pencil, or with ink, the axis of the incident normal ray (see Section VI).

(9) We measure the distance separating the screen from the operating table. Added to the known and fixed distance separating the anticathode from the table, we obtain the anticathode-screen distance.

Having traced on a piece of paper the two lines indicating the separation of the shadows, we place this paper on the graphic, by having one of the lines coincident with the line of the zeros, with the known anticathode-screen distance. The position of the second point gives the depth, in centimeters, of the projectile under the indicated point, by simply reading the number of intervals which separate the two points.

The explanation of this technique is more complicated than the technique itself. We have thought it advisable to discuss all the details, because each one is important. It is on their rigorous application that the accuracy of the results will depend.

IX. Localization of the Projectile in Depth in Reference to a Posterior Landmark.—It is very important when dealing with a seriously wounded patient, or one with multiple wounds, to avoid turning the patient over on the operating table under pretext of making the localization in reference to the point nearest the projectile.

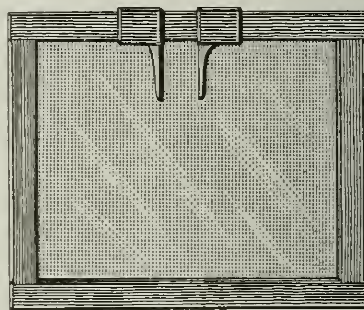

Fig. 6. Screen with Two Mobile Indicators, to Measure the Distance Between the Shadow of the Projectile and the Shadow of the Indicator After Moving the Tube 10 cm.

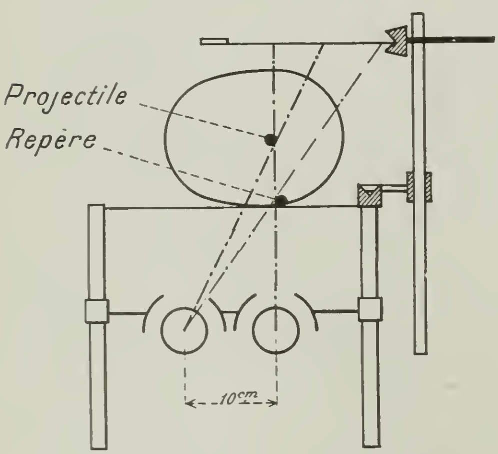

Fig. 5. Localization of a Projectile by a Marker on the Posterior Aspect. The Indicator Is Placed on the Opposite Side of the Excursion of the Tube.

As soon as the patient is brought into the examining ward, we endeavor to locate the point of penetration of the projectile and we lay him on his back or on his abdomen, according to the case. If we discover that one or more projectiles are closer to the side nearest the table, it is in reference to this side that we operate.

Without moving the patient we proceed in a method the reverse of the one ordinarily employed. We place the square of lead, or more simply we apply the metallic (hand-held) indicator, tangentially to the shadow of the projectile, to the part of the body nearest the table.

X. Practical Method of Localization in Reference to Posterior Direction.—In practice we must

(1) Place the metallic indicator on the skin on the side of the point of incidence (posterior face) in such a way that the shadow will be tangent to the shadow of the foreign body on the incident normal ray.

(2) Move the tube 10 cm. towards the side opposite to the tangent line of the shadows (see Fig. 5).

(3) Record by means of the metallic

ides or by two pencil lines, the distance etween the two shadows.

(4) Measure with the caliper (Fig. 7) he length of the axis (point of incidence to point of emergence of the incident normal

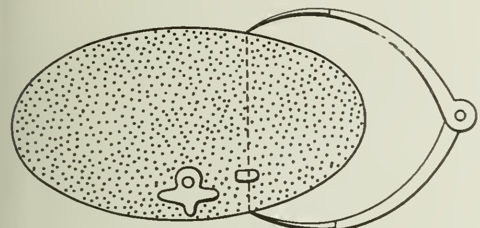

Fig. 7. Utilization of the Caliper in Connection with Author's Technique for the Localization of the Projectiles by a Marker or Indicator Held Posteriorly.

ray), adding to it if necessary the distance from the screen to the point of emergence.

(5) It will then be easy to find the depth of the projectile on the centimeter ruler corresponding to the anticathode-screen distance.

XI. Depth Verification in Certain Delicate Cases.—It happens in some rather delicate cases that the roentgenologist is doubtful as to the value of the information he gives to the surgeon; to which method shall he have recourse to verify his diagnosis?

In such cases we usually turn the injured member at an angle of 90° and having made sure that the line joining the point of incidence to the point of emergence is parallel to the table, we pass the incident normal ray successively through the projectile and through the marker, thus indicating on the screen the exact depth of the projectile (see Figs. 8 and 9).

XII. Anatomical Localization and Orthodiagrams.—It will not be difficult in many cases to draw exact conclusions from the point of view of anatomical localization. We have said (see paragraph II) that other roentgen ray findings could be taken into consideration.

In other cases (intra-articular projectiles) it is in the best interest of the surgeon to have a document which will clearly indicate to him the relation of the projectile to the bones in the vicinity. This is of much more importance to him than a landmark on the skin.

The document which we furnish is an anteroposterior and a lateral orthodiagram

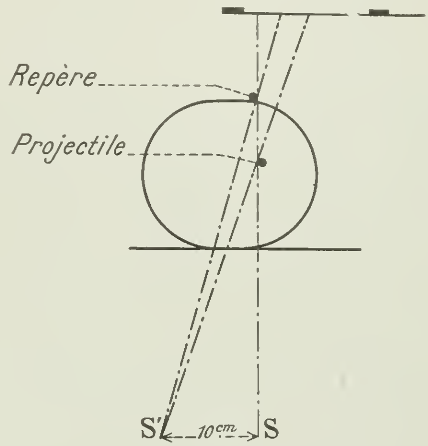

Fig. 8.

in preference to a simple screen tracing which gives distorted shadows and which may falsify the record. It is sufficient to trace with an indelible pencil on the glass of the screen the incidence of the rays coming out of a small diaphragm above the tube. This the assistant moves while the operator traces.

XIII. The Uses of Roentgenography, of the Hirtz Compass, and of Extraction Under

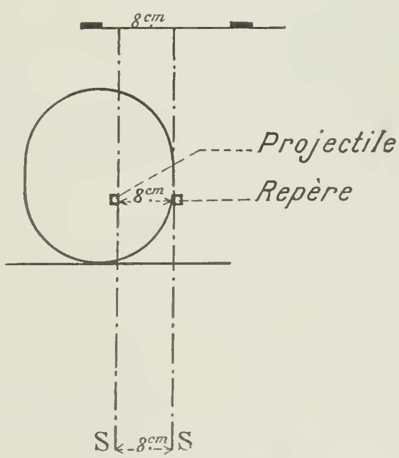

Fig. 9. Verification of the Method by Turning the Member 90°, and Measuring on the Screen the Distance Between the Shadow of the Projectile and the Shadow of the Indicator.

a Screen.—We shall only mention roentgenography as an exceptional method. There is no doubt that for the majority of French roentgenologists at the front

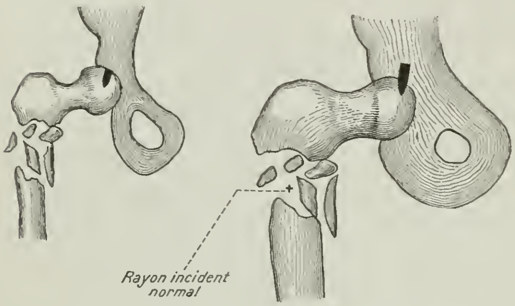

FIG. 10. FIG. 11.

FIG. 10. ORTHODIAGRAM SHOWING A COMPLICATED FRACTURE OF THE SUPERIOR OF THE FEMUR, AND A PROJECTILE APPARENTLY AT THE LEVEL OF THE FEMORAL HEAD.

FIG. 11. A PROJECTION OF THE SAME FRACTURE, SHOWING THE BONES ENLARGED AND DISFORMED. THE PROJECTILE IS AT A LEVEL ABOVE THE FEMORAL HEAD.

roentgenoscopy furnishes, from the point of view of the localization of the projectiles, information just as precise as roentgenography. Why then prefer a long, costly and complicated method, which can only be a method of complement, to a simple and rapid method which is sufficient in itself? Let it be well understood that roentgenography is properly indicated in the study of fractures, except perhaps those of the extremities.

We will speak only of the compass of Hirtz, and similar instruments, to point out that it is an instrument of guidance for the operator, based on data obtained by screen or plate localization. It has the inconvenience of being able to be used for only one projectile at a time.

As to extraction under the screen, it seems to us that we must have recourse to it more and more frequently at the front during quiet intervals, because we have a preference for primary suture of the surgical wounds; it therefore seems illogical, under those conditions, to leave in the muscular tissues even small projectiles which are hard to extract. We insist on the fact that extraction under the screen should always be preceded by an exact localization in the fluoroscopic room. This is the only method of giving to the surgeon exact information as to the depth of the projectile.

Shall we recommend operating in a darkened room under a fluorescent screen, or in the operating room with a bonnet fluoroscope for the roentgenologist only? The first method is certainly preferable from the point of view of good visibility for the roentgenologist himself; it also permits the surgeon to glance at the screen if necessary. The second has the advantage of being practicable in any operating room, but requires perfect adaptation of the eyes of the observer and a greater milliamperage through the tube (3 to 4 milliamperes). We should hold ourselves in readiness to employ one or the other of these methods, according to circumstances. To make a habit of either would be a practice both useless and dangerous.

LOCALIZATION OF FOREIGN BODIES

THE STANDARD METHODS APPROVED BY THE SURGEON GENERAL'S OFFICE, U. S. ARMY

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EXPERIENCE in military service during the present war has served to nphasize the importance of rapid and asonably accurate methods for the lolization of foreign bodies. The ordinary ractice of roentgenology, as a rule, has ttle to do with this phase of the subject. 1 civil practice methods could be used hich required a considerable amount of me, and it was usually possible to conılt with the surgeon and to repeat observations to an extent quite impossible in ne present emergency. The localization of nall projectiles in the eye had been deeloped in quite a satisfactory manner and o distinct improvement therein has been ttempted. During the war abroad a varity of methods and appliances have been sed and the choice of method has been eft largely to the individual operator, since ircumstances prevented systematic attenion to either mechanical equipment or pecial training.

According to the reports received from everal excellent surgeons in active service t the front, it would be desirable, and may ven be regarded as necessary, that all of he injured should have the benefit of an -ray examination; since it has been found hat there are many cases where foreign odies split off after entry, or are in such nexpected or peculiar positions that they an hardly be successfully handled without he evidence available from such an examnation.

In order to work on such an extensive scale it is necessary to consider very carefully the relation of *x*-ray work to surgery, and to analyze the methods which are to be employed with reference to simplicity and certainty, and to pay particular attention to the reports and information needed by the surgeon in order to facilitate his work. In this connection it may be remarked that there is a distinction between the *x*-ray requirements in evacuation hospitals and base hospitals. In the former, speed is essential and simple apparatus must suffice. In the latter, a more complete equipment would be expected. It may be well to recognize that time will not permit the use of plates or films in the evacuation hospitals and dependence must be put almost entirely upon fluoroscopic work. Consequently, all arrangements in hospitals near the front must conform to the conditions imposed by fluoroscopy.

As regards the methods that have been selected, it is not claimed that they are original, and no effort has been made to get any universal or entirely new procedure. After consideration of many methods it has been deemed wise to limit selection to those that best meet certain requirements. Among the desirable features more or less well met by various methods we may mention:

1. The apparatus required should be simple.

2. The manipulation should not require an undue amount of skill.

3. The time required should be a minimum consistent with reasonable accuracy.

4. All operations likely to lead to error must be excluded.

5. The comfort of the patient should be considered.

It must also be remembered that the operator is an essential part of the localizing apparatus and it is perfectly evident that medical men have not generally been trained in geometry and algebra. It is therefore necessary to devise methods which will relieve the operator of computation and thus reduce the chances of error, especially when an enormous amount of work is to be done under trying conditions. Among the operations giving opportunity for error even in ordinarily competent hands we may note:

1. Reading of fine scales.
2. Reading any scale in bad light.
3. Making arithmetical computations.
4. Drawing diagrams.
5. Changing from bright light to read scales and back to fluoroscopic work.

Attention has therefore been directed to such accessory devices and organization of steps as would tend to eliminate these contributing sources of error.

In limiting the number of methods for which provision is made there is no intention of denying that others may be equally useful and accurate, and it is no criticism of the methods or their advocates that they have not been selected. It was deemed more desirable to have a few methods for which careful provision had been made and in which men could be well drilled, but it is entirely optional with the roentgenologist which method he will use in any given case. It would be impossible to provide apparatus for all the methods that might have been proposed or advocated.

Reference to the standard methods has been made by letters instead of by the names of those responsible for their development. This is not done with any idea of detracting from the credit of the authors or of indicating novelty, since no claim of priority is made or desired, but simply because descriptions vary in the literature and might be quite confusing to the reader who tries to follow directions that do not apply to our apparatus.

Before discussing the various methods in detail, it may well be pointed out that refined mathematical accuracy is not generally a requisite for good service in this connection. As was remarked by Major James T. Case, Director of Roentgenology of the American Expeditionary Forces, "This war is not being fought with bird shot and a localization, as a rule, to ½ cm. will be entirely satisfactory." In a few cases, such as bodies in the eye or where a small foreign body is in a particularly dangerous and troublesome place, greater accuracy may be required, but it is necessary for the surgeon to keep in mind the fact that because of the incision and the introduction of retractors there may result a considerable displacement of the projectile and it is often difficult to connect its position with displaced skin marks. It may also be remarked that in the majority of cases a certain amount of anatomical localization should be given by experienced and well-trained roentgenologists which in many cases may be of greater value than a simple depth determination. Whether or not this is well done will determine to a considerable extent the value of the *x*-ray service, and every opportunity should be given the roentgenologist to ascertain the landmarks used in surgery and to adapt his work to the requirements of the surgeon using his data.

The various localization methods may be divided into two distinct groups. In the first of these a mark is made upon the skin and the distance of the projectile from this mark is determined. It is generally assumed that the skin mark was made at the place of emergence of the beam which formed a shadow of the projectile and that the tube focus was adjusted vertically beneath the projectile. A vertical line drawn later through the skin point can only strike the projectile if the body of the patient is placed in the same position on the operating table as it occupied during the *x*-ray examination, and careful distinction must be made between a vertical line as so described, and a line perpendicular to the surface of the skin at the marked point. The amount by which the surgeon may miss the projectile by failure to get a correct sight line increases materially with increased depth of the projectile and with decreased dimensions, and some idea of the size of the body sought should always be given. Much greater care will surely be needed in the localization of the smaller bodies.

In the other group of methods some material guide is given to the surgeon to assist him during operation and as a rule these require more time, both on the part of the roentgenologist and the surgeon's assistants. They are naturally better adapted to the work done in the permanent or base hospitals.

After receiving reports from both surgeons and roentgenologists abroad, and after conference with Major James T. Case, Director of Roentgenology of the American Forces in France, in which appliances and methods were carefully considered, it was decided by the Surgeon General's Office to adopt and provide apparatus for the following methods:

A. Two wire, double tube shift method.

B. Parallax method.

C. Tube shift method with mechanical triangulation.

D. Profondometer.

E. Hirtz compass with accessory devices.

F. Cannula and trochar with harpoon.

It happens that the first three of these are simple depth measurements, although B may give more than one depth, whereas the last three may be used to give more definite guidance to the surgeon during operation.

Brief descriptions of these methods will probably suffice excepting for those who are to specifically undertake the x-ray work and they will find detailed instructions in the revised *Army X-Ray Manual* which is shortly to be issued.

It is assumed that the majority of the work will be done with the standard x-ray table by fluoroscopic methods and with the tube below the table. The tube box is movable in two directions as in the usual trochoscope and is provided with a double shutter giving a diamond-shaped opening with the diagonals parallel and perpendicular to the length of the table and also with an adjustable slit, under separate control, parallel to the length of the table. The tube box runs freely and may be locked in any position against both lateral and longitudinal movement, and is also provided with a simple means for fixing the amount of tube shift for a particular purpose or for measuring any shift from a fixed position.

The fluoroscopic screen is carried by a ball bearing carriage mounted on the table rails and provision is made for a movement parallel to the table, for rotation about a vertical axis and also for a vertical shift. Each of these movements may be prevented by a suitable, convenient lock. The fluoroscopic screens are perforated with a small hole through which a marking device may be inserted to mark the skin in the vertical ray. When this ray is spoken of it is assumed that the table will be substantially in a horizontal position and that a line joining the target with the center of the diaphragm will be perpendicular to the plane in which the tube may move. The opening in the screen also serves a very convenient purpose in temporarily fixing in position the scales and other pieces of apparatus which it is desired to use on the fluoroscopic screen.

Method A. Probably the most generally used fluoroscopic method is that designated in our work as Method A. This method was proposed since the beginning of the war by Professor Strohl of the French Roentgenological Service. It is extremely rapid, reasonably accurate, and, as it requires a minimum of manipulation it is likely to be the method of preference for work in the evacuation hospitals. In this, as in the other methods here described, it is assumed that the standard apparatus adopted by the x-ray division of the army will be used.

The apparatus supplied for the standard equipment includes a substantial brass frame, carrying two wires firmly attached across two opposite corners and protected by a thin sheet of aluminum. These wires move with the tube box and when the diamond-shaped shutter is wide open they would cast shadows upon the fluorescent screen and these shadows, of course, move with the tube box. After bringing the shadow of the projectile to the center of the fluoroscopic screen and marking the skin through the opening provided, the operator places in position a small celluloid scale with two sliders. He then shifts the tube until the shadow of one of the

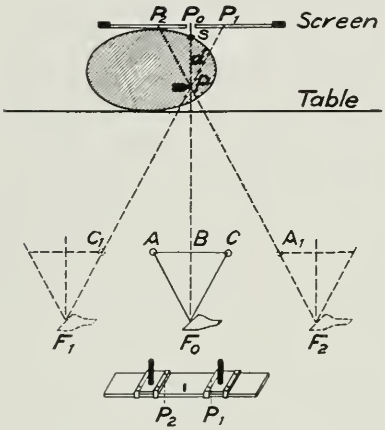

Fig. 1. Principle of the Method A Above. Simple Slider for Measurement of the Distance between the Two Images Shown below Diagram.

wires carried by the box coincides with the now displaced shadow of the projectile and adjusts one of the sliders to mark this position; then shifting in the opposite direction and leaving the first slider and the center of the device fixed, the shadow of the other wire is brought to coincidence with that of the projectile and the second slider fixed accordingly. The distance between these two markers is in a definite proportion to the distance from the fluoroscopic screen to the projectile in question, and by means of a properly designed scale the depth in centimeters and fractions of a centimeter can be read directly. In case the central point of the screen is not in contact with the skin where a mark is made, it will be necessary to correct for the distance between the skin and the screen. This is not necessary when the point marked is actually in contact with the horizontal screen.

On account of its extreme simplicity and the fact that only a single measurement has to be made, and that the target-screen distance need not be known, this method has been placed first in order of preference.

The principle of method A is illustrated by Fig. 1, which shows a vertical section through the foreign body P, and the target focus F_0. B is the foot of a perpendicular from F_0 on the line AC. A and C are the two metal wires rigidly attached to the tube box and equidistant from B. Let P_0 be the shadow of P by the vertical ray. If we shift the target parallel to the screen and to the left, both A and C being fixed to the box, they must move with it and at a certain point F_1, C_1 and P will fall on the same line, and the shadow of C in the position C_1 will coincide with that of P at P_1. Likewise, shifting the target to the right will bring A_1, F_2 and P into the same straight line, F_2PP_2.

Since F_1P_1 is parallel to F_0C,
F_2P_2 " " " F_0A,
and P_2P_1 " " " AC,

the triangles F_0AC and PP_1P_2 are similar. Consequently P_0P = depth of P below $P_0 = d$, is in the same proportion to P_1P_2 as BF_0 is to AC. Or we may write,

$$\frac{\text{Depth of projectile}}{\text{Image shift}} = \frac{\text{Height of } B \text{ above } F_0}{\text{Distance between } A \text{ and } C}$$

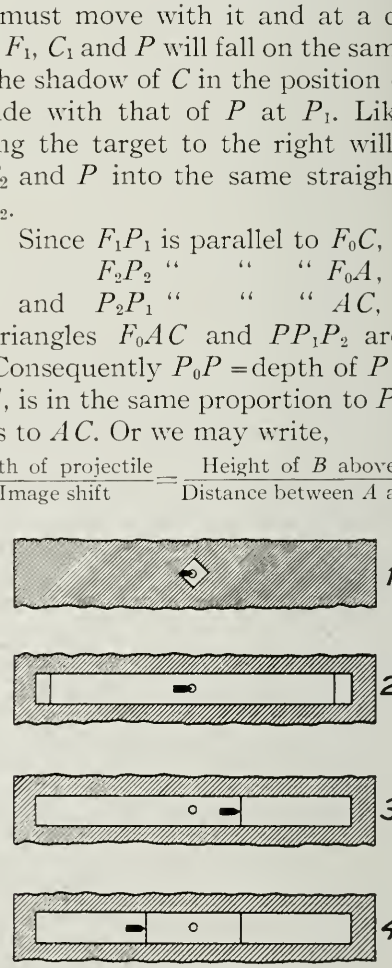

Fig. 2. Successive Appearances on Fluoroscopic Screen in Method A.

(1) Shadow of projectile with small diaphragm at the central point of the screen. (2) Rectangular diaphragm replaced by slit opening, shadow of wires at right and left. (3) Tube has been shifted to the left, bringing the shadow of the projectile and the right hand wire to coincidence. (4) Reverse shift of the tube bringing left wire and projectile shadow to coincidence.

The latter ratio is constant and is fixed the set-up on the regular army x-ray ıble.

Hence d = image shift multiplied by a ›nstant, k, that is

$$d = P_1P_2 \times k.$$

f we read P_1P_2 in centimeters and multiply ›y k, d will be found in centimeters.

The special sliding markers, described bove, are shown in Fig. 1. The center ›in drops into the hole in the lead glass ınd prevents slipping.

To avoid multiplication a special scale is ›rovided. The distance, P_1P_2, read on this scale gives the required depth. This scale is *ıot a centimeter scale*, but the readings give depth in centimeters and fractions thereof for a proper height adjustment of the tube.

Fig. 2 shows screen shadows in steps of this method. In 1 is seen shadows in central ray; 2 shows open slit and shadows of wires; 3 shows coincidence of shadow and right hand wire, and 4 points for measurements.

Method B. This method utilizes the optical principle of parallax and may be carried out with extremely simple apparatus, although a more elaborate device has been provided. If one observes the shadow of a projectile upon the fluoroscopic screen,

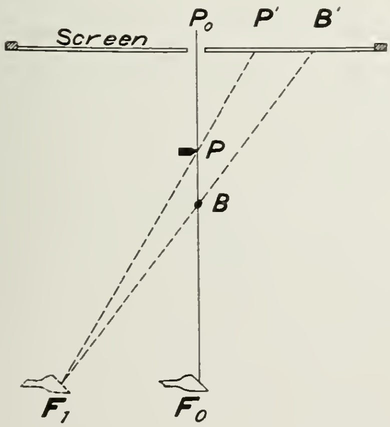

Fig. 3. Principle of the Parallax Method.

Auxiliary body, B, below P and distal from the screen shows greater shadow displacement to B'.

while the tube is moving and the projectile is very close to the screen, the shadow movement for a given tube shift will be very slight and the farther the body is removed from the screen the greater will be the extent of the shadow motion. If we ad-

Fig. 4. Ruled Celluloid Sheet to Indicate Equality of Motion of Two Shadows in Method B.

just a suitable opaque body outside of the patient until its shadow moves the same distance for a definite tube shift as was moved by the shadow of the projectile for the same tube displacement, the auxiliary body must then be as far from the screen as the projectile whose depth is sought.

In the case of a projectile in the abdomen, so far from the lateral boundary of the body as to preclude simultaneous observation of the indicator shadow and that of the projectile, the adjustment of the latter may be made after the patient has been removed, *provided the screen has been locked against vertical motion* so as to remain at the same distance from the target as before. Generally, however, the indicator may be moved up and down in a plane, passing through the projectile and perpendicular to the axis of the body, close enough to the patient to permit free motion and allow both shadows to be seen at once.

By means of parallel lines ruled on a transparent piece of celluloid it is fairly easy to ascertain when equality of motion of the two shadows is secured. In the more complete apparatus furnished for this work, Fig. 5, it is possible to mark the skin at the entrance and emergence point of the vertical ray and also along a continuation of the rod carrying the special indicator. This really gives three independent depths with some corresponding advantage to the surgeon.

The principle of this method is shown in Fig. 3 where

F_0P_0 represents the vertical ray,
P " " foreign body,
B " an auxiliary body opaque to the rays and adjustable at will.

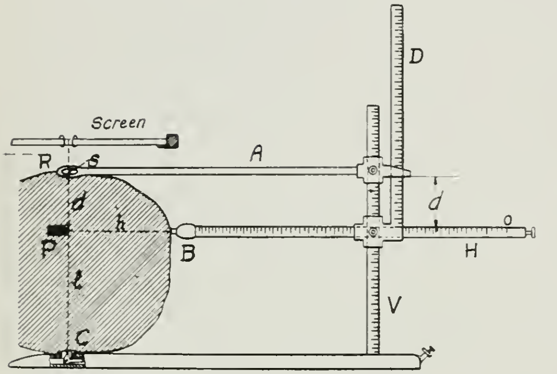

FIG. 5. SCHEMATIC DRAWING OF THE BLAINE MODEL PARALLAX LOCALIZER.

The shadows of P and B are shown as though they were in the plane of the paper, but this is not the actual case, as B will be quite outside this plane.

If, now, the target is moved toward the left to F_1, the shadows appear at P' and B', and P_0B' is greater than P_0P' if B is farther from the screen than P.

By raising or lowering B a position may be found where, on shifting the tube, the shadow of B and P move at the same rate. Then B and P are the same distance below the screen. The ruled sheet of celluloid, Fig. 4, is a convenience in making sure that P and B move the same amount when a convenient tube shift is made.

Apparatus.—The apparatus may consist essentially of the following parts, Fig. 5.

A base of suitable size carries a vertical post, V. Sliding on this post are two rods at right angles to P that may be adjusted vertically at will. The upper of these is not adjustable laterally so that the ring, R, is at a fixed distance from the upright, V. The other rod carries a ball, B. This may be perforated to permit of a projecting skin marker. B may be shifted in two directions at will. When adjusted so that its shadow moves at the same rate as that of P, when the tube is shifted, the distance between the rods, d, is the depth of P below the ring, R. This is true independently of the screen position.

By using three scales, D, H, and V, we may find the distance from the skin to P in three directions, viz., PR, PB, and PC. In all cases d and h should be observed and R and B marked. If the opening in the base, C, is used in centering, RC and PB are at 90°.

METHOD C. The single tube shift method with triangulation has appeared in a great variety of forms. Some of these involve the drawing of diagrams and the use of algebraic computation. In many cases the apparatus was designed to work at a fixed tube screen distance, which has certain disadvantages. The principle of the method is shown in Fig. 6.

Let F_0 be the target in such a position that the vertical ray at right angles to the plane of the tube movement projects the shadow of the foreign body, P, on the hole in the screen.

Shifting the tube to F_1, there will result an image shift to P_1,
and the triangles P_0P_1P and F_0F_1P are similar. Also F_1QP_1 is similar to each.

Therefore $\dfrac{P_1Q}{F_1Q} = \dfrac{PP_0}{P_0P_1}$, or $PP_0 = P_0P_1 \times \dfrac{P_1Q}{F_1Q}$

i.e. depth of foreign body = image shift × target-screen distance divided by sum of tube shift and image shift.

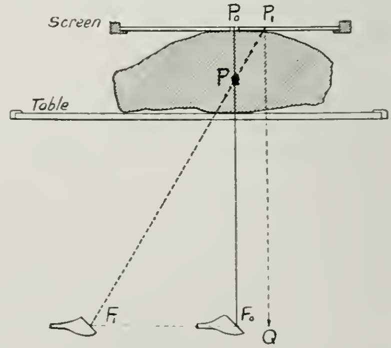

FIG. 6. PRINCIPLE OF THE SINGLE TUBE SHIFT METHOD.

Where no auxiliary apparatus is sup-ied, one must measure the various lengths y a scale and make a numerical computa-on. This may be made easier by the use special devices.

1. One may use a fixed tube shift of 10 15 cm. or an image shift of an exact umber of centimeters.

2. One may use a fixed target-screen dis-ance. This is not, however, always con-enient.

3. One may reproduce the exact set-up f Fig. 6 by use of a device as shown in Fig. and which may be supplied in case of a lesire to use this method.

This consists of two straight bars, *A* and *B*, at right angles to each other. *B* carries an adjustable slider, *R*. *A* carries two sliders, *E* and *G*. *E* is not moved after one adjustment unless a new table is used. The slider, *G*, has notches, 1, 2, etc., 1 cm. apart, and a slider, P_1, with a latch engaging these notches. A scale, *S*, with its zero point at the upper end is carried by *G*. A lug at *H* is in line with the zero of *G*.

If, now, DH = tube shift,
GH = target screen distance,
$P_1 0$ = image shift,

then a straight line, P_1D, will cross the scale, *S*, at the depth of the foreign body below the screen. The instrument should be fastened to the wall in a convenient place and the measurements needed should be made by a caliper, thus avoiding any reading of scales except the final depth.

If in the particular case illustrated, the image shift were 4 cm. and the zero point of scale, *S*, is set above *H*, an amount equal to the target-screen distance, and DH is the tube shift for an image shift of 4 cm., a string drawn as indicated will cross the scale at a point *P* and the scale reading at this point is the depth sought.

When using the standard table the slider, *E*, is adjusted so that a length measured on the screen-carrier support will show how much above *E* we must place *G* in order that GH may represent the target-screen distance.

It will be observed that this instrument serves to reproduce tube and image positions as actually observed by the roentgenologist; i.e., one vertical ray in which the skin is marked and one oblique ray whose intersection with the former corresponds to the distance of the projectile from the screen.

An accessory device is also supplied consisting of a strip of celluloid with a

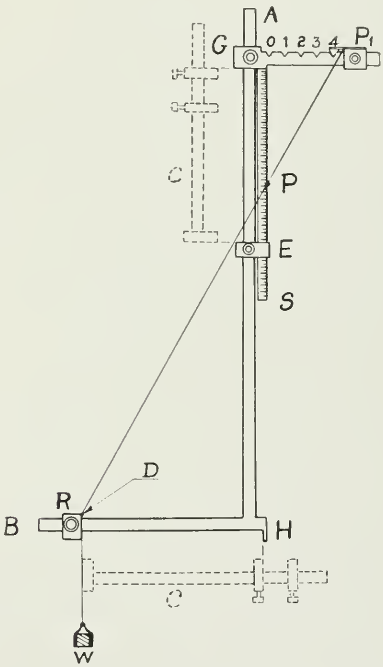

Fig. 7. Wall Meter or Indicator for Tube Shift Method, also Showing Method of Using Adjustable Double Slider Caliper.

pin centering in the perforation of the screen and having centimeter divisions clearly marked both ways from the center, making it quite easy to secure an exact number of centimeters displacement.

There is a considerable advantage in making the distance the image is shifted a definite number of centimeters and measuring the tube shift, since the relative error in measuring the small length of image shift is greater than that in the longer tube shift.

When supplied with the accessories indicated above, this method becomes as expeditious as others, and is as accurate as any of the depth methods. The exact details of manipulation are, of course, given in the regular *Army X-Ray Manual.*

All of the second group of methods require somewhat different manipulation and an added amount of data which may give the surgeon rather more definite indications and assist him materially in many cases.

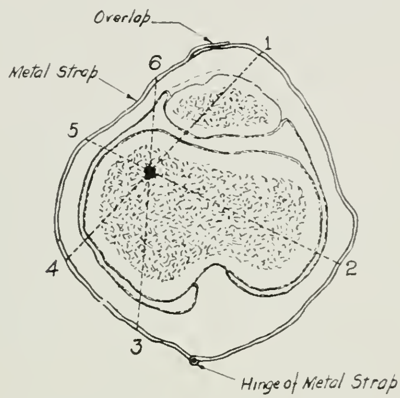

FIG. 8. PRINCIPLE OF PROFONDOMETER STRIP.

METHOD D. This method has been described by Major Joseph M. Flint in *The Military Surgeon* of March, 1917, and while the method is not new in principle it had not been generally used heretofore, as apparatus for its application was rarely available. It consists essentially in securing three lines of sight through the body, each of which is to pass through the projectile. The points where the rays enter and emerge in establishing these lines are plainly marked on the skin. Two pieces of flexible metal, such as a composition of tin, are hinged together in the middle and placed around the body in the plane of the skin marks and made to conform to the shape of the body. The strip is marked, showing the distance that one unhinged end overlaps the other, and the skin marks are transferred to this metal band. Carefully removing the latter from the body, it may be laid down on a card or a sheet of paper, and by bringing the overlapping end to its original position a tracing with a pencil will show the outline of the body in the plane of examination. The skin mark positions are then transferred to the diagram and we have an approximate duplicate of the shape of the body and the locations of the external skin markings.

If, on this diagram, Fig. 8, one numbers the skin marks in series 1, 2, 3, 4, 5, and 6, and joins 1 and 4, 2 and 5, and 3 and 6, and if the work has been strictly accurate, that is, if the sight lines were properly established, and if the shape of the body did not change by change of position when the band was put on, supposing the band has been properly formed and not distorted afterwards, these three lines will intersect in a point; practically they are likely to form a small triangle, but with an excellent chance of the projectile being located in this small area. If one now identifies the diagram, so formed, with a cross section anatomy for the same region of the body, definite anatomical information as to the position of the projectile and the relative position of muscles or organs likely to be encountered in its removal is gained.

It is also possible to use two short bands at right angles to each other, that may be made to conform to the body at a desired point, and to mount an indicating rod for use during operation.

The value of this method will depend to a considerable extent upon the care exercised in forming and handling the strip and in properly adjusting it to the cross section anatomy. It is suggested that in many cases at least one of the skin marks might well have definite relation to some anatomical landmark, so that there could be little opportunity for a rotation of the band with reference to the anatomical chart. This will be especially true of portions where the cross section is nearly a circle. It should also be observed that the accuracy of this method increases when the three sight lines are made to differ materially in direction. In some cases this would be a difficult matter, as in the case of a seriously wounded patient or one for whom change of position on the x-ray table is painful.

It is advised in every case that three lines f sight be determined, marking six skin oints, and for this purpose the parallax ocalizer furnished in the army outfit will e found very valuable, as it permits of narking the skin on the under side with the ame degree of certainty as on top. It may e noted also that the method here decribed eliminates the necessity of using nore than one distinctive skin mark, and t would do no harm, when using this nethod with a parallax localizer as a markng device, if at least one depth were determined as a check upon the accuracy of adjustment of the profondometer band.

Those who are especially interested will find articles by Major Flint giving more details with reference to this method in *The Military Surgeon* of March, 1917 and the *Annals of Surgery* for August, 1917.

METHOD E. There have been devised both before and during the war a very considerable number of mechanical indicators or compasses to be used during the operation as a surgical guide to better utilize information acquired by the *x*-ray examination. Of these, the one devised by Dr. Hirtz of the French Roentgenological Service has been most generally approved by roentgenologists and surgeons.

As originally proposed this instrument was intended to be used in connection with photographic work, whereby a permanent record could be made for the later setting of the compass, provided the identifying skin marks were not obliterated. On account of the very considerable time necessary to prepare a negative for examination and measurement, it has been found desirable in many cases to operate the compass by data secured from fluoroscopic examination, which is much more expeditious and in many cases will serve fully as well.

The essential feature of the Hirtz compass is the possibility of adjustment of the movable legs that support the instrument, so that when resting on fixed marks on the body of the patient the foreign body will be at the center of a sphere, a meridian arc of which is carried by the compass. This arc is capable of adjustment in any position about a central axis. An indicating rod passes through a slider attached to the movable arc in such a way as to coincide in

FIG. 9. HIRTZ COMPASS.

all positions with a radius of the sphere, and whether it actually reaches the center or not it is always directed toward that point. If its movement to the center of the sphere is obstructed by the body of the patient, the amount it lacks of reaching the center will be the depth of the projectile in the direction indicated by the pointer.

The value of the compass lies in its wide possibility as a surgical guide, in that it does not confine the attention of the surgeon to a single point marked on the skin, with a possible uncertainty as to the direction in which he should proceed in order to reach the projectile, but gives him a wide latitude of approach and explicit information as to depth in a direction of his own selection.

The compass is shown in Fig. 9 and schematically in Fig. 10. Three metal arms respectively labeled 1, 2, and 3 in clockwise rotation are so mounted as to turn freely upon a central pivot and have their upper surfaces all in a single plane. Each of these arms carries a slider, which may be adjusted to any position along the length of the arm. Each slider has an adjustable leg

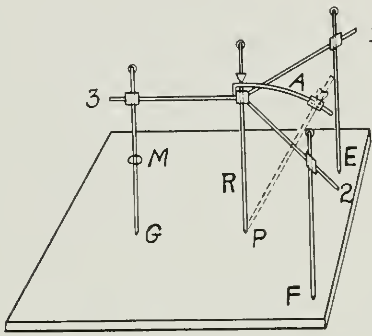

Fig. 10. Schematic Drawing of Hirtz Compass with the Legs Adjusted at Zero Points and Resting on a Plane.

at right angles to the plane of the arms, that may be held in any position by a small thumb screw. These legs are graduated and the zero point is not at either end of the legs, but a few centimeters below the upper portion, which terminates in a small knob. The center post about which the arms rotate has a hole at right angles to the plane of the arms and is also shaped to carry the curved metal arc, *A* (Fig. 10). The hole in the slider on arc, *A*, carrying the indicating rod, can be made to coincide with the opening through the center post.

When the three legs are set at zero, quite irrespective of the position of the slider on the arms or of their angular position, and the compass stands on a plane surface, the indicating rod, passed through the slider on arc, *A*, will touch the supporting plane at the center of the sphere of which *A* is a meridian arc. A friction clip on the indicating rod may be adjusted in contact with the slider on *A*, and the distance from the lower end of this clip to the pointed end of the indicator will be the radius of the sphere of which *A* is an arc.

Fig. 11 shows the compass with the legs shifted so that they no longer stand on the base plane, and in fact are at quite different heights, but the arc, *A*, and the arms of the compass have *not been displaced*, so that the pointer still reaches the center point *P*, in this plane.

Fig. 12 shows the compass actually set upon the body of a patient, its legs resting on three skin marks, *M*, *N*, and *O*, and with the indicating rod pointing toward the projectile, but failing to reach it because of contact with the skin of the patient at *S*. The depth of the projectile in this particular direction is indicated in Fig. 12 by *d*. If, now, the indicating rod is placed in the slider carried by the arc, *A*, the rod touches the skin at a different point, *S′*, and the distance between the friction clamp on the rod and the upper surface of the slider on the arc, *A*, will be the depth of the foreign body along the direction indicated by the dotted line. It is evident from the construction that the surgeon may place the arc, *A*, in any position throughout 360° and the slider at any position from the center to the extreme end of the arc and still have the indicating rod point to the foreign body and show its depth from the point of contact with the skin.

The exact amount which each leg of the compass must be shifted from its zero point in order to stand on the marker to which it belongs and yet have the indicating rod in the proper position is easiest seen in Fig. 13 in which only a single leg of the com-

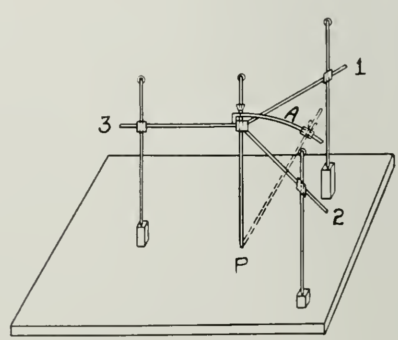

Fig. 11. Arms and Indicator of the Hirtz Compass.

Same position as in Fig. 10, but with the legs elevated on blocks whose tops might correspond to a skin marker.

pass is shown, but the same will apply to each of the legs in turn. Imagine a plane parallel to the plane of the three arms of the compass to be drawn through the projectile and that the leg attached at arm number one, standing on the marker, M, would, if it could pass down to this plane, intersect the plane at the point, E, and that under these circumstances the indicator passing through the central post of the instrument would touch the skin at S, vertically above P. If the distance from the plane, from which measurements are made, to the lower plane, containing the projectile, is measured and likewise the distance MM', it is seen that the amount by which this particular leg is raised from its zero point, where it would be set if it reached the point, E, will be the difference between the depth of the foreign body and the depth of the marker from *any plane of measurement*, for example, that of the fluoroscopic screen or a photographic plate. The fluoroscopic screen may be placed in any position parallel to the base plane, EP, and the difference, ME, would be quite independent of the height of the plane from which *all measurements* are made.

This may be summarized by saying that each rod is to be shifted from its zero point an amount equal to the *difference* between the depth of the projectile below the fluoroscopic screen, or other plane of reference, and the depth of the skin mark upon which this particular leg would stand, measured from the same plane. It is absolutely essential in the use of the compass to adopt a systematic procedure, so that the arm to carry the leg is identified with the depth measurement of its own skin point.

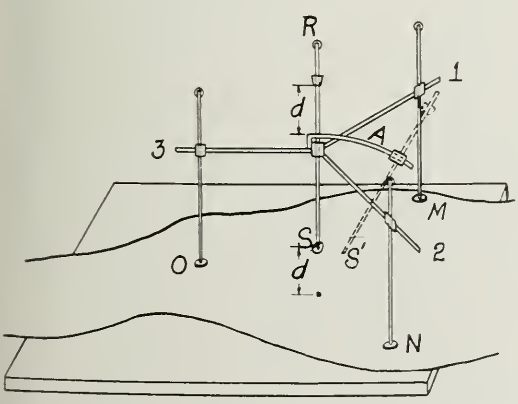

Fig. 12. Schematic Drawing of Hirtz Compass Set up on Skin of Patient.

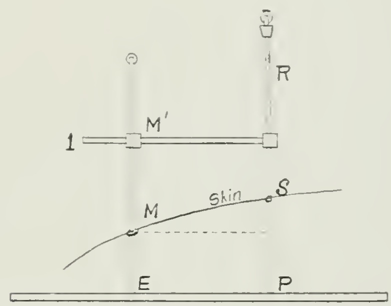

Fig. 13. Reason for Shift of Leg of Compass from Zero Point by the Amount Stated.

The data necessary to properly adjust the compass may now be stated by reference to Figs. 10 and 13. The indicating rod in the central position and the three legs of the compass mark out, in any plane parallel to the base plane of Fig. 10, four points of definite position in the plane. Any vertical shift of the legs will still allow them to retain their position in lines passing through the points, E, F, G and P. The point G, Fig. 10, is then in a vertical line passing through the marker, M, and the data necessary to set the compass must give the position in a plane of these four points and, in addition to this, must give the depth from a fixed plane, parallel to the base plane, E F G, of the three markers on the skin of the patient and of the projectile within the patient's body. Whether this data is to be found by a photographic or a fluoroscopic process is immaterial, as the steps in its use will be identical.

When a fluoroscopic method is to be used, an auxiliary device may be found of considerable aid in rapidly and accurately securing the requisite data. Such a device is shown in Fig. 14 (a) and consists of three arms, each with a slider very similar to the original compass. In fact the latter may be used with rather less convenience, by removing arc, *A*, and allowing the indicating rod to project a short distance below the center and with the legs temporarily removed. The auxiliary compass has its arms numbered in the same way as the original Hirtz compass and has a projecting pin which fits the perforation in the screen. One of the arms is rigidly attached to a ring concentric with the axis of rotation about the pin, while the other two are movable, but may be clamped by thumb nuts to the ring. It is evident that placing the perforation in the screen in the vertical ray passing through the projectile definitely fixes the position of the center post. If then, each marker in turn is brought into the vertical ray and the arm and slider adjusted so that the hole in the slider matches such a projection of each marker, the three openings in the sliders and the central pin fix the four points which it is necessary to obtain. It then remains to determine the depth of the projectile, for which one of the methods, *A*, *B*, or *C*, should be employed and also to determine the distance from the screen to the opaque markers. When using the fluoroscopic method, the latter depth can be very readily determined by simply passing a suitable measuring rod through the perforated screen, which has been brought into the vertical ray passing through the marker. This depth is to be recorded and accurately identified with the arm carrying the slider corresponding to that particular skin marker. In order to facilitate this measurement a set of three measuring rods with friction clips, differing slightly in shape, are provided. As soon as these four depths and the four marks in the plane of the screen have been determined, the work of the roentgenologist is completed, provided he has made sure that the skin marks are plainly visible. The adjustment of the compass may then be carried out by an assistant to either the roentgenologist or the surgeon, after which

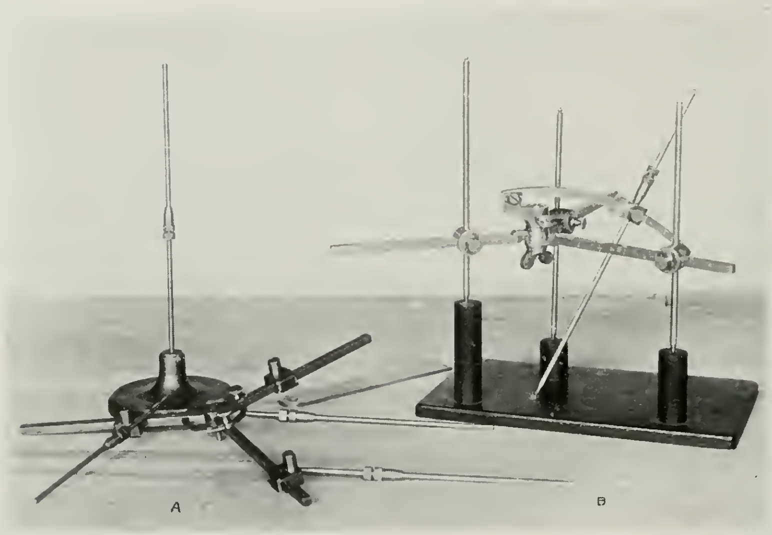

Fig. 14. Accessory Apparatus for Fluoroscopic Work with Hirtz Compass.

(a) Auxiliary compass, pedestal support and three markers with friction clips.
(b) Hirtz compass mounted with the three legs at different levels, so that a pointer reaches white spot on the base plane below at the center of the sphere of which the curved arc is a part.

he instrument can be sterilized and is eady for the surgeon's use.

In making this adjustment the operator must first bring the central opening in the shaft of the compass over the projection P_0 of the projectile in the fluoroscopic plane, and this must be retained in that position during the adjustment of the arms. It is advised that a small hole in a drawing board be provided in case the adjustment is to be made from a diagram and that P_0 be brought over this opening and the paper attached by thumb tacks or otherwise to the drawing board. Then each of the sliders on arms 1, 2, and 3 are to be brought into position, so that the feet of the compass rest on the projections of the markers. After tightening the thumb nuts on the sliders and the wing nut at the center of the compass, which is used to lock the arms in angular position, one should again see that these feet are adjusted to the proper points. Next, bring each leg so that its zero point coincides with the top of the slider by which it is carried. Then, for each leg, subtract the depth of the skin marker from that of the foreign body and adjust the corresponding leg from its zero point by the number of centimeters so obtained, being sure to lock each leg in position. The compass is then ready for use by the simple attachment of the curved arc and the indicator, provided the skin marks which indicate its proper position are not, in the meantime, obliterated. Probably the best way to insure the permanence of these marks is to tattoo them, which may be done by simple apparatus and not be undesirably conspicuous.

When using the special adapter provided with the army outfit, if the compass is to be used at once it may be very quickly adjusted as follows:

1. Remove curved arc and indicating rod, lower each leg until the rounded end is about a centimeter from the slider, and loosen the central lock.

2. Invert the compass and place upon the inverted adapter so that the pin on the adapter engages the central opening of the compass.

3. Adjust each leg in turn to engage the small opening in the sliders on the adapter.

4. Lock all the sliders on the arms and the central lock of the Hirtz compass.

5. Turn the compass right side up and put it on the stand provided, having previously firmly adjusted the sliding clip on the vertical rod of this stand, so that when the compass is placed thereon and the legs loosened in their holders, all three legs will come to their zero, if the base stands on a plane surface.

6. Leaving the compass supported by the stand, adjust each rod as previously indicated, always starting from its zero point.

When the operation is to take place a considerable period after an x-ray examination is made, a suitable record must be entered as a part of the temporary record of the patient and care must be taken that it is accurately labeled, so as to be identified with certainty at the time of operation.

When using the Hirtz compass roentgenographically two exposures are necessary, either made upon a single plate which remains in a fixed position relative to the patient while the tube is shifted, or else two plates may be used with proper markings, one being exposed with the tube in the first position, the other in a second position. The use of the two plates is recommended and in order to superimpose them for the purpose of measurement a small piece of celluloid, which may be attached to the tunnel plate changer, is used and carries two small metal wires forming a cross; when these crosses are made to coincide on superimposing the negatives, the proper measurements may be made.

In order to explain the procedure necessary in this case reference is made to Fig. 15, in which is shown the position of the tube for two successive exposures with reference to the plate and the formation of the shadows of one of the skin markers. It should be noted that each skin marker and the foreign body will be projected in the same way, only the displacement of their shadows in the two exposures will differ according to their distance from the plate.

In the method approved, the distance, CX, from the central position of the tube to the plate in the vertical direction is to be 60 cm. and the tube shift, F_1F_2, is to be 6 cm., that is, from a point 3 cm. to the left of

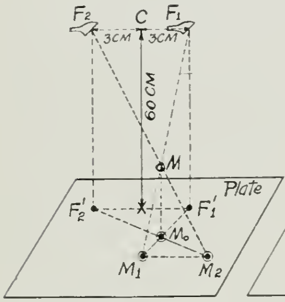

FIG. 15.

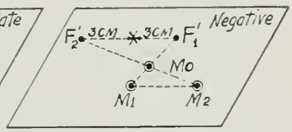

FIG. 16.

FIG. 15. SCHEMATIC REPRESENTATION OF PLATE, CROSS WIRE MARKER AND TUBE FOCUS POSITIONS FOR RADIOGRAPHIC USE OF THE HIRTZ COMPASS.

FIG. 16. CONSTRUCTION FOR FINDING ONE OF THE FOOT POINTS M FROM THE SHADOWS OF A CORRESPONDING MARKER AS SHOWN AT M_1 AND M_2 AND THE SHADOW OF THE CROSS MARKER, X.

C, to a point 3 cm. to the right of C. For this arrangement a table is supplied which gives the height of a point above the plane of the plate, corresponding to any probable shift of image measured on the completed negative, that is, Fig. 15, for a measured M_1M_2 there is given the height MM_0.

The reason for the procedure given with reference to measurements on the negative may be shown as follows:

Let X be the crossed wire marker at the center of the plate; CX a perpendicular to the plate at X and C the level of the tube focus. If M is one of the markers on the skin, it is required to determine M_0, the foot of the perpendicular dropped from M to the plate, and the height M_0M.

According to instructions the exposures are made with the focus at F_1 and F_2 where $F_2C = F_1C$. The shadow M_1 is cast by M when the focus is at F_1. If we draw F_1F_1' perpendicular to the plate, the plane, $F_1M_1F_1'$, is perpendicular to the plate and passes through M. The same is true of $F_2M_2F_2'$. From this it follows that the line of intersection of these two planes, MM_0, is also perpendicular to the plate.

But $F_2'F_1'$ is parallel to F_2F_1 and of equal length. Also M_1M_2 is parallel to F_2F_1 and therefore to $F_2'F_1'$. This at once gives the construction of Fig. 16. There appears on the negative the shadow of the marker X and the two shadows of M at M_1 and M_2. Hence, join M_1 and M_2 and draw a line through X parallel to M_1M_2. Mark one half of the tube shift on each side of X on the line so drawn as F_2' and F_1'. Join M_1 and F_1' also M_2 and F_2'. Then M_0, the intersection of these two lines is the foot point sought.

Measure M_1M_2 in centimeters and fractions thereof and find this length in column marked displacement in the table for this setting and opposite this number read the height of marker or projectile above the plate.

Fig. 17 shows the full chart construction for the feet 1, 2, 3 and the center rod P_0.

The only difference between the plate method and the fluoroscopic is that in the former the reference plane is below the patient and in the latter it is above. The method of setting the compass is the same in each case.

Fig. 18 shows the compass in position on the patient at operation.

METHOD F. This method is one that has been known under various designations and attributed to a variety of authors. It may be described as the method of direct

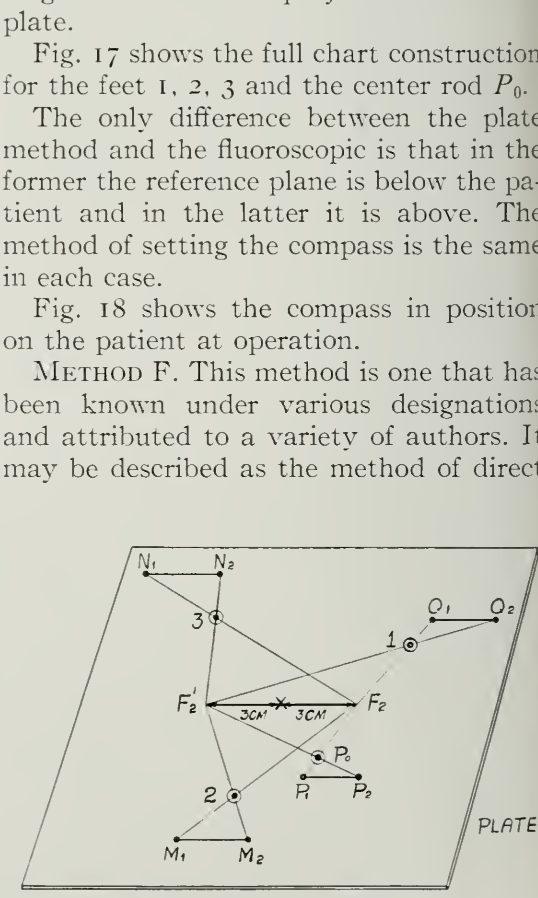

FIG. 17. COMPLETE CHART FOR SETTING FEET OF HIRTZ COMPASS.

pproach through the skin and tissue to the reign body, under fluoroscopic guidance, r, according to the apparatus used, as the nethod of cannula and trochar. While the nethod has been advocated by some excelent surgeons and has naturally given good esults in many cases, it is regarded by the service as the least desirable of the methods dopted and it is urgently advised that it hould never be used excepting in the hands of an operator who will either work under he direct supervision of a competent surgeon or anatomist or who has acquired that degree of anatomical knowledge and surgical judgment which would permit of its use without danger to the patient.

The illustrations in various publications showing the introduction of the instruments at an angle with the line of sight should be completely forgotten, as this method is bound to result in a considerable mutilation of the tissue before one is likely to come in contact with the projectile.

In using the standard army outfit, one should bring the target vertically beneath the projectile, stop down the diaphragm to a moderate size and lock the screen against all excepting vertical motion, with the central perforation in the vertical ray passing through the projectile. Then insert the cannula and trochar through the perforation in the screen and after puncturing the skin press slowly and carefully down in a strictly vertical direction until either contact with the projectile is felt or vision at two slight angles indicates that contact has been made. After this remove the trochar and pass the hooked piano wire or harpoon through the cannula, being sure that it passes beyond the end of the tube and that it is not withdrawn on removal of the cannula. While inserting the cannula it will best be held by use of a strong pair of forceps as provided. These may lie flat upon the fluoroscopic screen and, in this way, keeping of the cannula in a vertical position will be somewhat easier. The wire which has been inserted may, if one desires, be cut off a short distance, ¼ inch, above the skin, or it may be bent down close to the skin and, knowing the length of the original wire, the amount projecting gives the surgeon a definite idea of depth.

Fig. 19 shows the complete set of accessories for localization, as supplied and grouped according to the designating letters.

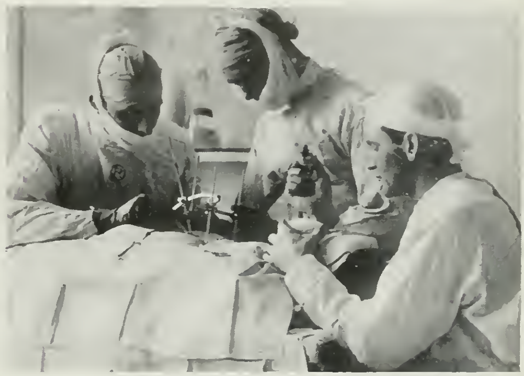

Fig. 18. Hirtz Compass in Position.

Fluoroscopic Assistance During Operation. Several methods have been proposed for the utilization of the fluoroscope at the time of operation, especially where the mobility of the projectile in the tissue and the uncertainty of its position are such as to delay, unduly, the work of the surgeon. The methods so far proposed may be grouped as follows under four heads:

1. The x-ray work may be done in the surgical operating room, thus requiring the surgeon to operate in special light which may be extinguished when he desires to examine fluoroscopically.

2. The patient may be returned to the x-ray room when the surgeon requires further information.

3. The roentgenologist may be called to the operating room for temporary assistance in pointing out the position of the projectile.

4. The operation may be performed with special forceps while using the fluoroscopic light as a guide.

Each of these propositions has its own

difficulties and its own merits. The objections to the first are the bad fluoroscopic conditions which would be likely to prevail and the fact that the x-ray apparatus would be operated at low efficiency, being necessarily delayed by the surgical operation.

In the second, the transfer of the patient back to the x-ray room, provided a suitable stretcher top is used, may, of course, be accomplished, but it involves moving the patient back again for operation and the possible displacement of parts during the transfer.

The objection usually raised to number three is the requirement of x-ray apparatus in the operating room and the possible danger from sparks igniting an ether-air or chloroform-air mixture. The latter can be avoided either by making the x-ray apparatus spark proof or by avoiding these fumes from the anæsthetic in the room. The roentgenologist must be supplied with a bonnet fluoroscope which automatically screens the eyes by suitably colored glasses when he seeks to find his way about a lighted room, and is automatically lifted or removed, when the fluoroscope comes into position.

In this case the process can perhaps be illustrated best by Figs. 20 and 21 showing also the type of indicator used by the roentgenologist and the surgeon; it being understood that the roentgenologist working above the sterile sheet can give an approximate indication, after which the surgeon, using a sterile pointer below the sheet, may, under fluoroscopic guidance by the roentgenologist, insert his indicator until contact is attained, after which the operation may proceed as before.

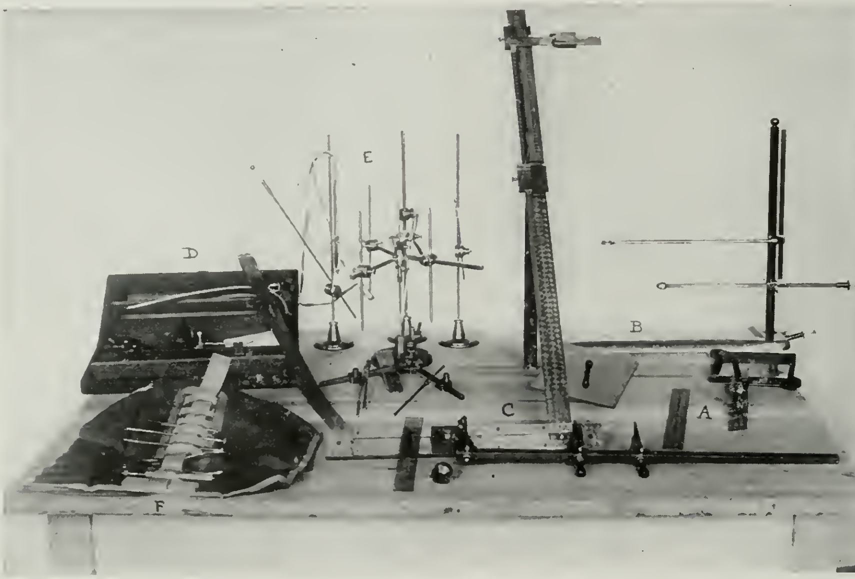

Fig. 19. Set of Localization Accessories Supplied in the Regular Army Outfit.

The fourth method is essentially one for the expert and will probably be of more value when a practical stereofluoroscope is provided.

The following extract from the report of the Director of Roentgenology of the American Expeditionary Forces in France indicates the preparation which will be made for this class of work.

"The ordinary base hospital or portable table regularly furnished by the X-Ray Division of the Surgeon General's Depart-

FIG. 20. INTERMITTENT CONTROL.
Roentgenologist with fluoroscope raised ready to lower it and proceed with examination.

ment of the Army will serve admirably for this type of surgery, either operating with the bonnet fluoroscope in the usual bright light of the operating room, or by artificial light of suitable color in the fluoroscopic room of the x-ray department, with proper arrangements for conveniently extinguishing the artificial light, and turning on the current going to the x-ray tube. An order has been placed for a hundred extra base hospital tables without the screen support, to be issued to operating rooms for this very purpose, our anticipation being that the bonnet method will be far more popular than the open screen method. We have acquired in France a small supply of collapsible operating tables with aluminum tops, also designed for this special type of roentgenosurgical work. Lacking any of these tables, the roentgenologist will be able to improvise a suitable equipment by combining the bedside outfit with an ordinary

FIG. 21. INTERMITTENT CONTROL.
Surgeon and roentgenologist working simultaneously.

stretcher, resting on the regular stretcher supports which will be available in the field.

"It is anticipated that the usual arrangement will be a base hospital table (without screen support) with overhead wire connections from the neighboring *x*-ray room, or there may be provided a special bedside unit without a tube stand with the tube under the table.

"For operations in the usual light of the operating room, there will be needed a bonnet fluoroscope so arranged that when the roentgenologist is not actually working with the *x*-ray, his accommodation will be preserved by means of dark glasses, which are automatically dropped before his eyes when the hood of the bonnet fluoroscope is turned up; a special metal pointer (*indicateur*) for the roentgenologist, one for the surgeon, and a special forceps for projectile extracting of special design to protect the hands of the surgeon from the *x*-rays. A foot switch will be a help, but in the absence of one, an assistant can turn the current on or off at will. Both hands of the roentgenologist must be free, so that he may be able to work."

The following abstract and table is from an article by J. Metcalf and Keys-Wells in the *Lancet* of May 27, 1916.

Depth of Anatomical Landmarks Beneath the Skin.—Surgeons will find the table given below of value in determining the exact position of a foreign body in relation to points on the skeleton. In the article published with this table, the authors state that the surgeon often experiences many difficulties when operating for the removal of a foreign body even after the roentgenologist has made an accurate localization. Previous to the war, the surgeon studied the ultimate depth of his operation only with regard to certain surrounding anatomical landmarks, and not in terms of centimeters or inches beneath a point on the skin. If the roentgenologist reports a projectile as being 4.5 cm. from a point on the skin of the back overlying the transverse process of the 12th dorsal vertebra, the surgeon has little knowledge as to where this depth will lead him. If, however, the surgeon knows that the average depth of this structure is less than 4 cm. from the skin he appreciates the fact that the projectile must lie in or just anterior to the transverse process. The objection is, of course, that individuals vary greatly in thickness of various parts, but the authors call attention to the fact that the soldier is selected after rigid examination and as a result the extremely thin and extremely obese are not present.

TABLE

HEAD: LATERALLY *Incision*	DEPTH OF ANATOMICAL POSITION
Just above zygoma	1 in. to sphenosquamosal suture
Just below zygoma	$1\frac{1}{2}$ in. to sphenoidal bone
To coronoid process or condyle of mandible	1 in.
NECK: ANTEROPOSTERIORLY	
Through center of larynx	2 in. to body of vertebra
$1\frac{1}{4}$ in. to side of center of larynx	$1\frac{1}{2}$ in. to transverse process of cervical vertebra
$1\frac{1}{4}$ in. to side of center of larynx	3 in. total depth of neck
Through middle line of trachea just below cricoid	$1\frac{1}{2}$ in. to body of vertebra
$1\frac{1}{4}$ in. to side of center of trachea	$1\frac{1}{2}$ in. to transverse process of vertebra
From center of suprasternal notch	$1\frac{1}{4}$ in. to posterior border of manubrium
NECK: LATERALLY	
From center of middle of neck.	$1\frac{1}{2}$ in. to transverse process of vertebra
From center of middle of neck	$2\frac{1}{4}$ in. to body of vertebra
From just below tip of mastoid process	$2\frac{1}{4}$ in. to body of 1st cervical

CHEST SUPERIORLY	DEPTH OF ANATOMICAL POSITION
From a point midway between root of neck and tip of acromion	2 in. to apex of pleura, downwards
From a point midway between internal and external extremities and just behind posterior border of the clavicle	2 in. to apex of pleura, downwards
CHEST: ANTERIORLY	
From center of lower border of clavicle backwards to subscapular fossa just clear of ribs	3 in.
From a point just over tip of coracoid to subscapular fossa backwards	3 in.
From a point 1 in. external to sternoclavicular joint just below clavicle	1 1/3 in. to 1st rib
From a point 1 in. external to sternoclavicular joint just below clavicle.	3/4 in. to pleura
From a point 2 in. external to sternoclavicular joint just below clavicle backwards	1 1/4 in. to 1st rib
From a point 2 in. external to sternoclavicular joint just below clavicle backwards	1 3/4 in. to pleura
From a point 2 in. below center of clavicle	2 in. to pleura
CHEST: POSTERIORLY	
To supraspinous fossa	1 in.
To intraspinous fossa	3/4 in.
To transverse process of 7th cervical vertebra	1 1/2 in.
To pleura level of 7th cervical vertebra	2 in.
To anterior level of body of 7th cervical	3 in.
To transverse process of 12th dorsal vertebra	1 1/3 in.
To pleura level of 12th dorsal vertebra	2 in.
To anterior level of body of 12th dorsal vertebra	3 1/3 in.
ABDOMEN: THICKNESS OF WALL FROM FRONT	
1/2 in. to either side of middle line just above umbilicus	1 in.
1/2 in. to either side of middle line just below umbilicus	1 1/5 in.
Just internal to anterior superior spine to iliac fossa	3 in.
Midway between anterior superior spine and pubic crest to front of acetabulum	2 in.
ABDOMEN: THICKNESS OF WALL FROM SIDE	
On level of tip of 12th rib in line upwards from anterior superior spine	1 in.
ABDOMEN: THICKNESS OF WALL FROM BACK	
To transverse process 3d lumbar	1 3/4 in.
To anterior level of body of 3d lumbar	4 1/4 in.
To anterior level of psoas muscle	5 in.
HIP AND THIGH FROM FRONT	
3 in. below anterior superior spine to head of femur	2 1/4 in.
3 in. below anterior superior spine to neck of femur	2-2 3/4 in.
6 in. below anterior superior spine (level of lesser trochanter) to front of femur	1 1/2 in.
To great trochanter	4 1/4 in.
To lesser trochanter	3 1/2 in.
Brim of pelvis 1 in. in front of sacroiliac synchondrosis	3 3/4 in.
To anterior inferior spine	1 1/4 in.
To spine of ischium	5 in.
To ischial tuberosity	5 1/4 in.
To anterior surface of line of junction of ascending ramus of ischium and descending of pubis	2 3/4 in.
HIP AND THIGH FROM BACK	
To ischial tuberosity	2 1/4 in.
To spine of sacrum on level of posterior superior spines of ilia	1 1/4 in.
To sacral groove	2 in.
To head of femur	2 in.
To great trochanter	3-3/5 in.
To lesser trochanter	3 in.
To brim of pelvis 1 in. in front of sacroiliac synchondrosis	4 in.
To anterior inferior spine	6 in.
To spine of ischium	2 in.
To posterior surface of junction of ascending ramus of ischium and descending ramus of pubis	4 1/2 in.

Relation Between the Roentgenologist and the Surgeon. In considering the great responsibility that must be assumed by the medical profession in this serious world conflict, every effort should be made to secure that degree of fair-minded consideration of the different subdivisions that is necessary to carry on this work expeditiously and in a satisfactory manner. This is no time for the exploitation of personal prestige nor for any propaganda in reference to any department or specialty in medicine.

Considered as an end in itself no *x*-ray examination, no matter how well carried out, or accurately reported, or how much is spent in equipment, will be of any value whatever unless it gives such information to the surgeon and the physician as will expedite and facilitate their work. In saying this the writer has no intention of minimizing the importance of the *x*-ray service. Consultation with eminent surgeons who have had actual experience has indicated that roentgenology may be of the very highest importance, but it is especially desired to call the attention of both the roentgenologist and the surgeon to the fact that the full realization of the ends to be attained can only be accomplished by mutual coöperation.

If either party is destructively critical of the work of the other, if either declines to give the information in a usable form or with sufficient accuracy for practical use, or is generally incompetent, it should not be assumed by the surgeon that all roentgenologists are to be condemned, nor by the roentgenologist that all surgeons are wrong or arbitrary. Each may be expected to assist the other in a tactful and effective manner in order that they may jointly realize ways to improve the work.

When time permits, it would be extremely desirable in the Service for the surgeon to attend a considerable number of cases during the *x*-ray examination and to allow the roentgenologist to be present at the operation of these cases. In this way better realization of the specific difficulties, generally unavoidable, which beset the work of each specialist, will be mutually appreciated.

This does not mean that the surgeon should be an expert roentgenologist, or the reverse. Each has a field sufficient for all his abilities and efforts, and division of labor is essential to its rapid performance and to the highest development of the art. But both parties should be jointly responsible for a most important and valuable work in which neither can attain the full measure of success without the assistance of the other.

ADJUNCTS TO ROENTGENOTHERAPY IN THE TREATMENT OF MALIGNANT DISEASE *

BY GEORGE E. PFAHLER, M.D.

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THE profession now recognizes that the roentgen rays have a profound influence upon malignant disease and that, in many instances, the rays alone cause a complete and permanent disappearance of the disease. Like every other method of treatment of malignant disease, however, there are many cases in which the disease will not disappear completely or permanently when one depends upon the roentgen rays alone. Therefore, as roentgenologists, it is our duty to consider the adjuncts, or the various aids, that will help to make many more patients well.

Among these adjuncts, I would place first *electro-coagulation*. It is my custom, in nearly all instances, to destroy superficial malignant disease by electro-coagulation before applying the roentgen rays. This applies to all the epitheliomata of the skin, both the basal cell and squamous cell; all the epitheliomata of the lip and the mucous membrane of the mouth; epitheliomata of the vulva and of the penis. I am sure that I get more patients well, and better and quicker results in this group of patients than by any other means, or any other combination. After the disease is destroyed and the dead tissue curetted away, the area is treated by deep roentgenotherapy, and in mouth cases or mucous membrane cases the glandular areas in the neighborhood are thoroughly treated. This roentgen ray treatment is repeated again in four weeks, and after that as many times as seems necessary, according to the degree of malignancy, the location and the extent of the disease.

As second adjunct, I would place *surgery*, and this is placed second only because it would be second in frequency as utilized by us. In dealing with the great bulk of deep-seated tumors surgery should, of course, receive first consideration, but in every case of malignant disease such surgical intervention should be followed by roentgen ray treatment. To be more specific, I believe that all carcinomas of the breast should be removed surgically if they are in an operable condition and the patient will give consent. Based upon the theory that the roentgen ray decreases the malignancy of the cells and decreases their power of reproduction, as shown by experimental evidence, I have, in a few instances, given a course of treatment covering the mammary glands and the glandular areas round about, and then immediately requested the removal of the tumor, and a complete surgical operation. Time is too short to draw any conclusions with regard to this procedure, but I can say definitely that there have been no unfavorable results. That is, the wounds have healed properly, and without any interference, and in the patients who have been thus treated there have been no recurrences up to date. *Metastatic* glands I believe should always be resected surgically, when it can be done, instead of depending upon the roentgen ray to control their growth. We have all seen enlarged glands disappear under roentgen ray treatment, but we are particularly liable to disappointment in the group of cases in which there had been metastasis from an epithelioma within the mouth, and in these cases I am most thankful for the assistance of a surgeon.

Radium. Radium can be used in conjunction with the roentgen ray, but it should never be applied through the same area of skin or mucous membrane. It can be utilized, however, to great advantage in the treatment of all malignant disease involving cavities. The radium can be introduced within the cavity and the roent-

* Presented in the form of a lantern slide demonstration before the Midwinter Meeting of Roentgenologists at Hotel Traymore, Atlantic City, January 4 and 5, 1918.

gen ray can be used for cross-firing purposes from the outside without any interference. In this way the radium simply furnishes another source of cross-firing and, in many instances, the radium can be brought in much closer contact with the disease than can the roentgen ray through the outside of the body. I have in mind particularly the carcinomas of the uterus, vagina, rectum, the mouth, nasal cavity and esophagus.

Fig. 1. Epithelioma Involving Two-thirds of the Lower Lip. Showing the Result of Combining Excision with Roentgen Ray Treatment.

Brief histories of a few cases will best illustrate the types which will not ordinarily yield to the roentgen ray alone, but which will yield and will get well from combined methods of treatment.

Case 1.—(Fig. 1.) Mr. G. R. Referred by another patient April 25, 1903. Had an epithelioma involving at least two-thirds of the lower lip. It followed a fever blister which developed two years previously. He had had an attempt at removal by a plaster applied by a cancer quack without success. At the time of beginning treatment it was an ugly, ulcerating, vegetating growth of the lower lip. He was given fractional doses of roentgen ray treatment, without filtration, applied three times a week during a period of three months, in 1903. He had, associated with the epithelioma, enlarged submental and submaxillary glands. At the end of three months, at my request, Dr. Laplace excised two-thirds of the lower lip, and the day following I continued roentgen ray treatment. The wound healed without any interruption. The submaxillary and submental glands disappeared and the patient has remained well to date, which is approximately fifteen years. *Remarks:*—I believe that if I had depended upon the roentgen ray alone, especially in that day, that I would have so devitalized the surrounding tissues before I got rid of the malignant disease that I would not have gotten him permanently well.

Case 2.—(Fig. 2.) Mr. J. H. Age 67. Referred by Dr. Jos. Gibbs June 24, 1913. Epithelioma had been developing four months and involved the entire lower lip. This seemed to me to be clearly a case that would not get well by roentgen ray treatment alone. Therefore, I destroyed the entire lower lip by electro-coagulation, for the entire lower lip was involved. There were no palpable submaxillary glands. The wound healed without interruption, and no metastasis developed at any time. Roentgen ray treatment had been given

Fig. 2. Epithelioma Involving the Entire Lower Lip. Showing the Result of Combining Electrocoagulation with Roentgen Ray Treatment.

ver the lip and under the jaw until March), 1914, at which time he seemed to be erfectly well, and he had no signs of recurence at any time nor of metastasis. He

ig. 3. Small Epithelioma of the Lip. Showing the End Result after Electro-coagulation and Roentgen Ray Treatment.

lied of apoplexy October 1915. *Remarks*:— have every reason to believe that this patient would have remained well indefinitely. He, of course, sacrificed his lower lip, but this was replaced in part by an artificial lip, and a beard which were attached by a dentist to a plate in his mouth. It enabled him to eat his food and to carry on conversation so that the average person was unaware of his troubles.

Case 3.—(Fig. 3.) Mr. A. F. Age 61. Referred by Dr. J. E. Bauman February 27, 1915. Epithelioma of the lip about $5/8''$ in diameter involving both the cutaneous and the buccal portion of the mucous membrane. Destroyed by electro-coagulation at once and the lip area and submental region treated by the roentgen rays March 5, April 9, and May 28, 1915. He is well today. *Remarks:*—In this case the roentgen rays alone would have probably given a fifty-fifty chance of recovery, but it would have required considerably more treatment, and I believe less positive results would have been obtained. In using the combined treatment of electro-coagulation and roentgen ray, I count on getting all of these patients well. I have not failed in any epithelioma of the lip that had not been previously treated by caustics or an incomplete operation, and in no case have I had metastasis to deal with. I saw this patient four times in all.

Case 4.—(Fig. 4.) Mr. W. S. M. Age 49. Referred by Dr. W. J. Dubler. An excessive smoker. Had an epithelioma involving the central third of the lower lip, and extending well inside the mouth, apparently extending about one-half inch in depth. Wassermann test negative. The whole area was destroyed by electro-coagulation, followed by three courses of roentgen ray treatment, and there has been no recurrence to date. He continued excessive smoking, and on October 12, 1917, he developed a small new lesion entirely separated from the previous area of involvement, and I believe having no connection with it. This was promptly destroyed with excellent results. *Remarks:* —This is the type of case in which one would expect a local excision and extensive dissection of the tissues of the neck in order to obtain a cure. The above procedure seems to give more satisfactory results with less traumatism.

Case 5.—(Fig. 5.) Mr. S. S. Age 46. Referred by Dr. Ernest Laplace, May 26, 1916. He had an epithelioma of the penis lasting for a year, and involving the glans and about an inch of the corpora cavernosum. It was of the squamous-cell type. The entire glans and about an inch of the

Fig. 4. Epithelioma Involving the Middle Half of the Lower Lip. Showing the Results of Combining Electro-coagulation and Roentgen Ray Treatment.

corpora were destroyed by electro-coagulation, with a portion of the prepuce. He was then given deep roentgenotherapy through ten portals of entry, covering the penis and glandular area leading therefrom, and this course of roentgen ray treatment was repeated again July 3, August 3, October 11, November 21, and December 31, 1916.

FIG. 5. EPITHELIOMA OF THE PENIS. SHOWING THE RESULTS OF COMBINING ELECTRO-COAGULATION AND ROENTGEN RAY TREATMENT.

Since then he has had no treatment, but has remained well and is working daily. There has been no interference with the urinary functions, and in general appearance, when nude, the effects of the operation would not be noticeable. *Remarks:*—There were, at the time of beginning treatment, some very small palpable glands in the left groin. These were not sufficient to be considered metastatic, and yet coul not be definitely ruled out. However, the disappeared under roentgen ray treatment When one considers the frequency wit which recurrence and metastasis develop from epithelioma of the penis followin surgical removal, one cannot help bu feel that this is an advance in the trea ment of malignant disease in this regior and it was this thought which prompte Dr. Laplace to refer the patient to me.

CASE 6.—(Fig. 6.) Mrs. K. L. Age 68 Referred to me by Dr. Wm. L. Rodmar April 3, 1914, with a large, adherent, sci rhous carcinoma of the right breast. It ha been growing five years; had been treate by a plaster without success. It was firml adherent to the chest wall, and involve the intercostal muscles. For this reaso Dr. Rodman considered it inoperable. W could detect no glandular enlargement i the axilla or supraclavicular region. roentgenogram of the chest showed a sha ow of the tumor and in addition a numb of small, dense glands along the mediast num. On account of the absence of pa pable glandular involvement, and with th possibility of the mediastinal glands n being malignant, I considered the con bined treatment by electro-coagulation an deep roentgenotherapy as applicable. destroyed the tumor by electrotherm coagulation, cooking from the surfa downward, and then shaving off the cooke malignant tissue until I reached the inte costal muscles. I had to work very car fully in this way for fear of penetratir the chest wall and lung. This destructio was preceded and followed by deep roen genotherapy over a period of three month the treatment being directed over th wound and toward the mediastinum, o course of treatment being given ea month. She returned to her home the latt part of June 1914, and has had no trea ment since. The wound healed by granul tion. She remained well for two year and then died of apoplexy. *Remarks:*— believe that the breast cases are rare th will be suitable for this method of trea ıent, but in just this type I believe that ıe method of treatment outlined offers ıore hope of permanent recovery than oes surgical removal, even if followed by oentgen ray treatment.

Case 7.—(Fig. 7.) Mr. H. S. Age 54. Referred by Dr. J. R. Umstad, October 31, 913. He had had an epithelioma on his eft forehead for eight years. It had een treated by roentgen rays, by caustics, y curettement, by violet rays, and by arbon dioxide snow, but never got well, nd was always followed by a recurrence. At the time of reporting for treatment, the pithelioma was about $2\frac{1}{2}''$ in diameter and extended down to and involved the outer table of the skull. The whole area was destroyed by electro-coagulation. The patient was told at once that he would require a secondary operation for the removal of at least the outer table of the skull. Following the electro-coagulation the patient received roentgen ray treatment until the wound was healthy in appearance. On March 31, 1914, Dr. Warmuth resected the dead bone, and then did a plastic operation covering the area with a flap of skin removed from the opposite side of the forehead. Both areas healed thoroughly and he has remained well to date, which is more than four years. *Remarks:*—I have never seen an epithelioma yield to roentgen ray treatment when the surface of the bone was eroded or involved by the extension. Therefore, some additional method of treatment must be applied. Likewise one will do well if they warn the patient in advance that surgical assistance will also be necessary. In this case all the various single methods of treatment of epithelioma had been applied without success. At the present time the opening in the skull seems to be filling in with bone. At least, it is quite solid.

Case 8.—(Fig. 8.) Mr. W. E. R. Age 40. Referred by Dr. Ernest Laplace, June 10, 1915. Considered by Dr. Laplace inoperable and hopeless. He had an epithelioma involving the whole inside of the cheek, the superior maxilla, the inferior maxilla, with a mass of metastatic glands under the jaw. I destroyed the disease inside of the mouth by electro-coagulation. Dr. Laplace, at the same time, excised the metastatic glands

Fig. 6. Inoperable Carcinoma of the Breast. Destroyed by Electro-coagulation, Followed by Deep Roentgenotherapy, and Allowed to Heal by Granulation.

and resected half of the lower jaw, which was found to have been almost totally diseased. This was followed by applications of radium inside the mouth, especially in the region of the upper jaw and on the inside of the wound, and he received roentgen ray treatment externally until December 16, 1915, since which time he has had no treatment. In June, 1916, Dr. Laplace closed the opening in his cheek which had been made by the electro-coagulation, and he has remained well, and is working every day since. *Remarks:*—When one considers the extent of this disease it seems that the man is fortunate in recovering, and I believe his recovery is due to the fact that no single method of treatment was depended upon, but that the roentgen ray, radium, surgery and electro-coagulation were all combined and used conjointly to eliminate the disease.

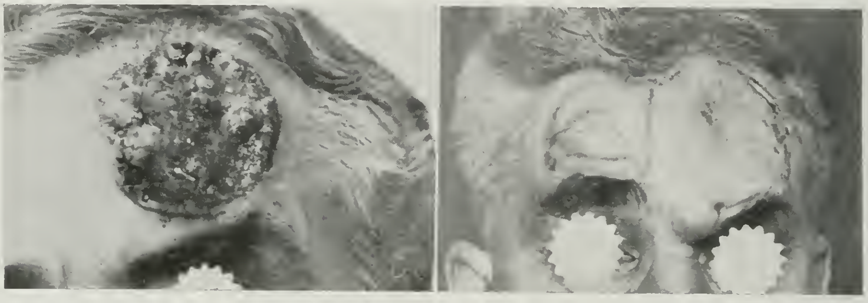

Fig. 7. Epithelioma of the Frontal Region. It Had Been Treated Unsuccessfully by Many Methods, Involving the Outer Table of the Skull. Destroyed by Electro-coagulation, Treated by Deep Roentgenotherapy and Followed by a Plastic Operation.

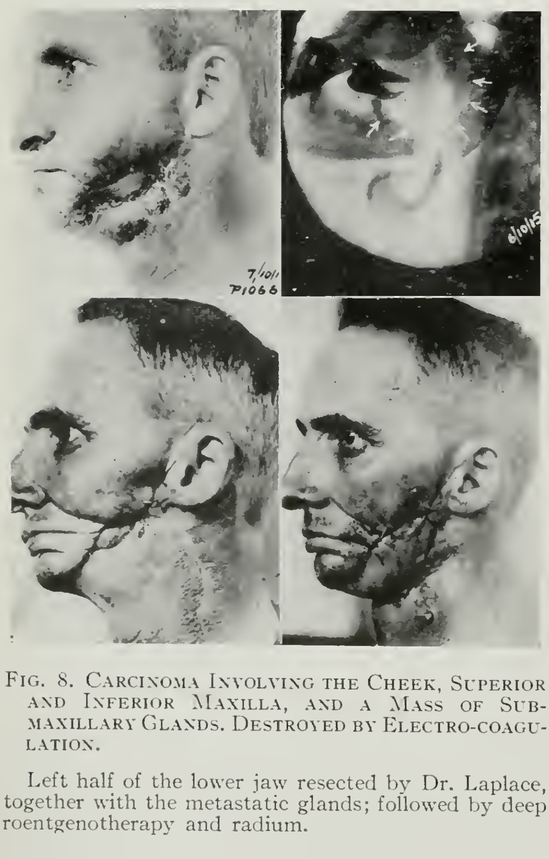

Fig. 8. Carcinoma Involving the Cheek, Superior and Inferior Maxilla, and a Mass of Submaxillary Glands. Destroyed by Electro-coagulation.

Left half of the lower jaw resected by Dr. Laplace, together with the metastatic glands; followed by deep roentgenotherapy and radium.

Case 9.—(Fig. 9.) Mrs. A. M. D. Age 65. Referred by Drs. J. E. Freeman and M. B. Hartzel. Twenty-eight years previously the patient first developed an epithelioma on the right cheek in front of the ear. It continued for three or four years without receiving any attention. Seventeen years ago she had a plaster applied without success. Seven years ago she was treated by roentgen rays in one of the hospital dispensaries. This treatment was continued for four years. At the end of this time, the disease had disappeared and was replaced by scar tissue. When she reported for treatment she had an indurated malignant ulcer in the center of the scar tissue $1'' \times 1\frac{1}{2}''$, and about $\frac{1}{4}''$ in depth. There was no doubt in the minds of any of us as to the malignancy of this lesion, and that it was a secondary malignant degeneration in the scar tissue resulting from former roentgen ray treatment. There was also associated the general firmness, scaliness and telangiectasis that is seen in this type of case. The diseased area on the right side of the heek was destroyed by electro-coagulation together with three small epitheliomata on the left cheek. She was then given a full dose of roentgen ray treatment over each area. The diseased area healed and she has remained well to date. *Remarks:*—This case represents another type in which one cannot expect a cure from roentgen ray treatment, but the violent reaction that follows the electro-coagulation seems to improve the local blood supply in some way and brings about a healing process with general improvement of the local and surrounding tissue.

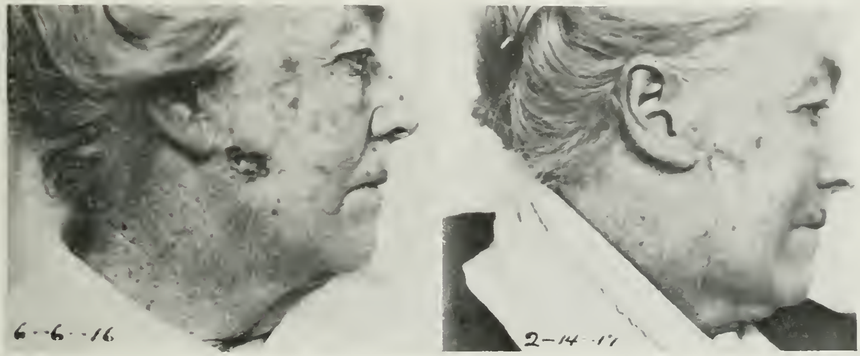

Fig. 9. Epithelioma Developing in a Degenerating Roentgen Ray Scar. Destroyed by Electro-coagulation; Followed by Healing.

Case 10.—(Fig. 10.) Miss E. H. Age 65. Referred by Dr. J. B. Cassidy, February 5, 1917. For five years the patient had been treated by roentgen rays at intervals and evidently with small doses. When she reported to me for treatment she had a great deal of scar tissue about the angle of the jaw, under the ear, an ulcerating epithelioma about two inches in diameter, with an induration, apparently malignant, extending about two inches further upward into the scalp. The whole area was destroyed by electro-coagulation together with about twenty-five small keratoses on the face. The large ulcer was then treated by roentgen rays February 13, March 19, April 14, and May 21, at which time the wound was healed by granulations and the scar tissue appeared to be healthy. It has remained healthy to the present time. *Remarks:*—This patient is another type that would not yield to roentgen ray treatment. There had been so much roentgen ray treatment given in small doses and scattered over such a long period of time that the cells had, in part, developed a resistance to the rays and were probably

Fig. 10. Epithelioma in Front of the Ear Partially Healed by Long Roentgen Ray Treatment, then Taking on Active Growth. Destroyed by Electro-coagulation, Followed by Deep Roentgenotherapy. Healed.

protected more or less by scar tissue. In addition to this the scar tissue, and even the other tissue round about the lesion, had lost its power of repair. In addition to this I have found that when these epitheliomata extend up into the subcutaneous tissues of the scalp they do not respond readily to roentgen ray treatment, but by combining treatment in this way success has been made of what would otherwise have been a failure.

Case 11.—(Fig. 11.) Mr. H. L. Age 64. Referred by Dr. M. B. Hartzel, October 9, 1916. The patient had been treated by roentgen rays for four years for epithelioma of the nose. For a time the disease seemed to have nearly disappeared, but continually recurred and finally the roentgen ray treatment seemed to have no effect upon it. When I first saw him he had lost most of the right ala, but the disease extended deep into the lateral wall of the right nostril and extended up into the bridge so

Fig. 11. Epithelioma of the Nose, Having Destroyed the Cartilage and Extending into the Deeper Tissues. Treated for Four Years by Fractional Doses of Roentgen Rays, Taking on new Activity. Destroyed by Electro-coagulation, Followed by Deep Roentgenotherapy. Healed.

that the cartilage was involved and the surrounding tissue had a dense and firm appearance. I destroyed the entire diseased area, together with about an inch of the outer wall of the right nostril. He then received roentgen ray treatment at intervals of a month during three months. Three weeks ago Dr. Laplace, at my request, did a plastic operation to close up the right nostril. The end result has been perfect. *Remarks:*—This patient would not have recovered from roentgen ray treatment alone, first because the tissues had lost the power of responding to roentgen ray treatment, and second because the cartilage of the nose had become involved. It is my experience that when the cartilage of the nose has become involved it will not get well from roentgen ray treatment alone, though it may improve many times.

Case 12.—(Fig. 12.) Mrs. A. Age 54. Referred by Dr. Stillwell Burns August 11, 1913. This patient received a severe burn of the left hand, in 1882. This healed with a tightly drawn cicatrix which continually cracked open and finally an extensive epithelioma developed about $2\frac{1}{2}''$ in diameter. The diseased area was destroyed by electro-coagulation, and then a course of roentgen ray treatment was given over the hand, over the arm, and in the axilla through six portals of entry. October 27, 1913, the slough had separated and there was an area of healthy granulations. In February, 1914, Dr. Burns very kindly did a skin grafting operation to close over the open surface. The patient has remained entirely well and reports herself in excellent condition, November 20, 1917. *Remarks:*—It is my observation that epitheliomata developing on the basis of scar tissue do not yield well to roentgen ray treatment. There seems to be a lack of reparative power, and in the process of repair the cells find a basis for recurrence. I believe, therefore, that in such cases the disease should either be thoroughly destroyed by electro-coagulation, as was done in this case, or should be excised surgically. It is the type of case in which e should not depend upon the roentgen ay alone.

Fig. 12. Epithelioma Developing in the Scar of an Old Burn. Destroyed by Electro-coagulation, Followed by Skin Graft by Dr. Burns.

Case 13.—(Fig. 13.) Mr. M. E. Age 48. Referred to me by Dr. John B. Deaver, April 10, 1917. In September 20, 1916, Dr. Deaver did an operation for the removal of an epithelioma of the lower lip with metastasis in the right submaxillary region. At the time that the patient came to me for treatment he had a tumor mass attached to and developing from the right lower jaw which was shown by roentgen ray examination to be metastatic disease, and involved the lower jaw bone. We first gave him a thorough course of roentgen ray treatment through eight portals of entry, cross-firing upon the disease, finishing on April 12. On April 16, two days later, at my request, Dr. Stillwell Burns resected the right half of the lower jaw, closing the wound immediately. The patient then received another course of treatment in May through nine portals of entry, and similarly in June, July, August, September and October. He is now working every day, has no signs of malignant disease, and, strange to

Fig. 13. Recurrent Metastatic Disease of the Jaw Bone, Showing Roentgenogram of the Diseased Area and the Photographs Showing the Projection from the Jaw Bone by the Tumor Mass and the Result After Resection and Roentgen Ray Treatment.

say, he is able to chew his food and live a normal life. A casual observer would now not notice any evidences of the diseased jaw in his face, so well was the operation done, and so perfectly have the tissues adjusted themselves. *Remarks:*—This case was considered by Dr. Deaver as inoperable in the sense of getting the patient permanently well. He would not have gotten well from roentgen ray treatment alone, but by carefully combining surgery and roentgen ray treatment I believe that this man will get permanently well. The period of time since the work has been done is too short to make any such claim as yet.

CASE 14.—(Fig. 14.) Mr. J. P. Age 58. Referred by H. W. Dachtler of Toledo, Ohio, January 20, 1913. He had had an epithelioma at the angle of the mouth for twelve years. In October, 1911, consulted Mr. Dachtler and was treated by the roentgen rays under which he got nearly well, but during Mr. Dachtler's absence from the city the disease redeveloped and would then not respond to the roentgen ray treatment. When he came to me for treatment he had an ulcerating epithelioma about an inch in diameter at the left angle of the mouth, with extension of the disease so as to involve two-thirds of the lower lip and one-third of the upper lip, continuing backward inside the cheek to the angle of the jaw. The whole area of disease, together with the whole left side of the cheek, was excised by electro-coagulation. He was then treated by radium at the angle of the jaw inside, which seemed to be the most obstinate in responding, and was treated by the roentgen rays externally until all the tissue had a healthy appearance. About a year later (April 1914) Dr. Laplace did a plastic operation, suturing the open wound and closing his mouth. He has remained well to the present time—almost five years since the treatment was begun. *Remarks:*—This case likewise represents a type that will not get well from roentgen ray treatment. When a patient under roentgen ray treatment reaches a point at which the disease remains stationary for a time and then takes on more active growth, further roentgen ray treat-

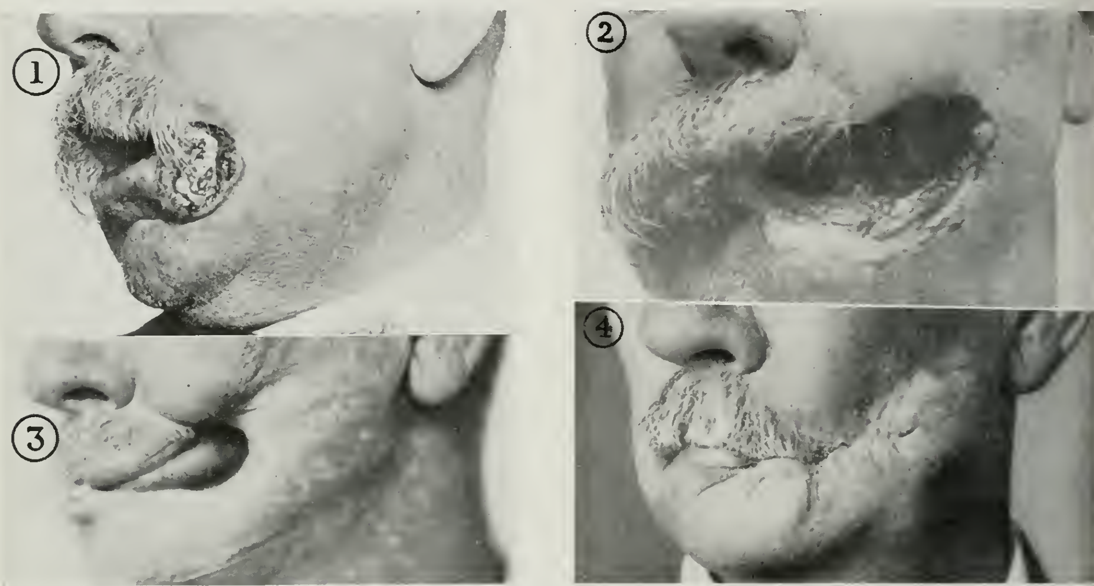

FIG. 14. EPITHELIOMA OF THE LIPS, ANGLE OF THE MOUTH AND INSIDE OF THE CHEEK, SHOWING (1) EXTERNAL LESION; (2) THE RESULT AFTER ELECTRO-COAGULATION; (3) AFTER HEALING PROCESS; (4) AFTER PLASTIC OPERATION.

ment generally fails and some other more active method of treatment must be instituted. When it is possible to use it, I believe that electro-coagulation will be the most efficient. The roentgen ray treatment can then be used again with benefit, as in this case. Here is another instance in which four methods of treatment were used to bring about a cure.

Case 15.—(Fig. 15.) Mr. J. M. L. Age 59. Dr. Laplace and the writer examined this patient December 14, 1914. For a year the patient had had an epithelioma growing on the inside of his left cheek, and at the time that he was seen by us the epithelioma was about $1\frac{1}{2}''$ in diameter, involved most of the depth of the tissues of the cheek, together with a mass of glands in the submaxillary region. After a conference we decided to destroy the disease inside the mouth by electro-coagulation and to resect the metastatic glands surgically, and then follow this by active roentgen ray treatment. After these operations the patient was given a course of treatment during December, 1914, and during January, February, March and April. Since then he has had no treatment, but was still well at his last report November 19, 1917—approximately three years. *Remarks:*—As a result of the methods of treatment used in this case we saved the man's cheek, eliminated deformity of the mouth, and by combining electro-coagulation, surgery and roentgen ray, have obtained a permanent result of which we can be proud.

Fig. 15. Epithelioma on the Inside of the Cheek Associated with Metastatic Disease in the Submaxillary Region. Treated by Electro-coagulation, Surgical Resection of the Metastatic Glands and Roentgen Ray Treatment.

Case 16.—Mr. D. G. Age 48. Referred by Dr. Paul Traub, February 20, 1915. The patient had an epithelioma developing in the right side of the mouth involving the alveolar process, the side of the tongue and the floor of the mouth, during a period of at least four months. The whole area was destroyed by electro-coagulation. In the destruction the inferior dental artery was reached, which resulted in a large sequestrum of the lower jaw first being thrown off and later necrosis and separation of the posterior two-thirds of the lower jaw, but with ultimate healing and healthy tissue. Up to the present time the patient has not reported for a plastic operation as requested, but has remained free from malignant disease. *Remarks:*—This again is a type of disease that will not respond to roentgen ray treatment alone nor to radium treatment alone. But by local destruction, followed by roentgen ray treatment, one can with due care eliminate the malignant disease. A surgeon will then have to be called upon to close the mouth. I believe that when the lower jaw is involved it is wise to resect half of the lower jaw, because if one resects the central portion of one side or destroys it the remainder of the bone does not seem to receive sufficient blood supply for nutrition, and a gradual necrotic process takes place which is most annoying; whereas if one does a complete resection the patient still has half of the lower jaw to chew with and the end results are, to my mind, more satisfactory.

CONCLUSIONS

1. The above cases have been selected with the idea of illustrating the type of case that will not respond to roentgen ray treatment alone, but which can be made well if the roentgen ray treatment is combined with one or more other well-recognized methods of treatment of malignant disease, which, for convenience, we will call *adjuncts*.

2. In many of these cases I am sure that nothing short of the combinations used would have made the patient well.

3. I make a plea for an early survey of the whole case and a careful choice of treatment before beginning, for this will save much suffering, much time, and much waste of energy.

DIFFERENTIAL DIAGNOSIS OF BONE TUMORS

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IN the diagnosis of bone tumors the essential thing is to determine whether the growth is malignant or benign. If that point can be determined the surgeon will be given the information that he wishes. It is well, however, to go beyond that and, if possible, determine the character of the growth belonging to these two great classes.

We have found the following set of cardinal points of great assistance in establishing the correct diagnosis. They are: *first*, invasion; *second*, bone production; *third*, point of origin; *fourth*, condition of the cortex. Of course it is not always possible to establish the presence of these four points, but practically with every tumor that we see we will be able to find one of these groups in which to place it. By so doing we can automatically rule out a number of growths. The establishment of one such point will almost inevitably give a clue to one or more other points and thus eventually establish the diagnosis.

Taking up the first cardinal point, *invasion:* if invasion or non-invasion can be established one can immediately place the tumor in either the malignant or benign group. This first point, however, is frequently the hardest to establish.

If the first point can be established the second group, *bone production*, should be decided upon. The establishment of this point immediately begins to limit the number of growths we have to take into consideration. It automatically rules out some of the malignant and some of the benign varieties.

The third point, *origin*, helps in establishing whether the group is medullary or cortical in origin.

The fourth point, *cortex*, helps very materially as it tells whether the cortex is present or absent, whether it is intact or not, whether it is swollen or not.

Malignant Growths.—The characteristics of malignant growths are the following: They generally start at some central point and grow equally in all directions. They are never definitely limited, and when medullary in origin the bone is never expanded as the growth is so rapid that it sweeps through and destroys the cortex before it can expand. The growth extends through the cortex as quickly as it extends down the medullary canal. It is not limited in any place in the medullary canal; it is so invasive that it is frequently very difficult to determine where the growth stops and where the normal medullary tissue begins. The non-malignant growths, as a rule, when arising in the medullary canal, have a tendency to extend up and down the medulla, the cortex being bulged in a cylindrical manner, not destroyed, and the growth terminating very abruptly, so that there is a definite line of demarcation.

The malignant growths most commonly seen are carcinoma and the subdivisions of sarcomata—namely, the round-cell, the spindle-cell, the periosteal and osteosarcoma. Giant-cell sarcoma is not included in this group on account of its benign nature. We have included it among the non-malignant growths. Carcinoma, round- and spindle-cell sarcomata are practically always medullary in origin. These are very rapidly growing tumors and extend equally in all directions. The cortex is never swollen but is eaten through and disappears. There is no new formation of bone, either within the growth or at its edges. New bone formation is only seen at the edge of the growth in extremely slow growing tumors. Such tumors grow so slowly that nature has a chance to establish a calcium wall before the growth has spread beyond that point. It is impossible, from an x-ray standpoint, to differentiate between the pure sarcomata and carcinomata, as the x-ray findings are identical. The only aid in helping to differentiate these conditions is the fact that the carcinoma, being metastatic in origin, is usually situated near the entrance of the nutrient artery, while the sarcoma, being either primary or metastatic in the bone, may occur anywhere within the shaft of the bone.

Periosteal sarcoma, as its name implies, is a bone producer. It arises from the periosteum and we may have extensive involvement of the soft tissues with very little of the bone being involved. It is probably the most characteristic of all our tumor growths, since in a typical growth we have small lines of calcium salts laid down perpendicular to the shaft but not quite reaching the cortex, resembling roughly sun rays. This deposit of calcium salts is within the growth and is outside of the bone proper—in other words, apparently in the soft tissue.

Osteosarcoma is also a bone producer, the amount of bone produced depending entirely upon the malignancy of the individual tumor. In the very malignant type of osteosarcoma we find but very little bone production. The growth arises both from the cortex and the medullary portion of the bone and produces bone as well as extensive destruction of the shaft. There is also new bone production out in the growth in the soft tissue and this bone is laid down in a somewhat similar manner to the periosteal sarcoma. The difference between it and the periosteal sarcoma is that with osteosarcoma we have more or less extensive destruction of the shaft and generally more bone production in the tissue outside of the bone, while periosteal sarcoma does not produce many changes in the shaft until a very advanced stage of the growth is reached. Of all the malignant tumors the above two tumors are the only ones that produce bone within the growths themselves.

There is one other malignant growth in which there is bone production, but this is not within the growth but in the normal bone surrounding the growth, namely, prostatic carcinoma. In this we find destruction of bone just as in the other malignant growths, but in the normal bone surrounding it we find eburnation and more or less density of bone, this being due to the fact that the growth is of such slow-growing nature that the normal bone around it is stimulated and sufficient time is given for the production of new bone. This new bone is confined entirely within the bone itself and does not take place in the soft tissue.

Benign Growths.—The characteristics of the most common of the benign growths are as follows: Osteoma arises from the region of the cortex and extends well out into the soft tissue. It generally assumes a cauliflower shape and is characterized by a large amount of new bone laid down in a symmetrical manner with a very definite border and no evidence of any invasion. It is frequently multiple at the seat of origin and may take on an appearance of a huge exostosis. It may spring from any portion of the bone but is most commonly seen near the end of the bone.

Osteochondroma is composed of both cartilage and bone and is generally medullary in origin, although occasionally but rarely arising from the cortex. When occurring within the medullary portion of the bone the growth has a tendency to extend up and down the shaft; the shaft is swollen, acquiring a cylindrical appearance. The growth may be loculated. The cortex is practically always intact unless fractured by some trauma. The growth is definitely limited, having a sharpened border. When the growth is situated at the end of the bone one will find that the cortex is very much distended but intact. It is very irregular in outline, the normal bony tissue being completely gone and being replaced by bone and cartilage. The amount of bone present varies according to whether much or little cartilage is in the tumor. There is never any new bone production unless there is trauma. There is some eburnation of the bone at the edge of the growth.

Bone cysts are always benign, practically always occur within the shaft of the bone and present appearances somewhat similar to enchondromata. They are generally situated near the epiphyseal line; they cause a cylindrical bulging of the shaft; they have a very definite border; they are sometimes loculated; and, as a rule, they do not expand the shaft as much or as irregularly as enchondromata.

Giant-cell sarcoma, while belonging to the malignant family on account of the type cell forming the growth, is benign in character and very slow in growth. It generally occurs near the end of the bone. Like a malignant growth, it grows equally in all directions, but instead of sweeping away the cortex the latter is bulged and expands so that, unless the growth is very large, the cortex will be found intact, thinned out to a mere line, but still sufficiently dense to be easily traced throughout its entire length. The growth stops abruptly and at its base, in the medulla, there is generally a calcium wall. It is practically the only one of the benign growths that extends symmetrically in all directions.

Fibromata are generally benign and have a cystic appearance, regarding formation in the bone.

There is one other benign condition which is frequently mistaken for a malignant growth, namely, an ossifying hematoma. This condition arises from some trauma to the bone in the adult or scurvy in growing children, where the periosteum has been elevated and a hemorrhage has occurred beneath. This condition cannot be demonstrated until sufficient time has elapsed for formation of new bone, and then production of new bone out in the soft tissue adjacent to the shaft results. It is very hard and dense and is frequently mistaken for sarcoma. There is, however, a definite bony border due to the deposit of calcium salts in the periosteum, and the bone is laid down more or less parallel to the shaft of the bone. This is an important point, because the malignant bone-pro-

-ucing growths lay down their bone gen-erally perpendicular to the shaft.

Myositis ossificans is readily distin-guished by bone being laid down in the muscle. As a rule it is not connected with the shaft and it follows the striæ of the muscles so that a mistake is not apt to be made.

APPLICATION OF CARDINAL POINTS

The practical working of these cardinal points may be illustrated as follows: Suppose, for example, we take a carcinoma. It is just possible that we might not be able to determine offhand whether there is invasion or not. We should then consider the second cardinal point, bone production. It will be found that there is no bone production, since carcinoma, being of epithelial origin, cannot produce bone. This would immediately rule out two malignant growths, periosteal sarcomata and osteosarcomata. In the benign group it would rule out osteoma and ossifying hematoma. In the malignant group sarcoma and carcinoma would still have to be considered; in the benign group, enchondroma, bone cysts and fibroma. We now proceed to the third cardinal point, namely, origin. Since we know it is carcinoma we know that it is medullary in origin. The other conditions mentioned are also medullary in origin. The fourth cardinal point, the condition of cortex, would then come under consideration. Since this is carcinoma we must find that the cortex is not expanded, but has been completely swept away. This would immediately rule out all the benign growths since they all have a definite cortex. Consequently, we would be forced to conclude that the growth is either sarcoma or carcinoma.

Now, as a second example, let us take one of the bone-producing growths, periosteal sarcoma. Again let us assume that we can not establish invasion. Since in periosteal sarcoma there is bone production we would take up the second cardinal point. Of the bone-producing tumors that are malignant there are only two, namely, periosteal sarcoma and osteosarcoma. Of the benign bone-producing tumors we would include osteoma and the ossifying hematoma. We would now proceed to the third condition, the point of origin. Arising from the cortex this growth could still be any of the above-mentioned conditions. In the fourth cardinal point, condition of the cortex, we should find that the cortex is slightly invaded, that the bone is laid down in the soft tissue and that the deposit is perpendicular in character.

There are only two conditions in which the bone is laid down perpendicular to the shaft and these are osteosarcoma and periosteal sarcoma. In osteoma the bone is laid down from a central point, presenting a cauliflower appearance; in ossifying hematoma the bone is laid down parallel to the shaft; and in both of these conditions, that is, osteoma and ossifying hematoma, there is a definite border. Consequently, in this example the bone is perpendicular to the shaft, there is no definite border, and the fact that the shaft is not involved indicates that we are dealing with a periosteal sarcoma.

In all the bone-producing tumors osteomyelitis must be taken into consideration, but we must remember that osteomyelitis when it comes within the shaft does not destroy as a solid mass but tends to destroy in spots, leaving dead pieces of bone in the shaft; also that it breaks through the cortex, probably in one or two places, leaving the rest of the cortex present. The shaft is not expanded but the periosteum, being thickened, frequently gives the appearance of a swollen shaft which in reality is due to the deposit of bone in the periosteum and not to actual expansion of the shaft. Then, too, in osteomyelitis we never see new bone in the soft tissue which is not connected with the periosteum. We may see an occasional piece of bone but it is generally a single piece, which means that it is a sequestrum being discharged through a sinus.

In conclusion, we must remember that these growths and metastases in the flat bones, such as the cranial bones or the scapulæ, do not present the same typical appearances as in long bones and, consequently, these cardinal points are not applicable. Also, the character of the growth is very materially changed after there has been any surgical interference. A third exception is that in multiple metastatic carcinoma we usually lose all sign of invasion, the growth being definitely limited and frequently the cortex being expanded without destruction.

Excluding the above exceptions, we will find that most of the bone tumors can be diagnosed by the cardinal points above mentioned. Even when the growth is atypical in appearance, by means of one of these four points it is possible to identify it.

USE OF RADIUM IN NON-MALIGNANT UTERINE HEMORRHAGE

Drs. C. Jeff Miller and E. L. King, New Orleans: The non-malignant conditions of the uterus causing menorrhagia or metrorrhagia may be thus grouped: 1. Cases in which there is little or no demonstrable pathologic change in the uterine wall, no history of infection, and in which the uterus is apparently normal in size and position, with normal adnexa. In such cases, the bleeding is, in all probability, due to some disturbance of the internal secretions, especially of the thyroid or of the ovary. This condition is often encountered in young girls about puberty. 2. The menopause. 3. Chronic metritis. 4. Hypertrophy or hyperplasia of the endometrium, especially when so marked as to be adenomatous or polypoid in character. 5. Fibroids, adenomas or adenomyomas of the uterus. 6. Chronic endometritis, especially after incomplete abortion. 7. Passive congestion of the uterus, as in retroflexion or prolapse. In the first three groups, radium may be used to the exclusion of surgery; in the fourth and fifth, some cases are suitable for radium and others require operation; while in the sixth and seventh groups, operation is indicated.

We have treated ten cases classified under the first two groups. In all of them the bleeding had persisted for years and had resisted every form of treatment. Nine of the patients were given intra-uterine radium treatments, the average dose being about 1,000 milligram-hours. In only one patient did the treatment fail to relieve the condition. Only one patient suffered from severe menopausal symptoms, although in several of them the symptoms were present in a mild degree.

Eighteen cases fall in the third and fourth groups. The patients ranged in age from 30 to 55, and most of them had suffered from bleeding for several years—as a rule, menorrhagia first, and later metrorrhagia as well. In every case, radium treatment was followed by amenorrhea; in two patients there was a recurrence of the bleeding about one year later, the flow being approximately normal. The others are still relieved. Six patients suffered from marked menopausal symptoms; five others were similarly affected, but the symptoms were mild and transient. The patients suffering most from the artificial menopause were nearly all between 40 and 51; this coincides with our experience after hysterectomy. In three women, aged 35, 45 and 51, the condition was relieved by corpus luteum extract. Eight patients suffered from leukorrhea for two or three months after the treatment. In those cases in which subsequent pelvic examinations were made, marked reduction in the size of the uterus was found, and the tenderness, as a rule, disappeared. The dosage in these cases was from 500 to 1,000 milligram-hours. (*Discussion, Annual Meeting South. Med. Assn.*, Memphis, Tenn., Nov. 12–15, 1917.) (Ref. *Jour. Am. M. Assn.*, Dec. 15, 1917, p. 2066.)

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Roentgen Pleuritis

In the February 1918 issue of the Journal, Dr. Lloyd Bryan made a report on "Roentgen Pleuritis." In our search for truth it is important that such records be made, but we must not draw hasty conclusions. There is a general tendency among patients to attribute any unusual developments or any intercurrent disease or symptoms to x-ray treatment, when, if one analyzes the symptoms, they are very generally a part of the disease for which the patient is being treated, or are due to an intercurrent affection such as would occur to any one suffering from any particular disease and treated by any particular method. Even family physicians are apt to attribute any complications that arise during the course of x-ray treatment to the treatment itself rather than search for the cause as one would search for the cause of a disease at any other time. This tendency does harm in two ways: *First,* it prejudices the patient and physician against x-ray treatment when often it is the only treatment which offers them hope of relief. *Second,* it blinds the attending physician to the real cause, and leads him to carelessly neglect the necessary search for the true cause, thus often allowing the patient to suffer unnecessarily. All roentgenologists who have had much experience in the treatment of malignant disease, especially about the chest, must have heard their patients complain of rheumatism about the shoulders and about the chest, and often must have had the attending physician explain that it was due to the x-rays, when, as a matter of fact, if one investigates carefully, the cause of these pains is due to metastasis developing in the bones or in the spinal column, or to an extension of the disease elsewhere in the chest. The treatment is, therefore, often interrupted, as I have experienced repeatedly, when, as a matter of fact, the only thing that would give comfort and prolongation of life is an increase in the amount of treatment rather than a diminution. As roentgenologists, therefore, we must be most cautious in attributing intercurrent affections to x-ray treatment, unless it is proven more definitely than in any of the cases on record.

In the first case, reported by Dr. Bryan, the left chest was treated three times in front, and twice through the back within two months' time without producing any dermatitis. At the end of two months a slight amount of effusion was found at the left base, and he believes that this was due to the treatment, when, as a matter of fact, fluid in the chest is quite common in connection with mediastinal tumors, even with any kind of treatment. Therefore, I see no reason for concluding that this is due to the *x*-ray treatment at all.

The second patient had large tumor masses in the neck and the mediastinum; she was given a series of *x*-ray treatments February 1914, and on September 20, 1915, she reëntered the hospital with fluid in the chest. This the author concludes is due to *x*-ray treatment, because she had received some treatment previous to entering the hospital. Based upon the facts presented, the diagnosis of pleuritis is surely unjustified, and must be regarded merely as a coincidence.

Strasser's patient was 68 years old, had had gout over fifteen years; for nine years glycosuria, fatty and arterial sclerosis, and for four years bronchial catarrh; Before coming under treatment he had twice a small area of bronchopneumonia in the left lobe, and an attack of angina pectoris. He was treated in all four times: June 10 the right thorax anteriorly, June 14 the right supraclavicular region, June 17 the right axilla, and June 28 the right chest posteriorly. Later the patient developed more evidence of angina pectoris and finally developed signs of a rightsided pleural effusion. Surely since, in the case of a patient suffering from the affections already enumerated before *x*-ray treatment was given, it would not be unusual that he develop a pleural effusion, it is not necessary to assume that it is due to the very small amount of treatment given.

The case referred to by Quadrone, was a twelve year old girl who suffered from a general lymphomatosis. She was treated by the *x*-rays and developed a pleuritic effusion from which she ultimately died. An autopsy was refused, but the exudate removed before death had the characteristics of tuberculosis. One can see clearly therefore, that this condition should no be credited to the *x*-rays.

With regard to the report of Primbraam and Rotky, these authors express in thei article the belief that the acute nephriti was toxic in origin rather than due to th *x*-rays, and they merely mention the *x*-ray as a possible cause, but believe that th toxic nephritis was due to the rapid ab sorption of the degenerating material. A the same time that the acute nephritis de veloped there had also developed abscess es in both mammary glands, and yet th treatment had been confined to the spleen One can see, therefore, that such an as sumption of the nephritis being due to th direct action of the rays on the kidney is entirely unjustified.

I have treated at least a thousand case of disease about the chest. It is well know that I give massive doses, and yet not on patient has had a pleural effusion develo that was not due to an extension and pro gression of the disease or due to an acut intercurrent infection, which had all th characteristics of an acute infection. In in dividual cases I have given a hundre times as much treatment as was given t any of these patients mentioned, over th chest, without the production of any pleurisy, and I have treated abdominal patients with a hundred times as much treatment as was given in the abdominal case reported by Primbraam and Rotky, i which I obtained the disappearance of tumor masses with increase in the patient's weight and general improvement in th patient's condition, with no evidence o an acute nephritis. I, therefore, believ that the diagnosis of *roentgen* pleuritis and *roentgen* nephritis, and other affections that develop during the course of treatment, must be made with the greatest caution and should be proven before announced.

George E. Pfahler

X-ray Experiences at the Front

In this issue we give space to a translation from advance sheets of a publication by ɛr French colleagues (Drs. Desplats and ˈickham). We are sure our readers will ɒpreciate this first-hand recital of ex-ɪriences in the zone of the advance.

There is no new principle in any of the ıethods described, but this does not lessen ıe value of the article, for it presents a iewpoint; and we are anxious to get the iewpoint of a number of different men ith a large experience in war work.

A careful research of the literature has onvinced the editors that there is very ttle likelihood of any method described t this late date being a new one. The ring ocalizer was in use at least as far back as 901, and probably earlier. Testing the nobility of superficially located projectiles vas described in some of the earliest pa-pers on roentgen ray work. The principle of marking the skin vertically over the foreign body and then calculating, or measuring, the depth by the shift of the shadows of the foreign body and of the marker was described early in 1896 by Morize in France, and simultaneously by physicians in England and Germany. The use of a chart for reading off the depths was described at least as far back as 1902 by Little; and shortly after the outbreak of the present war by nearly a dozen workers in the hospitals of the Allies.

Americans are especially interested in the remarks of Doctor Desplats on the need of provision for extraction of foreign bodies under the fluorescent screen, employing either the open screen or the bonnet method. Too many American surgeons are as yet unfamiliar with the technique necessary; yet, as our colleague states, this technique is not at all difficult to master. It is important, however, to have the coöperation of surgeon and roentgenologist in working out the details of an operating plan which at the same time meets the demands of a "surgical conscience" and its roentgenological counterpart, an "*x*-ray conscience." Just as the surgeon by long attention to operating room technique comes to a point where he mechanically observes the rules of asepsis, so also a certain autonomy of behavior may be developed in connection with *x*-ray work with the result that the roentgenologist automatically keeps himself protected from the dangers attending his profession. Our French colleagues tell us the method of operating with screen aid is becoming more and more recognized. Surely the United States Army Medical Department will not fail to profit by the recent experiences of our Allies, and will be duly influenced by the trend of opinion, as expressed in the article of Doctor Desplats.

J. T. C.

The Nineteenth Annual Meeting of the American Roentgen Ray Society will be held at Fort Oglethorpe, Ga., and Chattanooga, Tenn., Wednesday, Thursday and Friday, September 4th, 5th and 6th. Final arrangements have not been completed, but it is probable that the day sessions, at least, will be held in Camp Greenleaf, the greatest medical military training camp in the world. We are assured of adequate hotel accommodations and it is not improbable that accommodations may be secured at Camp Greenleaf for those who prefer that added touch of camp life. In addition to the especial present interest, this region is rich in historical interest and natural beauty, and will afford a splendid climax to the vacation period or a satisfying substitute for the many who will find it impossible to take their customary vacations this summer. Already there are offered papers sufficient to insure a program of more than average value. Complete details will be given in the next issue of the Journal. In the meantime, inquiries and communications may be addressed as follows: Concerning the scientific program, address the President, Major Willis F. Manges, M.R.C., Camp Greenleaf, Fort Oglethorpe, Ga.; concerning general arrangements, address the Chairman of the Executive Committee, Dr. David R. Bowen, 235 S. 15th Street, Philadelphia; concerning the exhibits, address Mr. Paul B. Hoeber, 69 East 59th Street, New York.

TRANSLATIONS & ABSTRACTS

Alvarez, W. C. and Taylor, F. B. Changes in Rhythmicity, Irritability, and Tone in Purged Intestine. (*J. Pharmacol. & Exper. Therap.*, Balt., November 10, No. 5. Ref. *J. Am. M. Ass.*, Dec. 15, 1917, p. 2070.)

The well-purged rabbit is likely to be apathetic and to look sick. Its bowel is full of gas and fluid, and the mesenteric circulation is disturbed. Excised segments beat poorly and irregularly in Locke's solution; they fatigue quickly; and respond poorly to drugs. Some parts of the bowel are abnormally irritable while others fail to respond at all to powerful stimuli. This unevenness in the gradient of muscular forces must interfere with the steady progress of food through the intestine, and probably favors the production of colic and gas pains. The conclusion drawn by Alvarez and Taylor is that it is not wise to purge shortly before an operation in which the bowel must stand the insults of drying, handling, cutting and sewing.

Weil, E. Albert, Roentgenotherapy of Tuberculous Peritonitis. (*Paris méd.*, October 13, VII, No. 41, p. 289. Ref. *J. Am. M. Ass.*, Dec. 8, 1917.)

Weil remarks that of all the various methods of treating tuberculous peritonitis that have been applied to date, systematic utilization of sunlight and sea air seem to have the most testimony in their favor. But both require the suitable environment which is within the reach of comparatively few. On the other hand, with the roentgen rays we can apply the chemical rays anywhere, even to outpatients. He has been applying roentgenotherapy systematically since 1914, using large doses of very penetrating rays, filtered. Some of the children he treated had the fibrous form of peritonitis and some the form with ascites. In every case in which there was not already generalization of the disease in the lungs or pronounced cachexia a complete cure was rapidly realized, with complete restoration of the general health. He used a Coolidge tube, a 5 mm. aluminum filter, a 20 cm. spark and a 1.5 or 2 milliampere current. The exposures were repeated about monthly, but he reduced the strength a little each time to ward off skin trouble. This technique does not entail radiodermatitis nor generalization of the tuberculosis. After the first series there may be a recrudescence of the fever and persisting malaise, but this reaction was never serious in his experience, and he never allowed it to interfere with his giving the effectual dose of 12 or 14 H units in the course of four successive days on the four quarters of the abdomen. In case of too much debility the series can be fractioned to spread out over ten or twelve days.

Medicolegal. Barring of Action for Roentgen Ray Burn. (Ogg vs. Robb, Ia., 162 N. R. W. 217. *J. Am. M. Ass.*, Sept. 29, 1917, p. 1108.)

The Supreme Court of Iowa affirms a judgment in favor of the defendant in that the plaintiff's alleged cause of action was barred by the statute of limitations. The court says it was alleged that in 1901 the plaintiff, then under 17 years of age, broke his right wrist. In July of that year, the defendant called the plaintiff in his office, without the knowledge or consent of the plaintiff's parents, and experimented on him with a roentgen ray machine to secure pictures of his hand and wrist. That the defendant continued for ten days in said experiments and used the roentgen ray machine on the plaintiff's hands and wrist and made long and close exposures. That as a result the skin on the hand and wrist became discolored. That the defendant then informed the plaintiff and his parents that the use of the roentgen ray machine caused such discoloration, and then falsely and fraudulently informed them that this discoloration was of no particular consequence and would be temporary in its effects, fraudulently concealing from them the true effect of radio-exposure produced by the roentgen ray machine. That the defendant then treated the discoloration for a time and it apparently disappeared, leaving a scar, but with the usual use of the hand. That the plaintiff and his parents fully relied on the statement and advice of the defendant as to the temporary effect of the roentgen rays, and nothing further was done in regard thereto until 1912. That the use of said machine by the defendant produced a cancerous condition which was latent until 1912, and the plaintiff had no knowledge of said condition until then. That then the tissues of the right hand where the roentgen rays had been applied broke down and became an epithelioma or malignant cancerous growth, which caused great pain and necessitated the amputation of the right forearm. Was the plaintiff's cause of action concealed by the statement of the defendant that the original burning was but temporary and was of no particular consequence, and that the defendant fraudulently concealed the true effect produced by the use of the roentgen ray machine? The plaintiff alleged that he was burned in 1901 and, as he alleged, by the negligence of the defendant. The fact was known to the plaintiff and his parents. All damages which subsequently developed were traceable to and based on that act. By the original act the plaintiff was injured, and, as the petition alleged, by the negligence of the defendant. He would have been entitled to some damages at that time; and, if it be true that cancer necessarily and in all cases is the result of such burning, or if cancer is the probable result, such fact could be shown as bearing on the question of damages in an action for the original injury. If cancer is not the necessary or probable result of such burning, then the defendant's statement would be more or less of an opinion, and, in that case, the fact that later and in 1912 a cancerous condition did develop and the plaintiff's damages might thereby be increased, would not constitute a new cause of action. It would seem then that the plaintiff's cause of action accrued at the time of the original injury.

McMahon, F. B. and Carman, R. D. The Roentgenologic Diagnosis of Primary Carcinoma of the Lung. (*Am. J. Med. Sc.*, January, 1918, Vol. CLV, No. 550, p. 34.)

Primary carcinoma of the lung is believed to be rare, only 428 cases having been reported. Most of these are from postmortem data, so that the roentgen rays in the future may show the disease to be less rare than hitherto supposed. The decisive value of the roentgenological examination has not been generally recognized, perhaps because the study has been almost wholly confined to isolated cases.

"In most instances the roentgen findings in primary carcinoma of the lungs are pathognomonic of the disease, and may be the first to suggest the exact nature of the pulmonary lesion. The areas of increased density, their size, shape, and position, are usually characteristic and aid in the clinical diagnosis more than most other signs. This does not imply that all other signs can be slighted or discarded, for it is by a careful collection and correlation of all the facts that a satisfactory differential diagnosis may best be established.

"In the roentgen examination three types of the disease are recognizable; namely, the infiltrative, the military, and the mixed, which correspond to the gross pathological groupings. For convenience each type will be discussed separately though many characteristics are common to all. A striking feature in all types and one of considerable diagnostic importance is the absence of practically any increase in mediastinal density. The presence of extensive pleural involvement in primary carcinoma of the lung renders the interpretation of the roentgenogram correspondingly more difficult, but not impossible. The presence of large pleural effusions tends to completely mask the roentgenographic picture and to conceal the underlying and principal pathological condition in the lung. A second roentgen examination is necessary after thoracentesis. Fortunately these latter two conditions rarely occur until the terminal stages of the disease.

"In the stereoscopic study of the infiltrative type of primary carcinoma of the lung, the roentgenogram shows one or more areas of increased density along the roots of the larger bronchi. The shadows are homogeneous or partially mottled. The borders are infiltrative and not sharply demarked. The areas of density are wedge-shaped, with the apex pointing toward the hilus, and there may be either unilateral or bilateral involvement. The degree of density is marked but varies with the extent and duration of the disease. Until there is extensive involvement the process does not reach the periphery of the lung, so that small areas of air-filled lung tissue may be seen between the growth and the chest wall. The most frequent site of this type of lesion is in one of the lower lobes. There is always present a hazy shadow-zone surrounding the growth, due to congestion from active hyperemia or passive congestion due to mild pressure, or to both conditions. The roentgen shadows found in this type of carcinoma of the lung at times make the diagnosis difficult. The roentgenogram will show the presence of a lesion in the lung, but if the neoplasm is in an early stage the areas of density may not be entirely typical of primary infiltrative malignancy. In such cases the roentgen diagnosis can be only tentative, and if the other findings are not sufficiently corroborative a subsequent roentgen examination should be made.

"Two of the cases studied by us were of the infiltrative type. In one (Case 176118) the roentgenogram showed the presence of a lesion in the lower right lung, the exact nature of which was doubtful until an exploratory thoracotomy and a microscopic examination were made. In the other case the lesion was more extensive and typical of primary malignancy. Postmortem examination confirmed the diagnosis.

"In the miliary type there are innumerable regular, irregular, or conglomerate small areas of increased density extending throughout all the lobes. Their borders are poorly defined and not sharply circumscribed from the surrounding parenchyma of the lung because of the marked infiltrating character of the neoplasm. The process is diffuse throughout both lungs and the areas of density are distributed as uniformly near the hilus as in the periphery of the lung. The shadows show no tendency to be arranged in groups or clusters. There are usually no true cavities but there may be localized dilatations of the smaller bronchi and bronchioles, the walls of which may be differentiated from the cavity formation only by the stereoscope. Dilated bronchioles are recognized roentgenologically by the absence of any thickened wall.

"The mixed type of primary carcinoma of the lung includes a combination of the infiltrative and the miliary forms. In this type are found poorly circumscribed, homogeneous, or slightly mottled areas of increased density in one or more parts of the lung, and multiple smaller areas of increased density similar to those found in the miliary type, diffusely studding the entire remaining portions of both lungs. Two of the cases (Cases 160751 and 109685) were of this type. In both the diagnosis was confirmed by a postmortem examination."

The authors thus demonstrate the close dependence of the roentgenographic signs upon the pathology of pulmonary carcinoma. The following shows that the roentgenologist must not only be a pathologist but must likewise be a student of clinical diagnosis.

"The differential diagnosis of primary carcinoma of the lung must be made from a large number of other pathological conditions found in the thorax, which in the roentgenogram may in a measure simulate carcinoma. A long and detailed description of each is unnecessary here, but the salient and important points concerning the more confusing conditions are as follows:

"Bronchiectasis may be confused with the infiltrative type of primary pulmonary carcinoma in the early stages, or when either lesion is atypical. Moore has shown, however, that in bronchiectasis the shadow is fan-shaped and extends to the periphery; also that when a lower lobe is involved the costophrenic angle is obliterated and the process is usually though not always bilateral. Further, in bronchiectasis, cavitation is invariably present, with shadows suggesting dense fibrosis around the cavity. When bronchiectasis is suspected the patient should be induced to attempt the evacuation of the contents of the cavity by forced coughing and expectoration, in order that the cavitation may be shown more clearly in the second roentgenogram.

"Pulmonary abscess and encysted empyema are usually not difficult to differentiate from carcinoma. In such cases the areas of increased density are sharply circumscribed and surrounded by a shadow zone of inflammatory change beyond which is the normal healthy lung area. The presence of the shadows of a fluid level with a gas bubble above in an abscess cavity may be further aids. Finally, the shadow of a thickened pleura is more frequently associated with these conditions than with pulmonary malignancy.

"In lobar pneumonia the shadows are usually localized, soft and hazy, and vary in density with the stage of the disease. In the early stage there may be only a slight difference in density from the surrounding lung tissue, while in the later stages the density is greater and the shadow is sometimes mottled. Any part of the lung may be involved but the condition usually includes practically an entire lobe. The pleura is much more frequently involved. Clinically, of course, the differentiation is even more emphatic.

"Regarding syphilis of the lung very little is known definitely from the clinical standpoint and less from the roentgen standpoint. While the disease seems to be more common than formerly and is recognized clinically, Dr. W. W. Bissell informs us that he has never seen a case in 4000 postmortems. In one proved case in the clinic the roentgen examination revealed marked enlargement of the mediastinal shadow with areas of increased density in the regions of the main bronchi while the periphery was free. The heart shadow was greatly enlarged and the aorta dilated. At autopsy multiple diffuse areas of dense patchy fibrous infiltration were found in both lungs near the hilus, together with a large heart showing marked myocardial changes and a saccular aneurysm of the ascending aorta. We have never seen or at least have never diagnosed gumma in the parenchyma of the lung. Gumma in the mediastinum may be differentiated from primary carcinoma of the lung. The shadow is usually large, well circumscribed, homogeneous, and unilateral or bulging to one side.

"In primary sarcoma and lymphosarcoma of the lung the roentgenogram corresponds in its characteristics to that of mediastinal gumma, except that in sarcoma the tumor shadow tends to be larger. Infiltration and involvement of distant portions of the lung rarely occur.

"In Hodgkin's disease the roentgenogram usually shows areas of increased density which are symmetrical, bilateral, well circumscribed and limited to the mediastinum. There are no changes in the density along the course of the main bronchi unless the tumors are very massive or there is marked myocardial degeneration leading to much passive congestion.

"In actinomycosis and allied affections of the lung the roentgen findings may be differentiated from those of primary malignancy. The areas of increased density are 'stringy' and fan-shaped in arrangement, usually found in the periphery and surrounded by a soft shadow zone of inflammatory reaction. The pleura is involved early and there may be an area of increased density corresponding to a tumor on the bony chest wall.

"There is a marked difference in the roentgen shadows found in primary and metastatic malignant disease of the lungs. As in the metastatic carcinomas, sarcomas, and mixed tumors the roentgenogram shows the same characteristics and their roentgen appearances may be enumerated collectively. According to Moore and one of us (Carman) the areas of density in metastatic malignancy of the lung are rounded, regular, clearly circumscribed, homogeneous, without inflammatory reaction; they vary in size, are usually multiple, and may occur in any part of the lungs.

"Cysts of the lung show in the roentgenogram as large, clearly circumscribed and homogeneous areas of increased density. They are usually single and are found in the right lower lobe.

"Fibromyxoma of the lung is easily differentiated from primary carcinoma. In the former the area of increased density is large, massive, homogeneous, and well circumscribed. An entire lobe is usually involved, most commonly the upper. Since the tumor is slow-growing there is very little, if any, congestion-shadow surrounding it."

This is clear and definite, but the paragraph on the differentiation from tuberculosis is far less satisfactory. They say:

"The differentiation from the roentgenogram of pulmonary tuberculosis will seldom be difficult. In chronic pulmonary tuberculosis the periphery is the common location of the areas of increase density, with very few, if any, changes in the hilus. The shadows are more circumscribed. The upper lobes, especially the apices, are usually the first and most commonly involved. Cavitation may be present, and there is frequently an associated pleuritis. In acute or subacute miliary tuberculosis the individual areas of increased density are smaller, more regular in shape, more discrete, more uniform in size, and with greater peripheral involvement than in the miliary type of carcinoma."

The symptomatology indicates in a striking manner the close resemblance clinically which pulmonary carcinoma bears to phthisis. Chronic cough, sputum, hemoptysis, hoarseness, loss of weight, fever and pleuritic effusion, all considered distinctive signs of tuberculosis are yet present in carcinoma. The authors in the forepart of the article state that:

"Cough is an early symptom; it is usually slight but constant and distressing. Expectoration, if any, is moderate in amount; it consists chiefly of mucus and at times may be blood-stained. Hemoptysis is common, but the quantity of blood is small. Inspiratory dyspnea comes on early, is nearly always present and is exaggerated by exertion. Hoarseness and change of voice from pressure-paresis of one or both vocal cords is common. Pain is a prominent, but not early, symptom. It is associated with substernal pressure symptoms or pleural involvement. Pressure may give rise to dysphagia. Weight loss and weakness are pronounced and progressive. A rise of temperature of 0.5° to 1° is usual; chills and sweats are rare. The infiltrative type runs a longer course than the miliary or mixed type.

"The physical findings are such as would be expected in massive or patchy infiltration and consolidation of the lung from any cause. Pleural effusion may mask these signs; on aspiration the fluid may be straw-colored, blood-stained, or darkly discolored. Engorgement of the veins of the anterior chest wall and edema of one or both arms may be present. Enlarged supraclavicular or axillary glands, are suggestive, and removal of such glands may aid the diagnosis."

This article emphasizes unconsciously the deeply important fact that roentgen ray interpretation demands a wide knowledge of pathology and clinical medicine. The roentgen ray plate may supply the data but we see only what we learn to see.

Such an article as this one by McMahon and Carman extends the confines of roentgenological knowledge.

Harbitz, Francis. Extensive Calcification of the Lungs as a Distinct Disease. (*Arch. Int. Med.*, Jan., 1918, p. 139.)

Calcium deposits may take place in degenerated or necrotic tissue, in exudates and blood clots, in lymph nodes, in lungs, in the arteries and in certain cases in many other organs of the body. Calcification may occur on a large scale and give rise to distinct disease. Virchow showed that in bone tumors, osteomalacia and leukemia, a "calcium metastasis" may take place, especially in the lungs, the left ventricle, the pulmonary veins, the gastro-intestinal walls and the kidneys. A selective deposit of carbonates and phosphates of calcium also takes place in bursæ and tendon sheaths, as for example in the subacromial bursa. In "calcinosis universalis" a calcium infiltration is found in nearly all tissues excepting those of internal organs and joints, while the bones appear normal. An extensive and most extraordinary calcification may occur in the lungs. The author's description of the autopsy in his own case is striking and instructive.

"There was no fluid in the pleural cavities; a few fibrous bands were present over the left lung and general adhesions over the right; the lungs were large, as in croupous pneumonia, solid and heavy, feeling like stones and sinking in water; the right lung weighed 2,750 gm., the left 2,130, in all 4,880 gm. Placed on the base, the lungs stood by themselves; in consistency the substance was almost like wood, but not uniformly so, being apparently full of small, solid particles, and under the pleura here and there were small, white, flat masses of mineral nature. The substance could be cut only with difficulty and felt like porous bone. Passing the finger over the surface felt like rubbing it over sandpaper, and here and there were round or irregular concretions. The distribution of mineral matter was about the same in both lungs, perhaps a little more marked in the left. The cut surface was peculiar, reddish-brown, with numerous small holes in an extensive stroma; bloody, frothy fluid exuded. The first impression that the lungs were free of air and compact was not correct; air was present everywhere, but the air-containing tissue was less in amount than the interstitial tissue with the mineral deposits. Areas in the anterior border of the right lung and the anterior surface of the upper lobe contained more air than other parts of the lungs. After drying a small slice of lung substance it had a peculiar yellow red color and a porous surface which felt like sandpaper and from which small calcareous granules would fall out. In both apices, at the hilus of the lungs and in the lymph nodes in the neck, were small, old caseous foci. The pulmonary arteries were sclerotic but not calcified or dilated; the pulmonary veins were normal. No calcification was present in the larger bronchi, trachea, or larynx.

"The extensive lime deposits in the lung in this case, so extensive that it seems quite remarkable that life lasted as long as it did, do not appear to be duplicated by any reports in the literature either of genuine 'metastatic' deposits or of the few cases in which there was no definite cause. It is noteworthy that the lungs weighed nearly six times as much as normal and that on first impression they appeared to be almost entirely airless; the deposits were diffuse and evenly distributed throughout the lungs, showing that they were independent of local changes such as thrombi or infarcts."

A similar case reported by Tschistowisch was associated with multiple myeloma. A case described by Pari was associated with cancer of the uterus with bone metastasis. Another case reported by Wells occurred in the course of myelogenous leukemia. Many other cases of partial calcification have been reported by various clinicians in association with a very large variety of diseases, so that it is impossible to regard the condition as consistently secondary to any definite or recognized group of diseases. But fundamentally there is in all cases a profound disturbance in calcium metabolism dependent upon disordered function of glands of internal secretion.

Abbe, Robert. Paget's Disease of the Bone: Excellent Repair after Surgical Operations. (*Jour. Am. M. Assn.*, Vol. 70, No. 6, Feb. 9, 1918, p. 371.)

Sir James Paget many years ago described the disease which has since borne his name. Much later the Germans renamed the disease "osteomyelitis fibrosa." To many roentgenologists the identity of osteomyelitis fibrosa (or osteitis fibrosa) with Paget's disease of the bone is a matter of surprise. Abbe objects to the German name as clinically delusive, because there is nowhere a fibrous change but only a large bony overgrowth.

He says: "Though the disease appears first in some isolated bone, it is not essentially a 'one-bone disease.' Usually it is noticed in a curvature and enlargement of one tibia, femur, clavicle or ulna; and the surgeon often examines the skeleton in vain endeavor to find a second diseased bone. Nevertheless, in almost all cases, a roentgenogram of the head will reveal a thickening of the frontal, parietal and occipital bones, sometimes of enormous degree —to an inch in thickness, with no prior suspicion.

"In the skull the enlargement is never at the expense of the cranial cavity. In the long bones there is curvature with much increase in bulk, by periosteal and endothelial growth. Occasionally, though rarely, a sarcomatous degeneration may ensue. While the disease is not widely recognized, it is by no means so uncommon as would be implied by the general ignorance of the profession about it, and quite a number of cases go unrecognized.

"In fourteen private cases of this disease seen during recent years, four cases with jaw complication have come to my notice. In two of these, extensive surgical operation was required and most excellent results were obtained. Its slow development is emphasized in one case of a woman whose lower jaw I had treated for a cyst on several occasions for twenty-two years. Only three years ago it suggested itself to me that it might be Paget's disease, and, on taking a roentgenogram, I found a very thick, typical skull. When its nature was thus shown, I ventured a wide removal of the outer plate and all cancellous and cystic structure of the forward half of one side of the lower jaw, leaving the inner compact structure."

The roentgenologist must be on his guard therefore in cases of hyperplasia of the jaw, and should roentgenograph the head to clinch the diagnosis of Paget's disease of one of the longbones.

Walker, C. B. The Diagnosis of Pituitary Disorders. (*Interstate M. J.*, 1917, XXIV, 817.) (Ref. *Internat. Abstr. of Surg.*, Jan., 1918, p. 24. Robitshek.)

Although *x*-ray demonstrations of the enlarged sella turcica are a very reliable diagnostic point in determining the presence of strumous, tumorous or hyperplastic condition of the hypophysis, it should be noticed that many cases of dyspituitarism, especially in the last two groups discussed, may show no enlargement of the sella and yet may have a supracellar or interpeduncular or even a more distinct tumor giving glandular or ocular field manifestations without distorting the sella.

BOOK REVIEWS

Diseases of the Chest and the Principles of Physical Diagnosis. By George William Norris, A.B., M.D., Assistant Professor of Medicine in the University of Pennsylvania; and Henry R. M. Landis, A.B., M.D., Assistant Professor of Medicine in the University of Pennsylvania. With a Chapter on the Electrocardiograph in Heart Disease by Edward B. Krumbhaar, Ph.D., M.D., Assistant Professor of Research Medicine in the University of Pennsylvania. Pp. 782. Price, cloth, $7.00 net. W. B. Saunders Company, Philadelphia and London, 1917.

A careful study of this treasure-house will add immeasurably to the diagnostic ability of every man who professes to interpret the roentgen findings of the chest. As a work for frequent study and reference this book should find a place in the library of every roentgenologist.

In the roentgen ray features of this treatise the authors have had the assistance of two of our well-known colleagues, Doctors Pancoast and D. R. Bowen, of Philadelphia, whose careful work is abundantly attested by the pages of this book. In a very admirable manner the roentgen findings are incorporated into the text in such a way that the result is a complete presentation of the physical diagnosis of the heart and lungs in health and disease. The roentgen ray findings are seen in their proper relation to the clinical aspects of the case.

Nevertheless, in spite of the very favorable impression created by the general appearance of the volume, we read the authors' opinion that the roentgen ray enables us to "control" percussion findings and often definitely establishes the presence or absence of deep-seated mediastinal lesions in cases in which ordinary physical diagnosis only permits us to "suspect" the lesion. On the other hand, "the ordinary methods of diagnosis are far superior to the roentgen ray in cases of incipient or early pulmonary tuberculosis. . . . In these instances the mistakes are usually on the side of the roentgenologist. The roentgen ray is rarely of much use as an early diagnostic method in cardiac or pulmonary disease." We feel that in these statements the distinguished authors of this work have taken too reserved a stand, and believe that the future will demonstrate a much larger field of usefulness for the roentgen rays in diseases of the chest than the above statements would seem to indicate.

J. T. C.

A Manual of *X*-Ray Technic. By Arthur C. Christie, M.D., Major, Medical Reserve Corps, U. S. Army; Chief, Section of Roentgenology, Surgeon General's Office, U. S. Army; formerly Captain, Medical Corps, U. S. Army, and Professor of Roentgenology and Operative Surgery, Army Medical School, Washington, D. C. With 48 illustrations. Second edition, revised and enlarged. Philadelphia and London, J. B. Lippincott Company. Price, cloth, $3.00.

This manual was prepared with a view to the needs of the medical service of the United States Army. The small number of medical officers in the service of the regular army necessitates frequent change of station, so that it often becomes necessary for one to familiarize himself in a comparatively short time with the essentials of roentgenologic technic. The author recognizes the need of specializing in roentgenology and urges that whenever possible the services of a specialist be secured. The manual before us is intended to instruct the men who are so situated that they cannot avail themselves of the help of the specialist, and should thus be of value to a large class of civilian physicians.

Careful perusal of the latter part of the work impresses one that the author has exercised sound judgment and commendable reserve, especially in the discussion of moot points, and has given his readers a fair statement of the legitimate field of roentgen diagnostics and therapy. In the chapter on therapy the author acknowledges the assistance of his colleague, Dr. Thomas A. Groover.

The technical descriptions are necessarily brief, considering the size of the work (150 pages). In fact, our one criticism would be on this point.

J. T. C.

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AN APPARATUS FOR QUICK AND ACCURATE LOCALIZATION ON THE SCREEN

PARTICULARLY ADAPTABLE FOR USE IN CONNECTION WITH THE SURGICAL OPERATING TABLE

BY SIR JAMES MACKENZIE DAVIDSON, M.B. C.M.

LONDON, ENGLAND.

The Tube.—The apparatus to be described consists in the first place of the couch with a roentgen ray tube supported below, the latter surrounded by a protective shield, or, as in the model from which the accompanying illustrations are taken, contained in a large lead-lined box. The tube is supported by two arms which are carried outside the box by a zigzag opening. This permits of the tube being easily raised and lowered, and also allows the circulation of air by which the tube is kept cool, while at the same time no roentgen rays can pass out in this direction. (See Fig. 1.)

Fluorescent Screen and Cross Wires.—This part of the apparatus which is carried outside the tube box is attached to an upright support, and from the upper part of this support there is projected a hinged arm which can be placed horizontally over the couch or stretcher upon which the patient lies. A rack-and-pinion arrangement enables this arm and the tube below to be moved upwards and downwards together, and the distance between them is rigidly fixed and constant. Attached to this projecting arm is a square frame holding a hinged fluorescent screen. In the center of the frame two cross wires intersect (see Fig. 2), and the whole device is so arranged that the intersection of the wires is vertically above the spot on the anticathode of the tube from which the roentgen rays originate.

Centering.—The tube is first thoroughly adjusted to this position, and the final centering is done by suspending a small plumb bob from the intersection of the cross wires. The screen is closed down upon it so that the plumb bob hangs two or three inches below the bottom of the screen, and the tube is then excited and the circular shadow of the plumb bob is observed. If it so happens that the cross wires occupy a position at the center of the circular shadow of the plumb bob, the adjustment is perfect, and nothing further need be done. Should the shadow be out of the center, the supporting arm near the pillar end has two rack-and-pinion movements which enable the arm to be pushed forward across the couch or—at right angles to this movement—in line with the length of the couch. While the shadow is being observed, these screws can be so manipulated as to bring the plumb bob in the dead center of the cross wires. This is a much simpler and quicker way of centering the tube than that of moving the tube itself. When this adjustment has been made, a small clamp is tightened, after which no displacement can occur. The adjustment once obtained, it remains constant.

Locating the Foreign Body.—With this arrangement it is quite obvious that a wounded person can be placed upon the table, the rack-and-pinion motion allowing the descent of the cross wires so that they are actually in touch with the skin, or as close as possible to it while allowing free movements. Two handles will be observed projecting from the supporting pillar; of these the observer takes hold, while, on the track below, the tube box is moved backwards or forwards in line with the length of the couch and across its breadth. In this manner the patient can be examined from top to toe. If a foreign body is detected, the apparatus is so adjusted that the shadow of this foreign body is made to appear at the intersection of the cross wires. When this adjustment has been obtained the box can be clamped to avoid displacement; the screen is hinged back, and the skin of the patient marked at the point of the cross-wire intersection. It is, of course, quite obvious that the foreign body in this position of the patient must be vertically below that particular point.

Ascertaining Depth.—To ascertain the depth at which the foreign body is lying below the cross wires is a simple matter, involving only a few adjustments after replacement of the screen. In Fig. 3 a small clamp will be noticed with the operator's foot upon it to tighten it; from this clamp an upright will be seen with a T piece, which T piece is rotated counter-clockwise, and the tube box and support displaced to the left to a precise distance of 6 cm. (See Fig. 1.) (An apparatus can

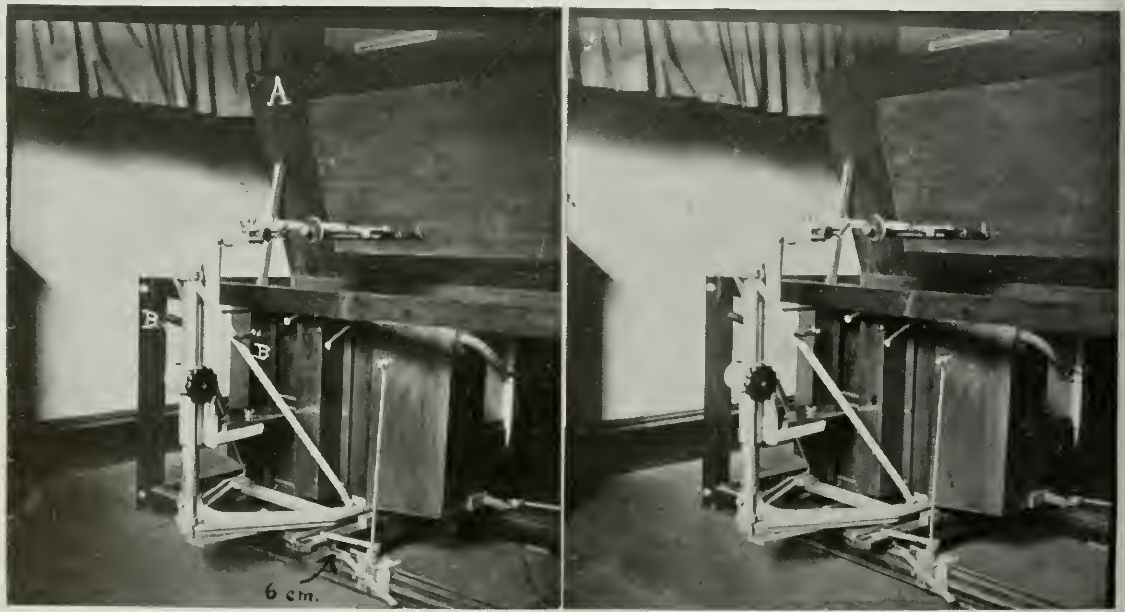

Fig. 1. General View of Apparatus with Couch Frame, Tube Box and Upright Support.

Showing (A) couch top raised and (B) handles for moving apparatus up and down.

be made to displace for any other distance that the operator may desire.) When this is done, of course, the shadow of the foreign body which had been previously accurately centered will be observed to be displaced to the right, and as the distance between the tube and the cross wires is always constant (in this case 50 cm.), the displacement of the shadow varies as the depth and can be accurately calibrated.

As a result of many experiments, I find that for easier visibility on examining the thick parts of the human body, a wire close to the surface of the screen and under the protective glass is more easily seen than the shadow of wires underneath the screen. I have, therefore, placed on the surface of the screen two fine cross wires in exact register—when the screen is in position—with the cross wires on the supporting frame. Then, to measure the displacement of the shadow, I have a very fine wire, like a fine knitting needle, which is made to travel across the screen horizontally, parallel with one of the fixed cross wires and intersecting the other. This traveling wire is attached to a nut on a two-thread screw. On the near side of this nut there is a small arrowhead indicator in contact with a calibrated scale, so that when the shadow of the displaced foreign body is observed, the little screw head can be rotated in such a manner as to make the wire travel to the position of that point in the shadow of the foreign body which originally was centered by the cross wires. It will then be found that the arrow points to a certain number, either in inches or centimeters, the latter preferably, and the depth of the foreign body can be read off immediately. It is quite easy to arrange an open scale with a multiplying gear for the traveling wire, but after trials in this direction I prefer to use the direct reading from the traveling nut, which obviates all slip, and any little error in adjusting the wire and the shadow is not therefore magnifiable on the measuring screen.

It must always be remembered that the

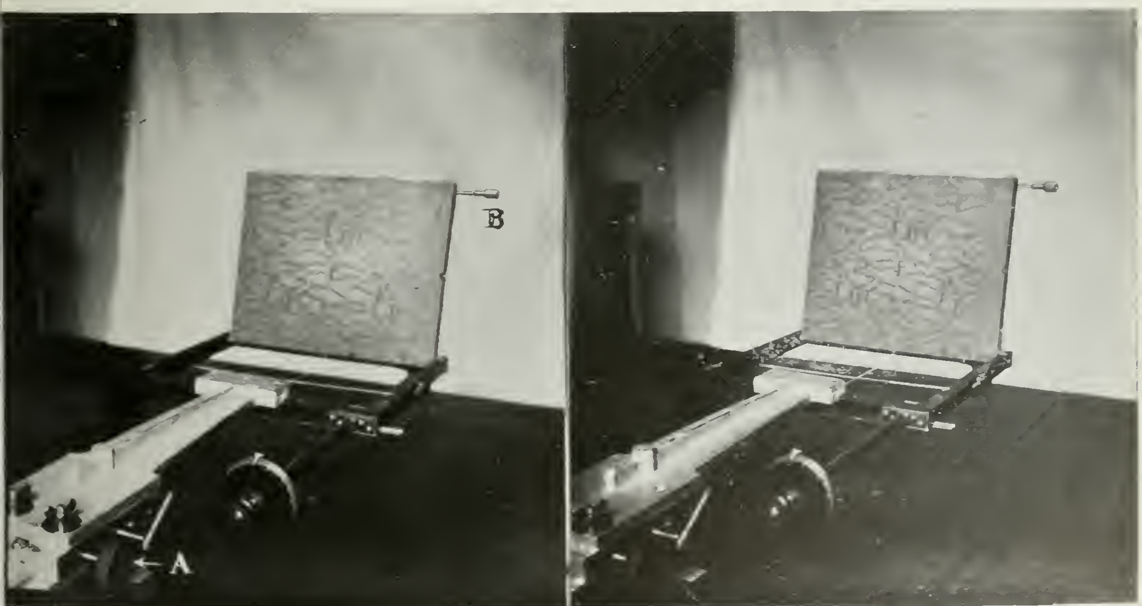

Fig. 2. Horizontal Arm with Cross Wires and Screen Hinged Back.

Showing (A) screws for centering cross wires and (B) handle to rotate screw rack carrying moving wire.

distances recorded on the micrometer scale indicate the distances of the foreign body from the cross wires on the supporting frame; therefore, if the central spot marked on the screen is any distance from the cross wires, of course this distance must be subtracted from the indicated distance to give accurate depth from the marked point to the position of the foreign body.

The manipulations which I have attempted to describe, although when written they may appear complicated, can all be carried out in about ten seconds. I know of no device at the present moment which is so accurate and rapid as this.

Application to Roentgenography.—If it is desired to use this apparatus for making plates, it is quite a simple matter to make the necessary arrangements. The point where the wires intersect indicates the vertical ray. This can be placed over the area which it is desired to examine; a little mark can be made on the skin vertically below the cross wires; the horizontal arm hinged back (as shown in the illustration); and then the plate in its holder is placed as usual on the patient's skin, and a roentgenogram made, either singly or with the stereoscopic shift. I have purposely, for quick localization on the screen, made this apparatus with only one method of shift, always to the left, thus avoiding mistakes, and making the thing "fool-proof." Should it be desired, however, to make stereoscopic plates with the shift *across* the couch, it is quite easy to make a little indicator, and while the tube box is prevented by a fixed clamp from moving parallel with the length of the couch it can be moved across the couch with any displacement desired.

Use in Connection with Surgical Operating Couch.—I wish specially to point out the utility of this apparatus in connection with the operating couch which the surgeon uses for the actual removal of the foreign body. Let us suppose that the surgeon has begun his operation and has difficulty in finding the foreign body.

Fig. 3. Foot Control of Upright Handle for Displacement.

Showing (A) position of handle before displacement. In Fig. 1 handle has been turned, indicating 6 cm. displacement.

He can observe the screen by means of a hood, or the room may be darkened for a few seconds. The arm of the screen is placed horizontally and racked up so as to be quite clear of the wound, over which it can be moved without touching, and therefore need not be disinfected. The apparatus can be rapidly moved, as already described, until the shadow of the foreign body is centered, when it can be clamped and fixed. The surgeon can then introduce into the wound a little probe which he can move about until it comes vertically over the foreign body, when it may be pushed down to the bottom of the wound and held there. The shift can be made at once, and, by moving the micrometer traveling wire over the point of his probe, the surgeon can read the depth below the cross wire with the aid of a little flash lamp. He then moves the micrometer traveling wire on to the shadow, with the corresponding part of it over the part which was previously centered, and reads the depth of the foreign body. The difference between the two readings gives him at once the vertical depth of the foreign body below the point of his probe.

Use at Clearing Stations.—The accompanying stereoscopic photographs, if viewed in a small lenticular stereoscope, will show fairly well the first model of the apparatus that I have had made. Now that the general principles of the method as here described are understood by practical engineers, it seems to me they would not find it difficult to devise and construct some convenient form in which these principles would be carried out, and which could be placed under an operating couch or under a stretcher. In this way wounded men could be carried in on stretchers, examined, the position and depth of the foreign body indicated, and then each man could be rapidly removed and his place be taken by the next. At clearing stations it appears to me that this would facilitate the work enormously, and, if the operating couches had stretcher tops, should there be any difficulty at any time in extracting the foreign body, and a separate roentgen ray outfit were not available for each operating table, the patient could be carried and placed on trestles between the tube and the screen as I have already described, and the position of the foreign body quickly ascertained.

I should advise the construction of a simple apparatus of this kind, as rigidly and lightly made as necessary, and a small portable track which could be laid down anywhere in clearing stations for it to run on. This, with two trestles to support the stretcher, would enable the wounded to be carried in to the required position between tube and cross wires.

The Upright Stand.—I have here described the method as applied to patients on a horizontal couch. It is quite a simple matter to devise an apparatus to work on an upright stand.

Tube Box and Diaphragm.—I should like to emphasize the advantage of this large box for containing the tube. It has a large hinged door on the opposite side to that from which I photographed it, with a lead glass window, which can be opened and gives easy access to the tube. Further, there is complete protection to everybody who keeps out of the direct path of the rays which come from the opening in the top of the box. Moreover, for those who wish to work with very small diaphragms, I have devised a simple modification which has proved very useful. A large square opening is placed on the top of the box. Two lead plates are also provided which slide together, so that they can be closed or opened in unison. In this way a very narrow slot can be adjusted, parallel to the line of displacement of the tube box. From either end of this diaphragm there are two lead plates which also slide and meet in the middle, but are operated by separate handles, so that when a small square opening is desired opposite the intersection of the cross wires, the handle operating the two plates closes them to a slot; then the two side plates are moved up until a very small narrow square opening is made, admitting of extremely fine observation, as the glare from the rest of the screen does not disturb the vision of the observer. Of course, after the object has been centered and the apparatus displaced to get the shadow shift, this fine diaphragm will completely eclipse the shifted shadow. Therefore, the lateral plate in the direction in which the shadow has been shifted—in this case always to the right of the observer—has to be opened until the shadow of the foreign body is seen, and then the other plate can be pushed across the center up towards it until one gets an equally small square opening for observing the shifted shadow as one had originally for observing the central shadow. This is quite easy of manipulation, and enables one to observe the central and the shifted shadow of the foreign body under the same optical conditions.

After considerable experience of this method of quick and accurate localization on the screen, I have every confidence in recommending it.

ROENTGENOLOGY IN WARFARE

BY J. HALL-EDWARDS, L.R.C.P., F.R.S. (EDIN.), HON. F.R.P.S.
Major R. A. M. C.

BIRMINGHAM, ENGLAND

INTRODUCTION

BY A. C. CHRISTIE, M.D.
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WASHINGTON

The following paper by J. Hall-Edwards is especially timely. It is written by a roentgenologist of ripe experience and sane judgment, and may be read with profit by surgeons as well as roentgenologists.

I wish to call particular attention to the author's plea for coöperation between the surgeon and the roentgenologist. With proper coöperation between these two the *x*-ray has rendered invaluable assistance in the present war, while without such coöperation it is valueless or even harmful.

The necessity for this harmony of effort furnishes the reason for another point insisted upon by the author—that all roentgenologists must be men with medical training. The non-medical technician cannot possibly bring to a consultation with the surgeon the experience and training necessary to give his opinions weight. The Surgeon General's Office has recognized this fact and has, from the beginning of the war, insisted that only officers of the Medical Reserve Corps, graduate physicians, should be assigned for duty as roentgenologists. The Surgeon General's Office has also recognized the necessity for thorough coöperation between the surgeon and roentgenologist. In the schools for instruction in surgery roentgenological methods are being thoroughly explained and illustrated, and in the *x*-ray schools no opportunity is lost to give to the students the surgeon's standpoint.

The American roentgenologist is anxious to profit by the experience obtained by our allies at great cost and sacrifice, and Mr. Hall-Edwards has rendered us a real service by publication of this paper calling attention to vital matters in the conduct of the *x*-ray work of the war.

I VENTURE to submit this paper in the hope that a few notes from one who has had considerable experience both in the present and South African wars, may prove of some value to my American friends who are now being brought face to face with the many difficulties which present themselves to the surgeons and roentgenologists engaged in war work.

Every roentgen department should be supervised by a trained medical officer—under no circumstances should a layman be allowed to sign a roentgenological report. Nothing is likely to be more detrimental to the future of our science than the effects which are certain to accrue if this injunction be disregarded.

There are at the present time hundreds if not thousands of *x*-ray assistants employed in the army who before the war were absolutely ignorant of the most elementary principles of *x*-ray technic. These assistants, after a few months' work in an *x*-ray department, consider themselves competent to undertake *x*-ray examinations on their own account. They were chosen for the positions they now hold chiefly on account of their having some elementary knowledge of developing and printing, and a certain number of them have gone through a short course of instruction in *x*-ray work prior to their being employed in these departments. Their knowledge, even at the end of the war, will be exceedingly limited, inasmuch as the majority of cases roentgenographed by them are essentially war cases, such as are seldom if ever met with in civil practice, so that even should they be endowed with special aptitude for observing details, their knowledge of *x*-ray procedure is extremely limited.

The interests of both the public and the profession must be safeguarded, and these assistants must be told that there is no more chance of their being able to make a living out of *x*-rays after the war (except as assistants) than there is of a navvy in the Royal Engineers being able to make a living as a consulting engineer.

Coöperation between the surgeon and the roentgenologist is essential to success. My experience as an inspector of roentgenological departments proved to me that the best work was done in hospitals where the roentgenologist was accorded his proper position, and where coöperation between himself and the surgeon was a daily practice. One of the most obvious causes of failure in the finding of foreign bodies is due to the absence of coöperation, and the fact that some surgeons refuse to coöperate results in failure and disappointment, to the detriment of the patient and the country at large.

In a few fortuitous instances, the surgeon is also a roentgenologist—such a combination should produce the best possible results in war time—failing this, the best that can happen is coöperation and consultation. Personally I would not sanction the operation for the removal of a foreign body from a vital part until a consultation had been held in the presence of the roentgenologist. In South Africa, no operation for the removal of a foreign body was undertaken without my being invited to be present. Moreover, my advice was sought as to the best method of procedure. To-day it is no uncommon occurrence for a surgeon to operate on the evidence of a roentgenogram taken for diagnostic purposes, and one which for reasons obvious to the roentgenologist is frequently misleading and inaccurate. My experiences are (owing to age and disability) confined to base hospitals in England, and the methods I employ are unsuited to hospitals at the front where cases in large numbers have to be dealt with in a minimum of time.

I rarely use fluorescent screens at the war hospitals, as the protective measures there provided are not, in my opinion, efficient. I depend almost entirely on a roentgenographic examination of the area in which the patient complains of pain or of inconvenience, and should I not find a foreign body there I rest content, for even should one be present in the tissues at some distance from the area roentgenographed, and there are no symptoms, I think that further interference is unnecessary, not to say undesirable, for reasons I shall put before you later. At the front both the diagnosis of the presence and the

Fig. 1. Piece of High-Explosive Shell in Thigh.

One of a pair of stereoscopic pictures showing the use of metal rings to increase the stereoscopic effect. The ring *A* is placed on the side of the limb furthest from the plate. The ring *B* is resting on the plate together with the cross wires.

localization of foreign bodies has to be made by means of the fluorescent screen, and under such circumstances it is absolutely necessary that the best possible precautions be taken for protecting both the patient and assistants. It is also necessary that a powerful apparatus be used—the tubes must be of the best obtainable and the operating room made perfectly dark, otherwise (as frequently occurs), a negative diagnosis may be given when a foreign body is present. Since the commencement of the war numberless methods of localization, good, bad and indifferent, have been published, but it matters little which is chosen as long as the procedure is carried out with scientific accuracy.

For base hospital work, however, when more time can be devoted to each individual case, I prefer a method in which the personal equation plays little or no part. The method of localization I usually adopt is that of taking a pair of pictures which can be used for the double purpose of taking measurements or for use in the stereoscope. A few months back I visited quite a number of roentgen departments in the south of England, and amongst other facts which were brought to my notice, I was particularly struck with the little use made of the stereoscope, and upon inquiry I found there was a general consensus of opinion that stereoscopic pictures are misleading. With this statement I entirely disagree. If stereoscopic pictures are carefully and scientifically produced, there can be nothing misleading about them, indeed they should be of the greatest possible value both to the surgeon and roentgenologist. It is a well-known fact that many people cannot acquire the habit of seeing stereoscopically, but I find that this disability can to a great extent be overcome by rendering the roentgenograms still more stereoscopic. This, in thin parts, is easily done by increasing the distance the tube is moved between the two exposures; by rubbing on the skin subnitrate of bismuth, iodoform, or some other opaque substance; and by placing beneath and above the limb in the neighborhood of the foreign body, some easily recognized metallic rings or pointers. In the thickest parts, the rendering visible of the surface of the skin is a much more difficult task, as the amount of bismuth or iodoform which is held by the skin is not sufficient to give a clear outline. It has been suggested that the limb should be encircled with a bandage containing some opaque material held in its meshes, but the drawback to this is that no matter how carefully such a bandage is applied, disconcerting lines and marks will always appear, due to the overlapping of the edges of the material, and the irregular manner in which the opaque substance is distributed through it. These markings infrequently hide or blur completely the finer details of the roentgenogram. I overcome this by the use (in addition to the crossed wires) of metal rings, some of which I place under the limb or against the plate, and others on the side of the limb nearest the tube. One ring having a tail-piece I place on the side of the limb nearest the tube, so that I always know the position from which I am viewing my pictures. (See Figs. 1 and 2.)

Since adopting this method I have not found a surgeon who cannot immediately get the full stereoscopic effect, and as I always take the precaution to mark the position of the rings on the skin, in addition to those of the cross wires, the position of the foreign body in relation to these markings is easily carried in one's mind. The objection which may be raised against my method is the time occupied in bringing about the result. By adopting the following procedure, however, the time is reduced to a minimum. A mark on the upright of my tube-holder indicates the distance of the anticathode from the plate, and the Mackenzie Davidson Localizer is always kept ready fixed up at this distance, so that fresh measurements do not have to be made on each occasion the localizer is required. The tube is centred over the changing-box and marks on the floor indicate exactly where the tube-stand should be placed, so that the central rays impinge upon the exact position where the wires cross. As a matter of fact, granting that the anticathode is always fixed at a known distance from the photographic plate, a table can be constructed showing the depth of the foreign body from the surface when the shadow-shift is known. The accompanying table is constructed for a tube distance of 18″ (45 centimetres) and a tube shift of 6 cms. In all probability this table has been previously published in your JOURNAL, but I insert it here again as it may prove useful to those engaged in war roentgenol-

FIG. 2. PIECE OF HIGH-EXPLOSIVE SHELL IN ABDOMINAL WALL.

One of a pair of stereoscopic pictures showing the use of metal rings in increasing stereoscopic effect. Rings marked *A* and *B* were placed on the abdomen. Rings *C* and *D* were on the plate which was placed beneath the patient, on the same plane as the cross wires.

LOCALIZATION TABLE

Tube Distance—18 inches (45 cms.) Tube Shift—6 cms.

Shadow Shift in mm.	Depth of F.B. in inches	Shadow Shift in mm.	Depth of F.B. in inches	Shadow Shift in mm.	Depth of F.B. in inches
1	0.29	21	4.66	41	7.30
2	0.58	22	4.83	42	7.41
3	0.85	23	4.99	43	7.51
4	1.125	24	5.14	44	7.61
5	1.38	25	5.29	45	7.71
6	1.64	26	5.44	46	7.81
7	1.88	27	5.58	47	7.90
8	2.12	28	5.73	48	8.00
9	2.35	29	5.86	49	8.09
10	2.57	30	6.00	50	8.18
11	2.79	31	6.13	51	8.27
12	3.00	32	6.26	52	8.36
13	3.20	33	6.39	53	8.44
14	3.40	34	6.51	54	8.53
15	3.60	35	6.63	55	8.62
16	3.79	36	6.75	56	8.70
17	3.97	37	6.87	57	8.77
18	4.15	38	6.98	58	8.85
19	4.33	39	7.09	59	8.92
20	4.50	40	7.20	60	9.00

ogy. A table from any tube distance can easily be constructed on the lines of the one published here.

One of the chief difficulties which is encountered in the carrying out of this method is the fading away of the marks made upon the skin. Nitrate of silver of course produces the most lasting marks, but even these are frequently removed by the iodine which is now almost universally used for sterilising the skin. I have tried several kinds of ink, some of which have been specially recommended by roentgenologists, and find none of them entirely satisfactory. The best method of making a permanent mark over a foreign body which may have to be removed on some subsequent occasion, is to tattoo the skin with India ink.

In our hospitals at home, the wounded soldier is allowed to know the results of the roentgenographic and roentgenoscopic findings. The plates are sent to the wards with the report and they are freely discussed by the nurses and patients, so that every man knows if a foreign body is located. This knowledge has an extremely detrimental effect on the man's convalescence. Having for eighteen months filled the post of Senior Medical Officer to a Command Depot, I have had ample opportunity of observing the effects produced in wounded soldiers by the knowledge that a foreign body is present in their tissues. They complain of pain, inability to use their limbs and general discomfort, even when the foreign body is so situated that it cannot possibly afford them the slightest inconvenience, and directly their work at the Depot is increased they fall sick, seek medical advice, and demand that the foreign body shall be removed. They are willing to undergo any operation and candidly confess that they will not be contented until the foreign body has been extracted. It is useless for the surgeons to tell them that its presence cannot possibly do them any harm—the piece of metal is "on their mind" and nothing will convince them that it should be disregarded. My experience in this direction leads me to suggest that measures be adopted to prevent wounded men from knowing the results of their roentgenographic examination. Neither the report nor the roentgenogram should be accessible to them, for it is an undoubted fact, at any rate here, that ignorance spells bliss. I would go a step further, and at once abolish loose case-sheets, and under no circumstances would I permit these to be attached to boards hung on the head of the bed, as is the usual procedure. All notes on cases and reports should be entered in a book, which is accessible only to the surgeon in charge of the case and to the Sister of the ward.

In this great and terrible fight for the world's liberty, the question of man-power is all important. It is therefore imperative that no effort should be disregarded to return to the fighting line all men capable of doing their duty.

The question of secrecy as to the presence of foreign bodies has a more far-reaching effect than would at first be imagined. The young and enthusiastic surgeon is apt to believe all the exaggerated statements made by the soldier, and seeing an opportunity for exhibiting his skill, is only too willing to undertake such cases, with the result that, to say the least, the man's stay in the hospital is seriously prolonged, even if nothing worse happens. As I have before stated, my experience of the conditions at the front is limited to hearsay and reading, hence my remarks almost entirely appertain to the conditions met with in base hospitals. Foreign bodies are rarely looked for until the wounds have healed or have nearly healed. The exceptional cases being those in which the symptoms are obviously due to the presence of the foreign body, in which there is a sinus leading to the same, or in cases in which there is much suppuration. In all such cases an exact localization should be made and every possible help rendered to enable the surgeon to extract the bullet. In the majority of cases which are now being sent home, the foreign bodies consist of small pieces of high-explosive shell. Very small pieces of this material are capable of inflicting an enormous amount of damage. I have seen the shaft of the femur broken into a dozen pieces by a small irregular piece of metal, measuring less than a quarter of an inch on its longest axis. Many of these foreign bodies held in the tissues are harmless, and did not the soldier know of their presence no symptoms would be in evidence.

Only a few days since my attention was drawn to a case in which a small nearly square piece of high-explosive shell was localized as being situated deeply in the cancellous tissue at the lower end of the femur. The symptoms complained of were entirely due to the damage done to the soft parts in the passage through of the foreign body. As this had passed through the synovial membrane there was, as it would be expected, a limited amount of synovitis. There was no evidence of any suppuration and I see no reason why the symptoms should not subside after a few weeks' rest, and there should be no reason why this foreign body should be removed. Now this soldier will, in all probability, be made aware of its presence, with the result that pseudo-symptoms are likely to arise and some enthusiastic young surgeon may be persuaded to remove it. In all operations for the removal of foreign bodies certain risks must be run, and it is of paramount importance that these should be taken into consideration. No operation, however small, can be performed without leaving behind some slight disability, and cannot be undertaken without risk. I know it will be argued that the risk is so small as to be negligible, but the fact remains that there is a risk.

Let us for a moment consider the risks of the removal of a foreign body situated deeply in the tissues and which, if left alone, would prove harmless. They are as follows:

1. The administration of an anesthetic.
2. The possibility of suppuration.
3. The remote possibility of death from shock.
4. The possibility that the foreign body may be missed, no matter how accurately it may have been localized.
5. Disability caused by the severance of nerves and by the scar.
6. The length of time during which the soldier occupies a bed unnecessarily.
7. The fact that having undergone any operation the mental condition of the man may be rendered worse rather than improved.

The question as to when a foreign body should be removed and when it should not, may to some extent be debatable, but there exist certain obvious rules which should be followed as a matter of routine.

A jagged piece of shell embedded in a muscle which is in constant use is a source of danger.

A piece of shell or bullet in such a position as to impede movement.

A piece of shell or bullet in the hands or feet in such a position as to be irritated by pressure and detract from the usefulness of the limb.

I am informed by a surgeon who has had considerable experience in base hospital work, that out of the thousands of cases that have come under his notice, in only one instance has a foreign body which had been left in the tissues caused trouble. This was in the case of a man who returned from the front with a swelling in his thigh and running a temperature. The swelling was found to be an abscess which had to be drained, and in the centre of which was found, not only a piece of shell, but what was more important, and which had not been diagnosed, a fragment of the man's tunic. In this case it is curious to note that no ill effects were experienced until the man had been on active service at the front for some months. In my twenty years experience as a roentgenologist, I have met with many cases in which bullets embedded in the tissues have produced far less disablement than would an operation for their removal.

Case 1. A man during the South African War had a shrapnel bullet pass through his chest wall and it was localized as being embedded in the lower lobe of his right lung. I have not seen or heard of the man for five years, but up to that time he was in the best of health and suffered from no disability.

Case 2. An officer consulted me who had a Mauser bullet apparently contained within the synovial membrane of his left knee. I strongly advised its removal, but he absolutely refused to undergo any operation. Five years afterwards he informed me that it had not troubled him in the slightest degree, and apart from the fact that he knew of its presence, it had caused him no disability.

Case 3. A well-known public man in this country was shot by a tramp, the bullet lodging somewhere in his neck. Seven years afterwards he consulted me owing to his having spat up some blood-stained mucus. The bullet was located embedded in the base of the skull. An examination of the patient's throat proved that hemorrhage was not caused by its presence. It is now seven years since he consulted me, and I believe I am right in stating that the bullet has caused him no disability.

These cases, together with many others which I have known, convince me that a major operation for the removal of a foreign body which is not causing obvious symptoms is, to say the least, undesirable. Having tasted the horrors of modern warfare, there are a large number of men who have returned home (some only slightly wounded), who are not at all anxious to return to the trenches. Some of these are prepared to undergo any operation to secure a longer stay at home. They are apt, under these circumstances, to exaggerate their symptoms and to bring pressure upon the surgeon to perform an operation. In the hurried roentgenoscopic examination made at the front, many foreign bodies are overlooked, and many injuries escape diagnosis. It is therefore necessary that these cases should be roentgenographed and a more complete examination made. A roentgenographic department is at the present time an expensive necessity, and it is therefore necessary (in order to prevent undue wastage) that the reports should be full and conclusive. The army form used for such reports in this country is divided into two parts—the first for a brief history of the case, which is supposed to be filled in by the surgeon-in-charge, and the second for the roentgenologist to record his findings and remarks. In my experience the first half rarely gives any indication of the true state of affairs, the usual remarks herein made being—1. For foreign body. 2. For injury to bone or fracture.—No indication is given as to the position of the wound or the existence of an exit wound. These facts have to be elicited from the soldier himself unless the dressings be removed and a careful examination be made by the roentgenologist.

Roentgenologists should insist that this brief history of the case be supplied in sufficient detail to enable them to get a grasp of the case and to carry out their work efficiently. They cannot be expected to obtain all these details themselves. The surgeon's notes should always be sent to the *x*-ray department with the case, and, whenever possible, splints and dressings should be removed, as it not infrequently happens that these render some of the finer details of the roentgenogram difficult to decipher.

Reduced pictures (however good they may be) are not in my opinion to be compared with full-sized ones. Especially is this the case in roentgenograms of comminuted fractures of the long bones where numerous fragments are present. In these cases stereoscopic pictures are a great help and personally I prefer them to any others. Many surgeons, however, prefer to have anteroposterior and lateral views, and it is a moot point as to which, under all circumstances, convey the greater amount of knowledge.

The free use of bismuth and iodoform paste (Bipp) in France, is a source of much annoyance to the roentgenologist at home. The paste not infrequently obscures the part which it is most urgently necessary to see; and where the presence of a foreign body is suspected, it must occasionally render the task of showing it absolutely hopeless. Small masses of the paste are sometimes mistaken for fragments of shell, and instances have occurred where an operation has been undertaken for their removal. Experience on the part of the roentgenologist will enable him to decide which is which. The general outline of the masses and the absence of sharp projections act as a guide. From the roentgenologist's point of view it will be a happy day when Bipp is replaced by some other compound which is not so obstructive to the passage of the rays.

The double-coated *x*-ray films made by the Austin-Edwards Dry Plate Co. are exceedingly useful under some circumstances, owing to the fact that they can be bent without injury. They can frequently be used when a plate cannot;—for instance, they can be slipped in between a bent joint and an angular splint, and a patient with a painful wound in the back can lie on one placed between the flesh and a folded blanket without discomfort, when it would be impossible for him to rest for a moment on a plate supported by a hard board.

I would like to lay stress upon the importance of always roentgenographing injuries to the long bones, where any injury is suspected, from more than one position, as it not infrequently happens that extensive injury may be done to the surface of one of these bones without any indication being seen in the a.p. view, whilst the injury stands out conspicuously in a lateral view, and vice versa. This injunction particularly applies to injuries about the ankle-joint and knee. In fractures of the lower third of the tibia, the upper portion of the fibula should always be included in the roentgenogram; and in all fractures anywhere near the joint, the joint itself should be included.

All roentgenograms should be numbered at the time they are taken. This is easily done by numbering instruments now procurable from dealers in *x*-ray apparatus, but inasmuch as these are unsightly and occupy a large space on the picture, I prefer to fashion little figures out of wire and stick these on a piece of adhesive plaster, which is laid on the plate at the time the exposure is made. The carrying out of this procedure involves only a small expenditure of time and prevents all possibility of mistake.

In conclusion I beg to thank you, Mr. Editor, for kindly publishing these notes and trust that some of the suggestions made herein may be of use to my American friends.

AN INSTRUMENT FOR RAPID FLUOROSCOPIC FOREIGN-BODY LOCALIZATION BY COMBINED PARALLAX AND DOUBLE RING METHODS *

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NEW YORK

IN THIS presentation the author expressly disavows any claim to the discovery of a new method of projectile localization. Historically it is a fact that the parallax method was one of the very first to be proposed after the discovery of the x-ray in 1895, and the double ring followed shortly after, as will be verified by a visit to the archives of roentgenology. Notwithstanding this, the parallax method has been "discovered" many times over. Levy-Dorn in 1896 made use of the parallax principle in the determination of the depth of a projectile by the simple maneuver of introducing his hand under the vertical fluoroscopic screen and moving a finger forward and backward until it was at the same distance from the screen as the foreign body. This, of course, was before the danger of such a proceeding was known and is absolutely not to be considered at this day. The earliest use of the double-ring principle appears to have been made by Redner, who fastened small pieces of metal on the skin at the points of inlet and outlet of the x-ray beam as it passed through the projectile. Rosenthal devised a handle with a ring which had an inker in its center while Angerer used a similar device, two such rings, however, being used. Exner combined the double-ring method with the triangulation method and later used the parallax in place of triangulation. From the foregoing it will be seen that nothing new has been "discovered" in this article.

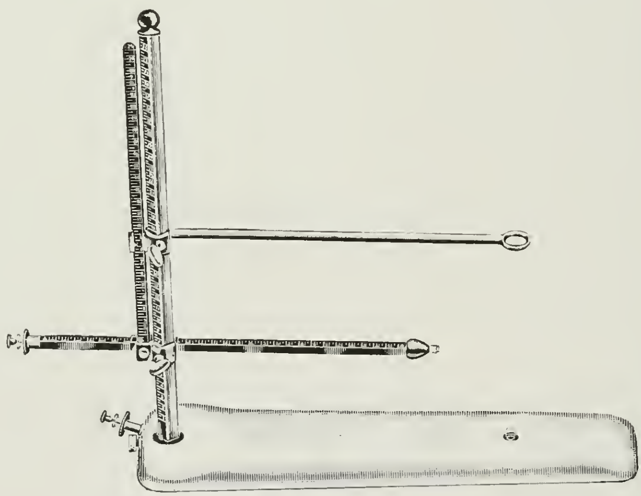

FIG. 1. INSTRUMENT FOR USE WITH THE PARALLAX AND RING METHOD.

The instrument herein described is illustrated in Fig. 1. It provides an easy,

* Original model presented at the Midwinter Meeting of American Roentgen Ray Society at Atlantic City, N. J., January 6, 1918.

convenient and rapid means of roentgenoscopic localization and enables the roentgenologist to not only obtain the depth from the skin above the projectile, but also the distance from the skin below the projectile, and, further, the distance to the foreign body from the skin on the side of the part at the level of the foreign body. Thus it could be termed a "triple localizer," giving, as it does, three depths at one setting of the instrument.

The Parallax Principle.—This is illustrated in Fig. 2, which shows that the shadow projections of objects in line, but at different distances from a source of light, will be superimposed on a plane surface, but will, on displacing the light, move in an opposite direction at different speeds and distances according to their relative positions. The shadow of the one farthest from the surface will travel the greater distance. If, now, this object be raised, its shadow will approach that of the one nearer the surface, and when both are on the same level, their shadows will be equidistant from the original point from which they started. This gives but one dimension, that of depth.

The Double-Ring Principle.—This is shown in Fig. 3, in which it will be seen that when two rings of same diameter are brought in line with the central beam of a light, their shadows will be superimposed upon a plane surface in a concentric manner, that of the one farthest from the surface being the larger and surrounding the shadow of the ring nearest the surface. Now if one of the rings be placed over and the other under an object, a line drawn through the centers of all three will be a straight line. This establishes only the line upon which the object lies.

The Combination.—It will be seen by the preceding paragraphs that each of the two methods described lacks what the other provides in the accurate localization of a projectile. Both are necessary to the surgeon: thus the parallax gives no information as to the line upon which the foreign body lies, though it gives the depth, while the double ring establishes the desired line but does not give the depth. Combining the two into one has proved to be a happy solution of the problem, and this instrument provides a means for applying

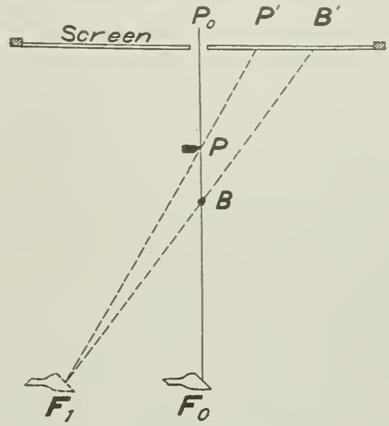

Fig. 2. Principle of the Parallax Method.

Auxiliary body, B, below P and distal from the screen shows greater shadow displacement to B'.

these desirable features. In the schematic drawing, Fig. 3, is indicated the manner in which this is accomplished. Here the upper ring, R, and the lower ring, C, are in vertical line with the projectile, P, and the parallax rod, B, is on a level with it.

The Instrument.—This consists of an aluminun base at one end of which is mounted an upright post which carries two horizontal arms. The upper arm has a ring at its free end and is adjustable in vertical direction only. The ring center is at a fixed distance from the upright post. The second arm is the parallax rod which is adjustable in two directions, vertical and horizontal. A ball or cone is attached to the end of this rod. In the center of this ball is a wick that can be extended when pressure is made on the plunger at the opposite end. In the base of the instrument is mounted a ring of the same size as the upper one, but with a finger containing a wick which can be pushed into the center of the ring. These wicks are to be inked with suitable skin ink for the purpose of marking the skin. To the right of the upright post is placed a vertical scale which is graduated to quarter-centimeters; this scale indicates the distance from the under side of the upper ring (the skin) to the center of the ball on the parallax rod (level of the projectile), thus giving the depth, *d*, from above. The upright post is similarly graduated and gives the distance from the upper side of the lower ring (the skin underneath) to the center of the parallax ball, thus giving the depth, *l* (height from below). A third scale is provided on the parallax rod which also is graduated in quarter-centimeters, this reading giving the lateral distance from the tip of the parallel rod ball (skin mark), thus giving the depth, *h* (lateral), from the side at the level of the projectile.

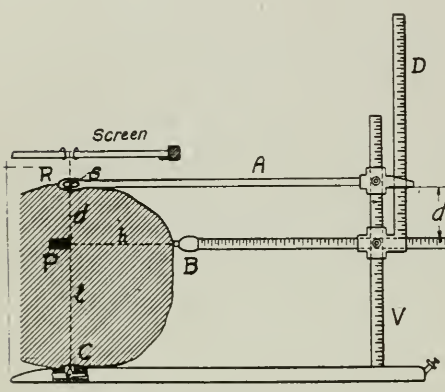

Fig. 3. Schematic Drawing of the Blaine Model Parallax Localizer.

All three scales are direct-reading and no addition, subtraction or other mathematical proceeding is required in this triple localization.

To facilitate the proper and accurate judgment of the shadow displacements of projectile and parallax ball, an accessory guide is found in a rectangular transparent celluloid sheet upon which have been drawn several parallel lines (Fig. 4). This is laid upon the surface of the roentgenoscopic screen and, being transparent, the shadows are clearly seen through the celluloid. This enables the roentgenologist to shift the projectile shadow from one of the parallel lines to another and then to raise or lower the parallax ball until the center of its shadow on the screen will coincide with the same transverse line on the celluloid sheet as that to which the projectile shadow was moved.

Modus Operandi.—The instrument must be placed on a plane surface which is parallel to the tube travel. If the table is level, the top will, most likely, be the same. The focal spot of the tube must be in the exact center of the diaphragm shutter. Incidently the double ring is a most accurate means of establishing this point. Thus, if the focal spot be in the true center of the diaphragm, the shadows of the two rings will be concentric on the screen, whereas, if it is not so situated, they will overlap. Should this be the case, it will be necessary to move the *x*-ray tube in its holder until the proper position is obtained. A sagging table top will interfere with the proper working of the instrument. With the U. S. Army portable *x*-ray table, the stretcher-type top necessitates the use of a filler board to provide the plane surface required to set the base of the instrument upon. A small pocket level will materially assist in ascertaining the proper setting of the surface to be used. This may be a wooden board ½ to ⅝ of an inch thick and about 12 x 18 inches in size. For the comfort of the patient, blankets may be doubled to the thickness of the board and placed to right and left of the board. Having determined that the instrument has the proper surface and focal-spot setting, it is removed and the wicks replenished with fresh skin ink such as the Finzi formula. The patient is brought on the table and a preliminary *x*-ray examination is made of the entire body to discover in what regions the projectiles or fragments lie which are to be localized.

Selecting one of these, the tube is brought directly under the projectile and centered with the smallest diaphragm opening and the *x*-ray turned off. The upper arm of the instrument is raised to a point higher than the thickness of the part to be examined and the parallax rod is drawn backward far enough so that the ball will not touch the patient's skin. The base of the instrument is now slipped under the part, the ring to set as near as possible to the estimated position of the object. Under the x-ray light the instrument is adjusted so that the two ring shadows surround the projectile shadow. The arms of the instrument should be as near at right angles to the long axis of the part as possible. Place the celluloid with parallel lines on the screen surface with one of the lines directly in the center of the rings and projectile and exactly in line with the arms of the instrument. If the projectile be at some distance from the edge of the part, the screen may be moved so that the projectile shadow is set at the far side of the screen, taking care that one of the parallel lines sets in line with the arms of the instrument as previously noted. The diaphragm shutter is now opened and the tube is displaced to right or left an amount sufficient to move the projectile shadow to the next parallel line. Lock the tube against longitudinal travel and bring the focal spot under the edge of the patient. Bring the parallax ball cautiously toward the skin but do not allow it to touch the skin. The shadow of the ball will be seen to be nearer to or farther from the starting line according to its relation, in level, to the projectile. The parallax rod is now raised or lowered until the center of its shadow is in the center of the same parallel line on which the projectile shadow lies. The x-ray light may now be discontinued. Move the parallax rod forward until it touches the skin, lock the two set screws and press the plunger to mark the spot on the skin. Press the plunger on the base to mark the skin underneath the projectile. Lower the upper ring until it touches the skin and mark the center of the ring with suitable skin ink. The instrument may now be removed and the depths on the three scales read and noted. The screen may be at any convenient distance from the skin; no deductions are necessary for screen to skin distance at any position.

The actual time that the x-ray is in operation is but a few seconds and with a little practice the entire localization can

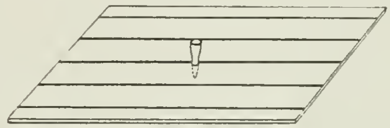

Fig. 4. Ruled Celluloid Sheet to Gauge the Shadow Displacements of Projectile and Parallax Ball.

be performed in approximately 1 minute. The degree of accuracy obtained leaves but little to be desired. Few errors of more than 2 to 4 millimeters occur when one has accustomed himself to the instrument. Major James T. Case, Director of Roentgenology of the American Expeditionary Forces, states that, as a rule, localizations within ½ centimeter are entirely satisfactory in practical roentgenosurgical work.

From the surgical point of view this instrument gives more information than the usual simple depth methods and permits the surgeon to choose between three points of attack for the removal of a given projectile. If the anatomy be such that it would be inadvisable from an operative standpoint to go in by way of the upper skin mark, the patient may be turned over and the rear skin point used; or, in other cases, the side may be the best from which to approach the foreign body.

The original model of this instrument had an inker in the center of the upper ring and all skin marks were made simultaneously by pressure of a single plunger to which were attached flexible cables to each wick. This was modified to conform to the requirements of the work in the medical department of the U. S. Army, which has adopted it as one of the standard localization instruments.

In such cases as it is inadvisable to use the instrument as above described—which necessitates the insertion of the aluminum base *under* the patient—the simple parallax principle may be used by releasing a small set screw in the base and turning the upright post with its upper ring and parallax rod, 90 degrees to the right. The base may now be set alongside of the patient and the depth of the projectile under the upper ring may be found in a similar manner as previously noted. If the instrument is level, the lateral distance may also be obtained, giving two dimensions at right angles to each other.

An additional use to which this instrument may be put is in marking the upper and lower skin points for the several pairs of spots required in such a method as the profundometer described by Flint in a recent publication, in which the several pairs are connected with straight lines. Their crossing indicates the location of the projectile.

TREATMENT OF MYELOCYTIC LEUKEMIA BY RADIUM

Thirty consecutive cases of myelocytic leukemia were treated at the Mayo Clinic by means of the surface application of radium element over the enlarged spleen. A certain degree of general improvement, together with reduction of the size of the spleen and of the leukocytic count, occurred in every instance, even in the most advanced and toxic cases. Marked temporary improvement occurred in twenty-six patients, and a remarkable improvement in thirteen. Hemorrhage ceased as a rule after one or two series of exposures. In two instances, hemorrhage occurred after radium exposures when it had not occurred previous to treatment. In these instances the hemorrhage seemed to be the result of overexposure; an anemia also developed; both the hemorrhage and the anemia were successfully combated by means of transfusion. In twenty-five patients there was definite improvement of the anemia concomitant with the improvement of the general condition. The reduction of the number of leukocytes was due chiefly to not only an absolute but also a striking relative fall in the myelocytes; there was a striking fall in the absolute count of polynuclears, while their relative percentage remained approximately the same. There was also a marked fall in the absolute count of small lymphocytes. Surface exposures of radium over the spleen of myelocytic leukemia usually effect a very rapid reduction of the size of the spleen, a fall of the leukocyte count, improvement in the general condition and together with transfusion, constitute at present the most effective temporary measure in the treatment of the disease. (*Boston M. & S. J.*, Nov. 15, CLXXVII, No. 20.) (Ref. *Jour. M. Assn.*, Dec. 15, 1917, p. 2069.)

THE APPENDIX WITH ESPECIAL REFERENCE TO PERISTALSIS *

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T IS the purpose of the writer to pursue an outline of the subject which will ve a bearing on the various phases rectly affecting the science of roentgen- ogy.

Acute appendicitis does not offer a very uitful field for roentgen diagnosis, be- use the usual clinical methods suffice r proper recognition. Occasionally one ight be enlightened in a left-sided appen- icitis, in which case a careful fluoroscopic xamination during the administration of n opaque enema would reveal a case of ansposition.

The vagaries of chronic appendiceal in- olvement often render the diagnosis diffi- ult. Atypical symptoms in some cases ead to a faulty diagnosis and, after re- noval, the appendix is found to be unin- volved and the condition of the patient re- nains as heretofore. The appendix has requently been removed when the real cause of trouble was a stone in the urinary tract (especially in the lower right ureter), tuberculous peritonitis, tubercular mesen- teric glands, painful right inguinal hernia, pleurisy, etc. This is a sin of commission because of the attendant operative risks, also, because an organ has been removed which probably has a function. Conversely, if a chronic appendiceal condition exists and its existence is not recognized, we not only allow the retention of an inflamma- tory organ but permit the development of functional and organic derangements, first in the appendix itself; second, on neighbor- ing and associated organs. It is widely recognized that when a patient has once had an attack of appendicitis there is lia- bility of recurrence unless the appendix has been removed. It is therefore evident that any method which can supplement clinical methods in attaining a correct diagnosis should be welcomed.

The roentgenological examination offers such tangible help and is disassociated from any risk or hazard to the patient.

Albers-Schoenberg, Holzknecht, Hurst, Béclère, Jordon, Groedel, Riedel and other European roentgenologists did some early work on this subject; however, consider- able credit must be given some of our American collaborators, notably Cole, Case, Quimby and George, for early ap- preciating the possibilities of this method of examination.

According to the classification of Treves there are four principal types of cecum and the origin of the appendix varies with the type of cecum present. The movable portion of the appendix may be met with in different situations. It may pass upward and in front of the cecum and colon; up- ward and behind the cecum, and even behind the colon between the two layers of the mesocolon; upward and to the inner side or upward and to the outer side of the cecum and colon. It may pass to the left under the ileum and mesentery; up- ward and to the left or downward and to the left into the true pelvis. It may pass directly downward under the cecum. It may pass to the right in front of or back of the cecum. It may occupy any of the pericecal fossæ, but more often enters the ileocecal fossa. When the cecum is mobile the appendix may be found almost anywhere within the abdomen. When the cecum is undescended, the appendix shares in the failure to descend and may be below the gall-bladder or in front of the right kidney and may pass in several directions; upward behind the cecum, to the left be- hind the ileum and mesentery, or down-

* Read before the Chicago Roentgenological Society, April 19, 1918.

ward and inward into the true pelvis. McBurney's point is an accepted empirical localization based on the law of average. The roentgen examination following the administration or injection of an opaque media will many times visualize the ap-

Fig. 1. Interesting Because Segmented. Suggests Appendicular Peristalsis.

pendix and always will visualize the cecum. In this way the location of the appendix can be quite accurately determined.

Physiologically considered the appendix is thought by some to be a vestigial structure. It has been suggested that the vermiform process in man is the degenerated remains of the herbivorous cecum, which has been replaced by the carnivorous form. The appendix is found only in man, the higher apes and the wombat, although in certain rodents a somewhat similar arrangement exists. In carnivorous animals the cecum is very slightly developed; in herbivorous it is usually large.

Robinson has deduced from a series of experiments that to suppose that the appendix is a degenerative, useless organ is gratuitous. He concluded that the acid liquid secreted by the appendix plays the part principally of a hormone, stimulating the cecum to provoke its contractions and expedite the issue of the feces collected.

"The observations of physicians show that constipation and cecal stasis are early and permanent in patients attacked by appendicitis."

The appendix is an independent organ and a useful one, the physiological function of which becomes more and more evident. Its ablation in numerous doubtful cases is a harmful act, since the large intestine suffers and the patient suffers a loss in the physiological function of defecation.

Berry and Lack are quoted as follows:

1. Lymphoid tissue is the characteristic feature of the true cecal apex throughout the animal kingdom including man. As the vertebrate scale is ascended it tends to be collected together into a specially differentiated portion of the intestinal canal—the vermiform appendix.

2. The amount of lymphoid tissue present at the cecal apex varies, most probably, though not certainly, in accordance with the varying diet of the animal.

3. The vermiform appendix of man is not, therefore, either a vestigial remnant or an organ in a state of retrogression; but is an actively functioning lymph gland. It is no argument against this view to state that because the appendix is frequently removed without any apparent functional disturbance that it is useless, because the same argument might be adduced against the stomach, which is occasionally removed

Fig. 2. Long Appendix with Segmentation Suggestive of Appendicular Peristalsis.

her wholly or in part and with more or ss success.

4. The appendix of man is not equally nctional throughout the whole of life, birth it contains practically no lymphoid ssue; within six weeks it has become a mph gland and continues as such during ie first half of life, after which it pro-ressively declines in functional activity. ymphoid tissue is, therefore, a tissue of ie growing animal.

5. Obliteration of the vermiform ap-endix is a pathological process.

6. The functions of the human appendix re the same as any other collection of ymphoid tissue in any other part of the ody.

Morgera states that the digitiform gland n *Scyllœa* is the homologue of the vermi-orm appendix in mammals. The glandular epithelium of the digitiform appendix shows a strong secretory power which has a strong effect on the emulsification of fats. The removal of this gland or the closure of the intestinal duct from it, in experimental animals, shows that the feces are not evacuated with their usual regularity. Extracts of this secretion injected into the lower intestinal tract have accelerated intestinal peristalsis or accentuated expression of feces. He writes a further report

Fig. 3. At Time of Examination Appendix Appeared Negative.

Mention was made of potential danger. Shortly afterward an acute appendicitis developed.

and says he is satisfied that the ectoproctic power of the vermiform appendix in man and mammals is identical with the above.

Heile made a series of animal experiments to determine the physiology of the

Fig. 4. Appendix Located External to Cecum.

Cecum and ascending colon pushed mesially by abscess which contains the appendix. Marked spasticity of descending colon.

appendix. From these he draws the following conclusions: "The appendix contains in its walls ferments which can be demonstrated in the lumen of the living appendix as secretions of that organ. These ferments are endocellular in nature and can be separated from their cell connection by autolysis. There are hormones present in the cells of the appendiceal lining, capable of initiating powerful contractions of the bowel in the living animal. Therefore the function of the appendix is analogous to that of the appendix of man."

Waller states that clinical observations become more and more convincingly certain that the appendix possesses a peculiar neuromechanism which normally is exercised in the designed functional activities of the ileocolic region.

Keith's recent "New Theory of the Causation of Enterostasis" and the theory of "Sphincteric Zones" as the pacemakers of intestinal peristaltic activities, consider a ceco-appendiceal plexus zone. It is considered that normally there is an intimate coördination in the rhythm of each successive segment of the entire intestinal tract, and that any disturbance, irritative or inflammatory, upsets this rhythm with reflex manifestations in the form of spasms. Thus given an irritative lesion in the appendix, reflex spasm occurs, and if permitted to continue over an extended period, there is a progressive weakening or atony of the circular muscle fibres which provokes an enterostasis. Such a view has recently been put forward by Ochsner.

Fig. 5. Appendix Lies Left of the Median Line.
An associated symptom was bladder irritability. Cecum lies in bladder region.

Cohn contends that antiperistalsis of the colon plays an important part in the filling of the appendix. The appendix empties by its own proper movements. Evacuation may be hindered; then there is stasis. The appendix is seen full when the larger intestine is empty for some time. While the colon is filling, the appendix fills and empties several times. In alternately filling and emptying, the appendix describes movements and takes forms which vary much. Its variations of forms have often been considered as twists at the time of operation or as pathologic alterations.

Siccordi states that in young rabbits it can easily be demonstrated that there are more or less regular contractions of the organ *in situ* and such can be registered graphically. These are ample and frequent rhythmic movements at certain temperatures of the solution. Such movements under favorable conditions persist for seven and eight hours after excision of the appendix and clearly demonstrate the peristaltic characteristics of the movements.

In man it is more difficult to demonstrate mobility of the organ *in situ*. In adults, in healthy appendices excised from individuals between the ages of eighteen and thirty-four years (as the graphs presented by Siccordi demonstrate), rhythmic movements take place in special Ringer's solution; very slow, slight, but sufficiently regular and with modifications according to the temperature. He says that the oscillations and variations of the appendix musculature can be made manifest by administration of barium and the *x*-rays.

Waller recites the observations of one case, after administration of opaque meal and fluoroscopic examination:

"The appendix is alternately of greater and lesser density in various areas (suggesting segmentation) and at certain periods of the examination the apex is well

Fig. 6. Cecum only Partially Descended. Appendix Lies on Iliac Crest.

Anomalous development present; the pelvic colon runs horizontally to the right with angulation in region of appendix. What might appear as the transverse colon is the pelvic colon.

Fig. 7. Appendix Lying on Pelvic Brim with Fixation of Tip.

filled. At times there appears to be motion in this organ, but I am not absolutely certain that this is independent of the peristalsis of the adjacent viscera. After manipulation of the cecum (at which time the appendix is well filled) the tendency to evacuation of the appendix is evident."

Fig. 8. The Conformation of this Appendix Was Virtually the Same in Both Lying and Standing Postures. This Was Due to Extensive Adhesions.

Fig. 9. Short Cecum and Ascending Colon.
Riedel's lobe of liver present with low hepatic flexure. Appendix adherent. Case of Situs Inversus.

The writer has had the same experience in several cases in which segmentation was present, leading him to conclude that peristalsis in the appendix did exist.

There are two methods of visualizing the appendix: One is by injecting an opaque

Fig. 10. Appendix Curled and Adherent. Cecal Stasis Marked.

enema; the other is by the ingestion of an opaque meal. The second is preferable because of the greater frequency with which the appendix can be demonstrated. This would demonstrate that antiperistalsis in the cecum and ascending colon were the

FIG. 11. APPENDIX RUNS UP AND TO THE LEFT TOWARDS GALL-BLADDER REGION.

Previous diagnosis gall-stones. Fixation of appendix produced angulation of ascending colon.

prime factors in filling the appendix, rather than gravitation. In examining the patient the fluoroscopic method is the most satisfactory. This should be done in the vertical and horizontal positions. Occasionally the Trendelenburg position is necessary to release a pelvic cecum which might be incarcerated or possibly adherent.

By proper manipulation an otherwise hidden appendix can be shown; also its movability and relationship to the surrounding structures can be noted. The plate method should also be used, for it occasionally gives additional information. Sometimes stereoscopic plates are indicated whereby one can trace a retrocecal appendix or an appendix in close proximity to the cecum or ileum.

It is necessary that the lumen of the appendix be patent. The appendix may not be demonstrated if its lumen is obliterated or if adhesions or kinks are present near the proximal end; or if an acute attack exists, the infiltrated mucous membrane prevents the entrance of the opaque substance. Also an enterolith, or previously contained food matter, may prevent its filling.

The writer has had several cases in which the first examination failed to reveal the appendix, but a second examination disclosed its presence.

The time of examination is important, for the appendix commences to fill shortly after the cecum. This is usually after the sixth hour, although there are cases that fill earlier. From this time until the bowel is empty and often for several days afterwards, the appendix remains visible. Pirie has reported one case in which the shadow persisted for forty-three days.

Pathologic evidences of previous appendiceal inflammations are: Peritoneal adhesions; obliterations of the whole or portions of its lumen; strictures of the lumen with more or less dilatation distal to it; and, lastly, the presence of hard concretions which are retained by strictures or produce the same effects as strictures.

Concretions can occasionally be shown. The other factors are inferential from the following information. The visualized appendix with fluoroscopic manipulation will give us: (1) The size, including length and caliber; (2) position and direction; (3) drainage; (4) mobility; (5) kinks; (6) the location of applied pressure to visceral

FIG. 12. APPENDIX CURLED UPON ITSELF WITH TIP SELF-ADHERENT. SPASTIC COLON.

topography. This latter point is quite important, for should pain be constantly excited by pressing on the appendiceal shadow, one should suspect its involvement, for seeing palpation is more valuable than palpation without seeing.

This often throws light on cases in which anomalous symptoms have resulted from the appendix being located in the pelvis, behind the cecum, or unusually high, when the symptoms may simulate gall-stones or duodenal ulcer.

The fluoroscopic examination will often reveal the presence of adhesions in connection with the appendix, terminal ileum and cecum, whether to each other or the surrounding parts.

If the cecum is in the pelvis it can often be drawn into the right iliac fossa; if not, it may be necessary to resort to the Trendelenburg position.

The appendix produces effects on remote organs. The stomach may be hypertonic so that it empties itself rapidly, which phenomenon is more frequently associated with duodenal ulcer. More commonly a spasm occurs in the center of the stomach. Indeed, chronic appendicitis is, after gastric ulcer, the most frequent cause of spasmodic hourglass constriction of the stomach. Sometimes pressure over the appendix will produce a spasm; in many cases epigastric discomfort was simultaneously produced. Barclay states that appendicitis causes an impairment of the ileopyloric reflex producing dyspepsia. Occasionally we have associated a delayed pylorospasm. Intestinal stasis sometimes results from adhesions following a chronically inflamed appendix.

Fig. 13. Lack of Descent of Ascending Colon and Cecum with Correspondingly High Appendix, Adherent near Right Ureter.

Fig. 14. Appendix External to Cecum. Cecum in True Pelvis and Adherent.

Cecal and colonic stasis are often due to reflex inhibition resulting from chronic appendicitis. In such cases the cecum and ascending colon are unusually large. Enterospasm usually affecting the proximal half of the transverse colon is sometimes present. When the appendix is situated in the pelvis, dyschezia may be produced.

Conclusions.—1. Because the appendix may have a physiological function it should be studied roentgenologically before removal in chronic cases.

2. Because it possesses peristalsis, the roentgen demonstration of appendiceal retention or rapid expulsion of barium is of diagnostic value.

3. Because of its reflex influence over the

Fig. 15. Appendix Curled with Tip Adherent to Cecum.

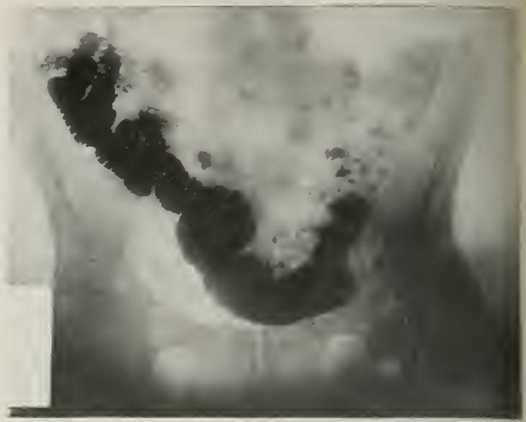

Fig. 16. Six-hour P. C. Examination Marked Ileal Stasis with Distention of Small Bowel. Due to appendiceal involvement.

alimentary tract, the appendix should be investigated by the barium method in many diseases of the stomach and intestines.

4. Because of its anatomical relation to the cecum, the location of the appendix can be determined approximately even when not visible on plate or screen.

5. When barium-filled, the appendix can be studied by the screen in great detail and accurately palpated for pressure-pain and adhesions.

ROENTGEN RAY AND ANTIBODY PRODUCTION

To test the effect of the ray on antibody production after it is well under way, that is, a few days after the introduction of the antigen, it proved advisable to use animals that would stand repeated bleedings better than the rat. The purpose now is to present briefly the results of experiments of this and like nature made by Hektoen on the dog and the rabbit. He found that exposure of dogs and rabbits to the roentgen ray at about the same time as antigen is introduced may restrain in high degree, and under some conditions completely, the production of antibodies as measured by the antibody content of the serum. The results correspond fully to those previously obtained from experiments on the white rat. When antibody production is at or near its height, exposure to the roentgen ray appears to have but little if any effect on the antibodies in the blood, and at this time dogs appear to have an increased resistance to the effects of the ray just as rabbits in the period of active production of antibodies have an increased resistance to effects of benzene. Whether there is any relationship between this apparent resistance to the effects of roentgen rays and the reported beneficial effect of the rays in the later stages of tuberculosis in guinea pigs remains to be determined. The results obtained from these observations harmonize with the view that antibodies are produced in the spleen, lymphatic tissues, and marrow, as these structures suffer most directly from the action of the roentgen ray; they indicate also that one reason why the lymphocyte appears to be an important agent of defense in tuberculosis and other conditions may be its power to form antibodies and that the rapid development of tuberculosis in roentgen-rayed guinea pigs may depend, at least in part, on interference with antibody-production. L. Hektoen.

(*J. Infect. Dis.*, Chicago, January, 1918, 22, No. 1. Ref. *J. Am. M. Ass.*, Feb. 16, 1918, p. 486.)

POSTROENTGEN TREATMENT OF CARCINOMA OF THE BREAST *

BY RUSSELL H. BOGGS, M.D.
PITTSBURGH, PA.

THE technique of the treatment of carcinoma of the breast by the roentgen rays has been steadily improving. Since the introduction of the Coolidge tube many have been able to standardize their dosage. Some advances have also been made in deep therapy. However, in studying the work done by a large majority of roentgenologists, we find two serious defects. The first of these is, that they leave many chains of lymphatics untreated. And the second is that, while they give a physiological dose superficially, in cross-firing they employ too few ports of entry, so that as a result, the deep tissues receive only from 1/3 to 1/7 the physiological dose.

It is absolutely imperative that every roentgen therapeutist should make a comprehensive study of the lymphatics draining the breast before he attempts to treat mammary carcinoma. Since we know that the lymphatic supply to the breast is greater than that of almost any other organ of the body, and since we have learned from a study of bone metastases how extensively the lymphatics become involved, we realize that when we rayed only the line of incision, axilla and supraclavicular region, our treatment was very incomplete. It omitted a great number of glands which we now know it is necessary to treat, namely: suprascapular, paravertebral, supraxiphoid, lateral intercostal and inguinal group. Nor should we neglect to ray the internal mammary glands, since it is from these that the involvement from one breast to the other takes place.

Autopsy has shown that the liver is the seat of metastases more frequently than any of the internal organs, and in many cases becomes involved in comparatively early stages. According to Handley, the frequent involvement of the liver is attributed to the cancerous dissemination along the deep lymphatics of the fascia of the thoracic wall to the epigastrium and to the umbilicus, whence these cells follow the subserous lymphatics to become deposited either on the surface of the liver, or are conveyed along the lymphatics of the falciform ligament to the portal glands. If Handley's deductions are correct we should never omit heavy treatment over the epigastric region.

The next in frequency are the lungs, pleura and the glands of the mediastinum. These are supposed to become involved through the intercostal or supraclavicular lymphatics.

In some patients we find the pelvic viscera are involved. Handley says that these are involved in 8.6 per cent. of the early cases in young patients, and in only 4.8 per cent. of the late cases of all older patients. The reason for this lower percentage in older patients is, that with age the lymphatics undergo senile atrophy, and the diminution of the caliber of the lymphatic vessels always has a tendency to oppose cancer dissemination. This truth, that the smaller the vessels the more they oppose the advance of metastases, is also shown by the fact that the disease is not so malignant in thin patients as in those who are fat. Right here while this fact is before you, I would like to say that if the roentgen rays did nothing more than produce a sclerosis of the lymphatics and a reduction of the size of the vessels, the treatment would still be indicated, as it would always check the progress of the disease and in some cases effect a cure.

A study of autopsies shows that almost any organ of the body may show metastasis from cancer of the breast, and how-

* Read at Eighteenth Annual Meeting of the American Roentgen Ray Society, New York City, Sept. 20-22, 1917.

ever much confined to the superficial tissues this dissemination may seem to be, no one can absolutely foretell how far the so-called "microscopic growing edge" of cancer may extend. In 7 per cent. of the cases of carcinoma of the breast, bone metastases are a late sequel. Any bony structure may undergo metastasis, but the clavicle and the distal extremities are rarely involved.

In view of the wide distribution and depth of metastases, we know that in treating carcinoma of the breast, the rays must be so directed that the deep glands in the axilla, under the clavicle, in the mediastinum, those leading to the liver, and all the viscera which invite metastasis will receive a full roentgen dose. This means that cross-firing must be employed so that the deep glands will be given from 3 to 7 times the amount that is given to any skin area. If we give 20X Koenig (Gauss modified Kienböck scale) dose at the surface, in order that the tissues at a depth of two inches will receive 20X, sufficient ports of entry must be employed to make up for the amount of intensity of the light which is lost by distance and by absorption by the tissues. If the glands to be rayed are four inches from the skin, more cross-firing or more ports of entry must be used than if the glands are only two inches from the skin. Experiments have shown, if the glands to be treated are four inches below the surface, that the intensity diminishes from 100 to 15, that is about one-seventh of that at the surface. I am sure that the majority of those treating carcinoma of the breast by the roentgen rays employ too few ports of entry, and consequently the deep tissues receive only a fractional dose. This failure to employ deep therapy is responsible for many recurrences.

Most of us would like to give a more radical treatment in order to produce better end results. We know that all the glands which favor metastasis from breast carcinoma should receive deep radiation, but we must remember that the number of square inches that can be radiated is limited, when a full dose is given more than once. Now we are all looking for some means by which the skin will safely tolerate larger doses. Many roentgenologists have adopted the following or its equivalent as a standard dose, or the amount which each area of the skin will tolerate safely: Using a Coolidge tube and a modern transformer, focal-skin distance 8 inches, filtering the rays with 4 millimeters of aluminum, with a 9-inch parallel spark gap, 25 milliampere minutes are given. With most transformers this dose will measure 20X Koenig (Gauss modified Kienböck scale). This is the dose I employ in most cases, and I ray the following areas:

(1) In order to prevent recurrence in the wound and destroy any foci in the lymphatics of the anterior chest wall and those leading up to the inner clavicular area, three to four areas receive treatment, the last being directed towards the liver. Then the liver area is given one anteriorly, one laterally and one posteriorly. With this amount of treatment, the scar is nearly all removed and a recurrence in the area is rare, in comparison with the number of recurrences in cases not treated by radiation. The scar will not tolerate as much radiation as regions where the circulation has not been interfered with by operation.

(2) The axilla is given from three to four doses, in addition to what it receives indirectly while other areas are treated, so that it will receive a full dose at the proper depth. One area below the axilla laterally can be covered by one treatment. The supraclavicular glands are usually involved from the axillary.

(3) The supraclavicular region is divided into four areas. One treatment is directed obliquely inwards including the lower cervical glands, one downward through the shoulder area to the axilla, one obliquely downward and backward through the clavicle, and one obliquely forward and downward from the posterior surface. Care must be taken that the glands under the clavicle receive a full dose.

(4) The suprascapular area much more frequently discloses metastases than the subscapular. Each should receive a full dose on the affected side, while on the opposite side the subscapular area might be omitted in early cases.

(5) The mediastinum should receive one or two treatments from the posterior to an area between the spine and scapula of the opposite side directed towards the affected breast region, besides the treatment it receives when other areas are rayed.

(6) The opposite side is rayed according to indications, and during the course never receives less than from 4 to 8 treatments.

(7) The epigastric region must never be omitted, as this is one of the avenues by which the liver and pelvic viscera are invaded.

The interval between the first and second course of treatments is four weeks. However, in most cases the supraclavicular glands are rayed again in two weeks instead of four, since this chain is often involved, and the surgeon seldom advises opening it, because he has learned that it is really inoperable when involved. Competent surgeons agree that if an operation could be performed before a diagnosis could be made clinically and without a microscope, 80 per cent. of the cases could be cured.

Deaver and McFarland in their recent book, "The Breast, Its Anomalies, Its Diseases, and their Treatment," make the following statement: "It has been stated that 80 per cent. of patients in whom the disease is confined to the breast, as proved by both macroscopic and microscopic examinations of the tissues adjacent to this organ, are permanently cured of their disease by the radical operation. Therefore, a patient presenting a small movable mass localized to the breast can be assured that four out of five cases of a similar nature are cured by operation. When axillary lymph nodes are palpably enlarged as the result of metastases, the chances of operative cure are at once diminished to one in five." This deduction is practically the same as that of Halstead, who says that notwithstanding the present day extensive operation, death from metastases occurs in 23.4 per cent., even in cases with a microscopically negative axilla. Deaver questions whether as much palliation is received from operative as from non-operative methods, and expresses his general dissatisfaction with operations of a palliative nature in the treatment of carcinoma of the breast, since in certain cases the disease has been excited to greater activity by an incomplete operation, and the life of the patient considerably shortened. In this connection he mentions the unreserved statement of Bloodgood, that "Incomplete operation hastens death." He further states that since 1897 extraordinary advances have been made in roentgenotherapy that remove most of the indications for the ultraradical operative procedures, which have practically no curative value and a primary mortality of at least 25 per cent.

Since this carefully prepared volume of Deaver is a résumé of the entire medical literature and world-wide clinics, and since he has included a valuable chapter on roentgenotherapy by Pfahler, it deserves more than passing notice. For my own part, I am well convinced from the cases I have seen during the past fifteen or sixteen years, that proper postroentgen treatment will prevent from 25 to 50 per cent. of recurrences even in early cases, because cancer cells can be destroyed at a greater depth and distance from the original growth. It is only a question of time, until the profession will realize that postoperative treatment is just as necessary as is asepsis, before and during the operation.

For the last five or six years, I have considered anti-operative roentgenotherapy a very important and useful field in early as well as in advanced carcinoma of the breast, but only a comparatively few cases have been referred, as surgeons do not want the operation to be delayed for three or four weeks.

It is a demonstrative fact that in lymphatics, where the vessels are of a small size, carcinoma cells do not disseminate nearly so readily as where they are of a larger size. It has been proven that after roentgenotherapy, the lymphatics undergo a sclerosis, thus reducing the size of both the lymph nodes and vessels which in turn reduces the danger of metastases. A cancerous mass which has been rayed, changes in type, always becomes more scirrhous, and is rendered much less malignant. Carcinomatous tumors in the breast which have been growing very rapidly will be checked and reduced in size within a very short time after full doses of radiation. It has been suggested that some of the patients are rendered "immune" to the growth of carcinoma for some time after such treatment. However, no one can prove at present whether there is really an immunity, or whether the checking of the growth and improvement in the general health of the patient are due entirely to histological changes in the tissues. Observers agree that the type of tumor changes, and that the danger of metastases is reduced by such treatment.

Anti-operative treatment will often render a more advanced case operable, and if deep metastases have not already taken place, more permanent cures can be obtained surgically. As I have before mentioned, metastases will not occur so readily if the caliber of the lymphatic vessels has been reduced by treatment. However, if the liver or any other of the internal viscera had a metastatic involvement before treatment was given, the cure by operation would be only an apparent cure. But the operation would not hasten metastases as it would without anti-operative treatment. Postoperative roentgen treatment cannot take the place of anti-operative treatment-as many think.

We all know much palliation and many times a temporary cure can be produced in inoperable and recurrent cases. A study of the lymphatic supply of the breast and the extensive metastases, usually visceral, which have already taken place, explains why the results are often only temporary. By temporary, I mean from one to three or more years.

Although much advancement will yet be made in roentgenotherapy, sufficient results have been already obtained to make it a recognized method in the treatment of postoperative cases, recurrent and metastatic, primary inoperable and primary cases which cannot be operated upon.

AN INEXPENSIVE HEAD VISE

BY CAMP C. THOMAS, B.S.

ANN ARBOR, MICH.

RARELY does the initial installation of a roentgen laboratory include an efficient device for immobilizing the head while radiographing the sinuses. We met such a situation by constructing the "head vise" here illustrated and found it to be valuable in all views except the lateral. The total expense, including labor and materials, was seventy-five cents.

The base is made of pine 14″ x 10″ x ¾″. The jaws of the vise are mounted 4½ inches from one end of the base, and are five

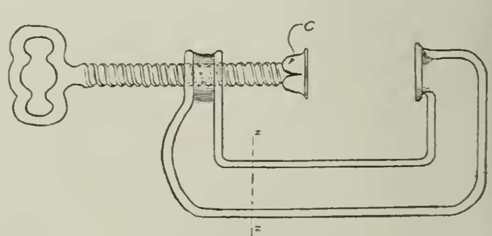

Plate I

inches high, as illustrated here in Plate II.

The jaws are made by welding iron brackets to the part sawed from a carpenter's iron clamps, labeled N, in Plate I.

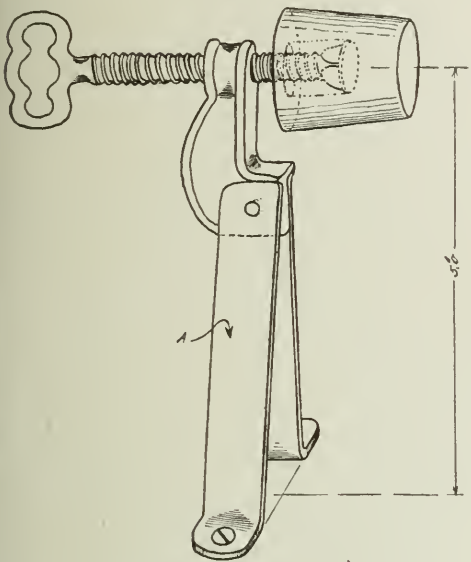

Plate II

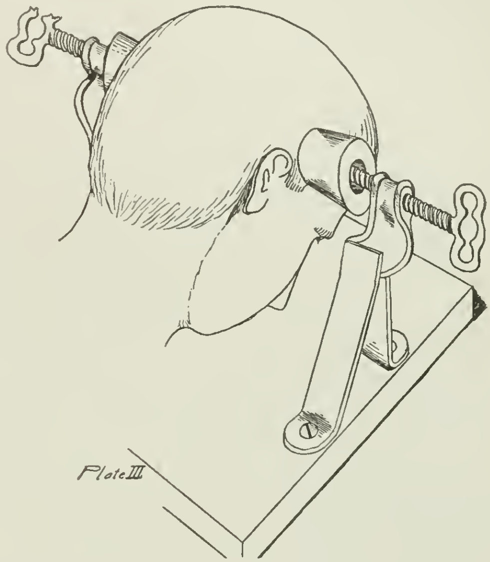

Plate III

The pivoted plate of the clamp jaw is imbedded in a large cork, and cemented or glued. The carpenter's clamps are made of cast iron and were purchased for ten cents each at a "5-and-10-cent store."

The corks used as faces of the vise jaws do not obstruct the rays and cast no shadows on the roentgenograph.

The vise may be used at an inclination of 25 degrees by raising one end of the base six inches with removable pegs.

In making stereoroentgenographs the aluminum plate-changing tunnel may be used with the vise, or the base may be made of light veneer with a plate-changing compartment.

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GASTRIC FUNCTION FOLLOWING GASTRO-ENTEROSTOMY

Smithies[1] in discussing gastric function after gastro-enterostomy considers the development of pain, anorexia, nausea, vomiting, gas, eructations, constipation, diarrhea, weight loss, weakness, nervousness, gross hemorrhage, anemia, cachexia, jaundice, visible abdominal peristalsis, abdominal tenderness, and abdominal ridge or mass. A brief notice is made of "stomach size" and "gastric stagnation." He then considers in considerable detail the analyses of the gastric juice. The paper is purely a clinical study and as such is able, admirable and interesting. We are surprised, therefore, to have the paper end abruptly with the following paragraphs which we quote verbatim.

"Roentgen examinations: Fluoroscopic study was made of 39 cases within 7 weeks of gastro-enterostomy and of 26 cases operated upon from 6 months to 9 years previously. The results were so greatly at variance with the patient's physiologic digestive function or his clinical condition that we are still in doubt as to the clinical worth of the procedure. Apart from the screen and plate examinations demonstrating the patency or closure of the pylorus or gastroenterostomy stoma, contractures of the stomach, incorrect surgical procedures, new ulcer or recurrences of ulcer or cancer, or anomalous pocketing or regurgitation of the opaque meal, little reliable information respecting gastric function was obtained. Many of these facts were clinically evident from simple routine examinations and from well-taken histories.

"In patients who have been operated upon at other clinics and in whom the surgical maneuvers are in doubt, fluoroscopic examinations furnish a valuable method for rapidly establishing the mechanical status of the stomach and the jejunum. However, in all cases, where stenoses, contractures, pocketings, or retention of the opaque meal appear to exist, frequent examinations, particularly after full doses of atropin or belladonna, should be made before opinion is given. Many abnormalities seen at the first seance disappear upon repeated examination, especially upon the examination after anti-spasmodic medicines have been administered."

[1] "Gastric Functions Following Gastro-Enterostomy," *Surg. Gynec. & Obstr.*, March, 1918, p. 281.

This comment on gastric roentgenology i interesting chiefly because it illustrates e irrational animosity which the dis- nguished author seems to entertain and ltivates towards the x-ray.

In his entire article he touches upon ly two conditions which could by any ssibility be demonstrated by x-ray meth- ls; namely "stomach size" and "gastric agnation." In his sneering disparage- ent of the x-ray he does not mention ther of these conditions in connection ith his own cases. In the final paragraph e mentions "the mechanical status of the tomach" and *the apparent* retention of the *paque meal*, in connection with cases "op- rated upon at other clinics." But he does nanage to mention a fairly wide range of -ray usefulness. His style in this regard f applied to urinalysis would read some- what as follows: The examination of the rine apart from showing the presence of albumin, sugar, casts, indican, pus, the reaction, the phthalein index and the spe- cific gravity contributes but little informa- tion respecting the renal function.

He estimates the size of the stomach by air inflation, at the same time apologizing for its inaccuracy. For the estimation of gastric stagnation he uses the stomach tube. If a few bits of raisin skins or lettuce leaves have adhered to the stomach wall, then the stomach is adjudged to show food retention. So particular is he in this regard that the stomach is "lavaged with 2 liters of warm water in order to avoid missing retention of food bits."

While he is insistent that stomach retention after an opaque x-ray meal must be guarded by repeated examinations after full doses of atropin, he ignores entirely the fact that gastric and pyloric spasms are exactly as common after a stomach-tube test-meal as when barium is mixed with the food. Dr. Smithies is not to be judged more at fault in this matter than other internists who hold the x-ray strictly accountable to fallacies and methods discovered and prescribed by roentgenologists, while forgetting that clinical methods in no way absolve the stomach from its peculiar spasms and responses to reflex influences.

In contrast to Smithies' unwarranted statements we may quote from Carman and Miller's paper[2] based upon 950 cases at the Mayo Clinic in which both the x-ray and the clinical methods of estimating gastric retention were compared. Conclusions:

"1. It would seem that the bariumized carbohydrate meal described above is a more sensitive test for gastric motility than the modified Riegel meal as commonly used in the Mayo Clinic.

"2. The roentgenologic double-meal method is more informative than tubing after a motor test-meal, since the former not only shows delay of evacuation beyond six hours, but also yields information as to hypermotile conditions, and often, by showing both the active and passive factors concerned in motility, aids in the judgment of the net result.

"3. A distinct residue after six hours from the barium meal given under the conditions prescribed has been, nine times out of ten, in our experience, indicative of grave pathology and usually denotes obstruction at or near the pylorus.

"4. The roentgenologic method is probably capable of further elaboration and refinement. By this means the motility of the stomach for various foodstuffs, given separately and in combination, can be determined with ease and accuracy, and by such determinations the diagnosis of gastric disorders might be further promoted.

"5. The six-hour barium residue may be the most definite and striking roentgenologic sign of a gastro-intestinal lesion. Other signs may be so slight and indefinite that a diagnosis might not be ventured without this retention."

The confidence of the medical profession in gastric roentgenology need in no respect be impaired because of Dr. Smithies' failure to find it useful in the examination of cases after gastro-enterostomies.

A. W. CRANE.

[2]Collected Papers of the Mayo Clinic, Vol. VII, 1915, p. 96.

Use of Intensifying Screens for Skeletal Roentgenography

The conviction of most experienced roentgenologists is that the intensifying screen, although very useful in gastro-intestinal work, is to be avoided in the roentgenography of bones and joints. This conviction is not to be disputed in the case of the average patient of 150 pounds or less. But there comes a point with increasing thickness of parts where the screened plate may be made superior to the unscreened plate, provided a certain technique be followed.

The parts of a heavy patient especially suited for the screened plate are, the spine, both anteroposterior and lateral, the hips and the shoulders. Here it may be necessary with unscreened plates to use small diaphragms and long exposures. For these reasons the use of stereoscopic plates may be often impracticable. But better plates, with larger diaphragms and in quicker time, may be made with screens.

The technique is simply the use of a soft ray, a transformer current of low voltage, sufficient time, and an aluminum filter between patient and plate to cut out a proportion of the secondary rays. It is important to use a current of low voltage yielding a maximum of a 5 or 6 inch spark. The tube should be regulated so that 1 second may be allowed for every 3 centimeters of tissue thickness when 35 to 40 milliamperes are flowing through a Coolidge tube with a tube distance of 24 inches. This should give a parallel spark gap of from 3½ to 4 inches. The secondary rays generated in the tissues by these soft rays are partly stopped by the ordinary aluminum cover of the cassette, but it is better to add ½ cm. thickness in addition to improve the definition.

It will be seen that the time is about one third that of the unscreened plate if a 4 to 4½ parallel spark gap is used. This is a very different matter from the so-called instantaneous exposures usually associated with the use of intensifying screens. From 5 to 15 seconds for spines are needed for this method in contrast to 1/10 to 1/3 second used in gastro-intestinal plates in the same cases.

This same technique applied to the roentgenography of the head is especially useful. The average anteroposterior plate is thus made in 7 seconds with a distance of 16 to 18 inches while the lateral at 24 inches is made in the same time. We have found it especially useful to make the first plate of a stereoscopic pair of the head on an unscreened plate and to make the second on the screened plate. The fine focus Coolidge tube is thus saved from overheating. The two plates stereoscope extremely well, the difference in tone, structure and detail contributing to the stereoscopic effect, while the grain of the screen becomes partially effaced by the superposition of the unscreened plate. The fact that in the stereoscope one plate must have the glass side out while the other has the film side out, in no way detracts from the practicability of this method.

In order to use a plate-changer holding cassettes, the unscreened plate may be put into an empty cassette or a piece of black paper may be fitted over the screen and the plate placed upon it so that the film side will be presented to the rays.

Our work in this line has been done exclusively with fine focus Coolidge tubes. Accuracy of adjustment and great steadiness in the character of the rays are required. It is altogether probable that a steady gas tube could be used with equally good results if managed with sufficient care. It is obvious, if the tube hardens under fire or softens with heat, that either the plate will be gray and flat from too high a ray, or be underexposed from insufficient penetration. Thus the method has the disadvantage of a narrow range for variation of ray-penetration.

A. W. Crane.

TRANSLATIONS & ABSTRACTS

Coolidge, W. D., and Moore, C. N. A Portable Roentgen Ray Generating Outfit. (Research Laboratory General Electric Co. *General Electric Review*, January, 1918, Vol. XXI, No. 1, p. 60.)

The authors became interested in the problems of a portable military *x*-ray outfit because of inquiries from the Red Cross when it appeared that this country might become involved in the European war. Existing military outfits were investigated and experiments carried on regarding six possible systems. The following is quoted from their article.

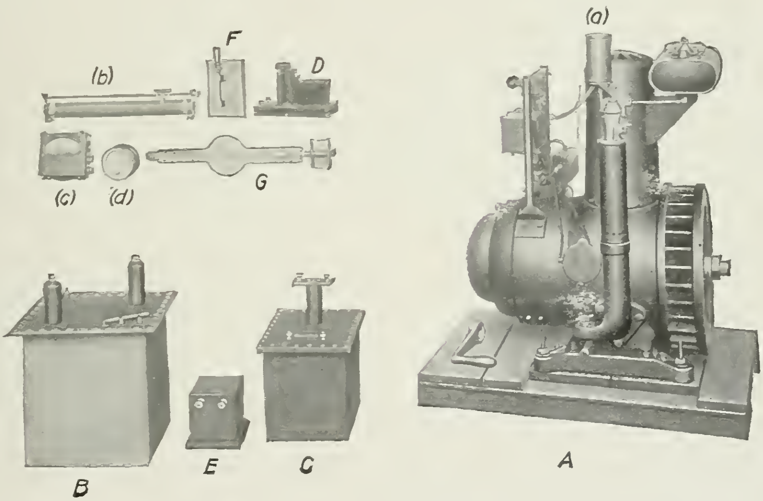

Fig. 1. Separate Units Comprising Portable Roentgen Ray Outfit.

THE SYSTEM CHOSEN

System (4), consisting of a gasolene-electric set furnishing alternating current to a step-up transformer, and with a special self-rectifying roentgen ray tube operating directly from the latter was finally chosen. The advantages of this system when compared with the others may be briefly summarized as follows:

It is simpler.

It is more efficient electrically.

It is lighter in weight for a given output, and hence more portable.

It does not involve the care of a storage battery.

It involves the use of no moving parts other than the gasolene-electric set.

The outfit is self-contained, requiring merely gasolene to run it, and hence can be operated anywhere at any time regardless of the presence or absence of electric supply circuits.

The one member having moving parts, namely the gasolene-electric set, can be located at any desired distance from the roentgen ray room.

THE OUTFIT AS DEVELOPED

Separate Elements Comprising the Outfit.—Having settled upon the system, it became necessary to get the component parts. The exigency of the case made it desirable to use, in so far as possible, apparatus which was already in production and hence readily available. For this reason, apparatus was borrowed from many different manufacturers and tested for its fitness for the particular purpose in question. The elements which were finally chosen are shown in Fig. 1. A description of each of these elements, together with the reasons for choosing it, is given in the following:

(*A*) *Gasolene-electric Set.*—Various single- and multiple-cylinder engines of the 2-cycle and 4-cycle type were tried out, and the conclusion was reached that the one which was best adapted to the purpose was the Delco-light engine made by the Domestic Engineering Company of Dayton, Ohio. This engine was already direct-connected to a dynamo.

The Delco-light set was originally built for direct current at 40 volts, but by a change in armature- and field-windings and by the addition of a pair of slip rings and brushes it was adapted to furnish alternating current at the desired voltage. The engine was also provided with a special throttle-governor for regulating the generator voltage. This governor consists of a solenoid (a) mounted above the carburetor, the movable core of the solenoid being connected to the butterfly valve of the throttle. The solenoid is operated by direct current taken from the commutator of the generator. A variable resistance (b) is placed in series with the solenoid, and by means of this resistance any throttle opening and hence any desired engine speed and alternating current voltage may be obtained. The alternating-current voltage is indicated by the voltmeter (c).

(*B*) *Roentgen Ray Transformer.*—A small transformer for dental radiographic outfit, was chosen for the following reasons:

- It is an oil-insulated closed-magnetic circuit transformer of the proper capacity.
- It is oil-tight.
- Its design is such that, with the load in question, the "inverse" voltage is not prohibitively high.
- It was available on short notice, as only two minor changes were required. These changes consisted in adapting the primary winding to the voltage of the generator and in bringing out leads for the milliammeter (d) from the grounded middle point of the secondary (this makes the milliammeter a low-tension instrument).

(*C*) *Filament-current Transformer.* — Here again it seemed imperative that an oil insulated transformer should be used, and that this should be electrically efficient, of light weight, and oil tight.

(*D*) *Filament-current Control.*—That chosen for this outfit was selected because of its small size, fineness of regulation, and the fact that the setting, once made, was not easily disturbed.

(*E*) *Booster.*—The line voltage drops considerably when the full load is thrown on the generator. To prevent the lowering of the filament-current which would result from this, a small transformer was designed, the primary of which is inserted in the primary circuit of the *x*-ray transformer and the secondary in the primary circuit of the filament-transformer, as shown in the wiring diagram (Fig. 3).

(*F*) *Operating Switch.*—A single-pole single-throw switch of substantial construction was chosen.

(*G*) *Special Self-rectifying Tube.*—There was no tube suitable for diagnostic work and capable of rectifying its own current, for frequent long exposures, with as much energy as that available from the Delco-light set. It, therefore, became necessary to undertake its development, and the result is seen in Fig. 2. This tube is fully discussed in a separate paper published in the current number of the *Review* by one of the authors. Briefly, it is a hot-cathode tube with a 9.5 cm. (3¾ in.) bulb. The cathode has been especially designed to give a focal spot 3.2 mm. (⅛ in.) in diameter and with a very uniform distribution of energy. The target consists of a small wrought-tungsten button set in a solid block of copper, and this block is electrically welded to a solid copper stem 1.6 cm. (⅝ in.) in diameter which extends out through the anode arm to an exter-

FIG. 2. SPECIAL SELF-RECTIFYING ROENTGEN RAY TUBE.

al radiator. A platinum sleeve is silver-soldered at one end to the copper stem and attached at the other end to the glass of the anode arm. The target, complete with stem and radiator, weighs 860 gms. and has a heat capacity of 81 calories per degree centigrade. The present standard solid tungsten target,

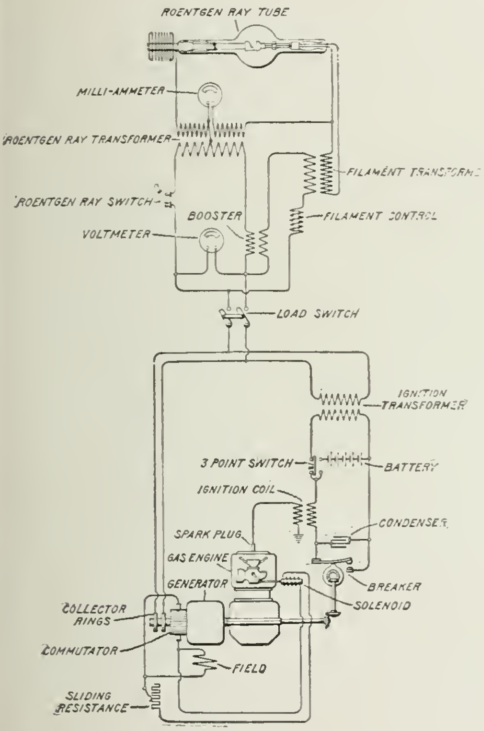

FIG. 3. COMPLETE WIRING DIAGRAM.

complete with molybdenum stem and iron supporting tube, has a heat capacity of less than 10 calories. Because of its greater heat capacity, it takes much longer to heat the radiator type of target to redness than it does the solid tungsten target. Unlike the latter, the target in the new tube, even at relatively low temperatures, cools rapidly in the interval between radiographic exposures, and, therefore, permits of starting each exposure with an essentially cold target. As a result the focal spot, even though small, is kept from reaching a temperature high enough to allow "inverse" current to pass through the tube. Furthermore (and this serves as an additional safeguard), this type of tube does not allow an appreciable amount of inverse current to pass even though it is so badly overloaded that the focal spot becomes heated to the melting point. A probable explanation of this striking fact is given in the companion article on the tube.

COMPLETE WIRING DIAGRAM

This is shown in Fig. 3 and needs no further explanation.

COMPLETE OUTFIT

The complete outfit is shown in Fig. 4, in which the gasolene-electric set is seen at the left. The roentgen ray and filament-current transformers, the filament current control, and the booster are in the lower part of the box at the end of the table (see Fig. 5, which shows the inside of this box). On a shelf in the top of this box are a voltmeter for showing line voltage, the adjustable rheostat for controlling line voltage, a milliammeter for indicating the tube current, and the operating switch. (There is a cover for this box which is screwed on for shipment.) The x-ray tube is permanently located in the movable tube box under the table.[1]

TECHNIC

The outfit as described lends itself readily to a very simple technic. Experience extending over several years has convinced the writers that it is very convenient, for experimental work, to have extreme flexibility in a roentgen ray generating outfit, so that the penetrating power of the rays can be varied at will between wide limits. It has also convinced them, however, that roentgenologists would get better average results in diagnostic work if their outfits were made much less flexible, so that the roentgen ray tube could be used more, for example, as the ordinary incandescent lamp is. When such a lamp is lighted on the ordinary constant-potential circuit, it gives always the same kind and the same amount of light. It is entirely practicable to operate a roentgen ray tube in this same manner. It is merely necessary to see that the filament current is always the same and that the high-tension voltage impressed upon the tube terminals is always the same. Under these circumstances the tube always gives out roentgen rays of the same penetrating power [2] and of the same intensity. More

[1] The table, tube box, and shutter were all developed by the cooperative work of others, including Major Shearer, Major Geo. Johnston, and the Kelley-Koett Company.

[2] These rays are not homogeneous, but the mixture is always the same.

artistic radiographs can be made by adapting the penetrating power of the rays to the thickness of the part to be radiographed, but experience shows that with a suitable compromise voltage (we have adopted that corresponding to a 5-in. spark between pointed electrodes which is equal to 57,500 volts effective, as actually measured by a sphere gap) excellent radiographs can be made of all parts of the human body, and with a great simplification in apparatus and technic. The time factor becomes the only variable and this is adapted to the thickness of the part to be radiographed.

With 57,500 volts (effective) and 10 milliamperes and a distance of 45.7 cm. (18 in.) from focal spot to plate, the writers have found that for Seed plates and the average adult subject, the following table of exposures gives good results:

Exposures 18 in. distance

	Sec.		Sec.
Hand	1	Chest	10
Elbow	2	Hip	20
Ankle	2	Head-lateral	25
Knee	4	Frontal sinus	50
Shoulder	8		

Too much weight should not be attached to this table, as it is based on a relatively small amount of work. It is merely given to show in a general way how the time of exposure varies for different parts of the body when the intensity and penetrating power of the rays are held constant.

The compromise voltage used for radiography appears well suited to fluoroscopy, and at this voltage a current of 5 ma. appears to give sufficient illumination.

The reason for adopting for radiography the amount of energy corresponding to 10 ma. at a 5-in. spark was that it was the maximum amount available in the tube when operating from the Delco-light generator.

This energy could, of course, have been taken at any desired potential, as this was merely a matter of transformer design. The reasons for choosing the potential corresponding to a 5-in. spark were: Given a certain amount of energy to work with, the roentgen ray intensity, as measured by the illumination of the fluorescent screen or the action on the photographic plate goes up rapidly with the voltage. This is obvious from the well-known fact that roentgen ray intensity, measured as above, increases with the first power of the milliamperage and with the square of the voltage, while the energy delivered to the tube is proportional to the product of the first power of the current and the voltage. This, then, was an argument in favor of high voltage. On the other hand, contrast, in both radiography and fluoroscopy, decreases with increasing voltage. This is an argument against the use of too high voltage. The voltage corresponding to a 5-in. spark between points appeared to be a good compromise.

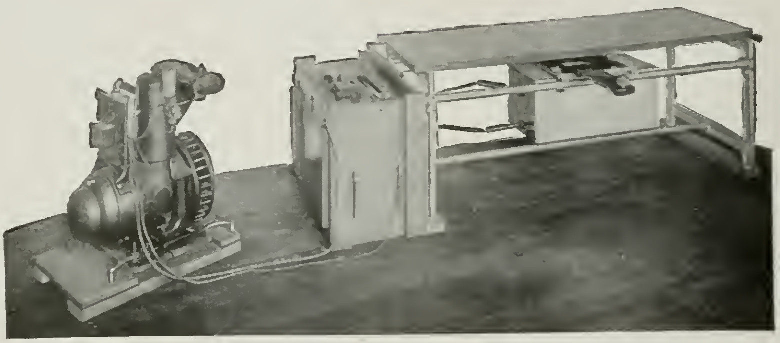

Fig. 4. Complete Portable Roentgen Ray Outfit.

The authors have adopted the following general method of using the outfit.

After starting the engine, the resistance (b) is all cut out. This causes the engine to idle at its lowest speed.

For radiographic work, the resistance of (b) is raised until the line voltage indicated by (c) is about 160. The filament current is then adısted once for all[3] by means of the control D) until, upon closing the x-ray switch, the nilliamperemeter registers 10. As the x-ray witch is closed the line voltage is seen to drop. The resistance of (b) should be changed until he line voltage, with the 10 ma. load, is 122. The line voltage is now observed when the oad is taken off, and is in future work brought

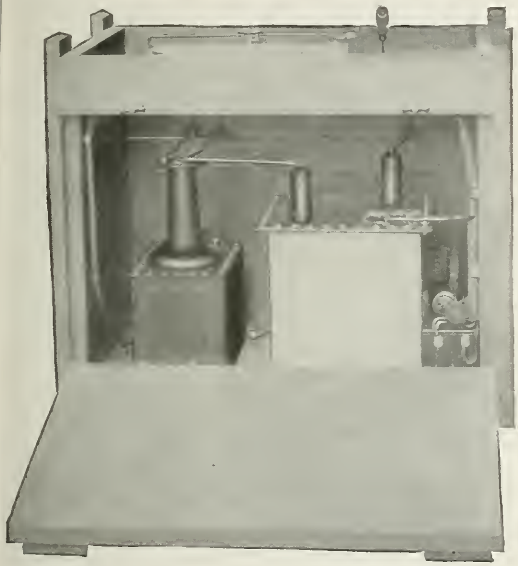

FIG. 5. TRANSFORMER AND INSTRUMENT BOX.

to this point before closing the roentgen ray switch. The important point is that the voltmeter reading when the 10 milliampere load is on shall always be 122. If this condition is fulfilled, all radiographic work will be done with a tube voltage corresponding to a 5-in. spark between points.

For fluoroscopic work, it is not necessary to touch the filament current control. This should be left just as it was for radiographic work. After closing the roentgen ray switch, the rheostat (b) is so adjusted that the tube carries 5 milliamperes. The tube voltage will then be the same as it is with the 10-ma. setting for radiographic work.

ENGINEERING DATA

(1) *Electrical Efficiency.*—Wattmeter measurements taken at various points in the circuit showed that, with the radiographic load of 10 ma. at 57,500 volts (effective), the alternating-current generator was delivering 820 watts, and that this energy was consumed in various parts of the outfit as follows:

	Watts
Main line loss	10
Booster loss	12
Filament-current control loss	14
Filament-current transformer loss	5
Energy consumed in filament	43
Energy delivered to roentgen ray transformer	694
Total	778

The difference of 5 per cent. between this total and the 820 watts measured directly at the brushes of the generator is doubtless to be explained in part by experimental error and in part by distortion of wave-form.

From the above, it is seen that 85 per cent. (694 watts) of the energy from the generator is delivered to the roentgen ray transformer.

The energy in the high-tension discharge passing through the tube was not measured directly. (If time had permitted, it would have been determined by thermal measurements of the heat generated in the target.) It should be approximately equal to 575 watts (the product of tube current and voltage, or 0.010 by 57,500). *According to this, the roentgen ray tube gets, in the form of high-tension discharge, 83 per cent. of the energy delivered to the roentgen ray transformer and 70 per cent. of the total energy delivered by the alternating-current generator.*

(2) *Gasolene Economy.*—This was determined for various roentgen ray loads. In the following table, the first column gives the number of the experiment, the second the load, the third the engine speed in revolutions per minute, the fourth the dynamo voltage, and the last the economy expressed in hours of operation per gallon of gasolene consumed.

Expt. No.	Roentgen ray Load	R.p.m.	Dynamo Voltage	Hours per Gallon
1	0	900	90	5½
2	0	1440	160	4
3	Radiographic	1382	122	3½
4	Fluoroscopic	1320	114	3¾

In Experiment 1, the engine was idling at its lowest speed and the roentgen ray switch was open. In Experiment 2, the engine speed was that required for radiographic work, but the roentgen ray switch was open. In Experi-

[3] It should subsequently need to be changed only when tubes are changed.

ment 3, the radiographic load is on for 15 seconds and then off for the remaining 45 seconds of each minute. (This particular schedule was chosen as representing the severest radiographic service which was likely to be required of the outfit.) The fourth experiment was with a fluoroscopic load kept on continuously.

(3) *Weights.*—The weight in pounds of the different parts of the outfit is given in the following table:

Engine and generator, with wooden base	377 lbs.
Tube box and shutter	110 lbs.
Table	164 lbs.
Transformer and instrument box with contents	244 lbs.
Total	895 lbs.

ADVANTAGES OF THE OUTFIT

The advantages of the complete outfit, as described above, may be summarized as follows:

(1) Simplicity of apparatus.
(2) High efficiency with consequent light weight and portability.
(3) No moving parts other than the gasolene-electric set.
(4) Control of line voltage, making it possible to duplicate electrical conditions and x-ray results very accurately.
(5) The tube has been designed to carry all of the energy that the generator can deliver. For this reason no harm can be done to the tube by raising the filament current too high. Under such conditions the milliamperage will go up, but the voltage will decrease so that the energy delivered to the tube will not go up appreciably.
(6) The gasolene-electric set can be placed at any desired distance from the high tension part of the outfit, so as to avoid noise in the operating room.
(7) No storage battery to get out of order.
(8) Engine can be made to idle at very low speed, conducive to long life. This advantage comes from the use of the voltage governor instead of a speed governor.
(9) An accidental short circuit of the generator does no harm; it simply lowers the line voltage to such an extent that the field excitation goes down, the ignition fails, and the engine stops.

IMPROVEMENTS WHICH COULD BE MADE BY SPECIAL DESIGN

The outfit described was developed primarily for army use, and the exigency of the case made it necessary, in so far as possible, to make use of parts which were already in production and hence readily available. It could be further simplified and improved by special design.

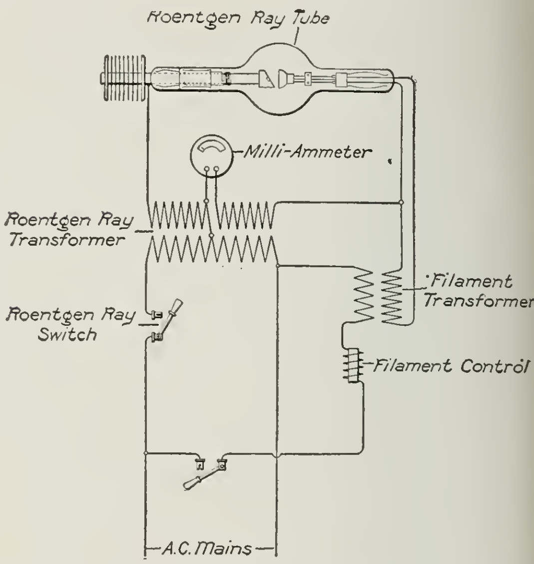

FIG. 6. WIRING DIAGRAM FOR OUTFIT OPERATED DIRECTLY FROM EXISTING ALTERNATING CURRENT MAINS. (WHEN GASOLENE ELECTRIC SET IS NOT NEEDED.)

The greatest improvement would come from a reduction in the "inverse" voltage. By proper electrical design of the dynamo and the high-voltage transformer, this "inverse" voltage could readily be reduced to a point where it would be but slightly in excess of the "useful" voltage.

This would make it practicable and easy to work with a high-tension system grounded on one side. The cathode of the tube would then be connected to the lead covering of the tube box, and through this and the supporting mechanisms to the grounded metal frame of the table. There would then be only one high-tension terminal to the transformer and only one high-tension wire going to the tube (to the anode). The grounding of the cathode end of the tube would make it possible to dispense with the relatively bulky filament-current transformer insulated for high potential and o replace it with a very small ordinary low-voltage transformer. It would also, for the following reasons, increase the allowable tube travel: first, the grounded end of the tube could safely be moved to the extreme end of the table; and, second, owing to the reduction in inverse voltage, the length of tube and tube-box could be materially reduced.

The set described is intended to be used as a unit; but it would be a simple matter to so modify it that it could be operated from existing electric circuits without running the gasolene-electric set. The wiring diagram (Fig. 6) shows the simplicity of such a system. Where different line voltages are to be encountered, the roentgen ray and filament-current transformers would have special primary windings with several taps, or with several sections which could be connected in series or in multiple. Another method of accomplishing the same result would consist in using an auto-transformer provided with suitable taps to take in current of any commercial voltage and deliver it at the 122 volts given by the Delco-light set. There is already sufficient iron in the transformers to take care of a wide range of frequencies. For operation from direct-current mains, a rotary converter would be needed. When operating from existing electric mains, with either alternating or direct current, the booster would not be needed.

In closing the authors wish to express their thanks to the many different manufacturers who loaned the apparatus used in the investigation of the different systems referred to in this article.

Swayne, W. C. Rectal Diverticula as a Causative Factor in Pelvic Inflammation in Women. (*Bristol M.-Chir. J.*, 1917, XXXV, 91.) (Ref. *Internat. Abstr. of Surg.*, Jan., 1918, p. 34. Tuholske.)

Diverticula occur most frequently in the sigmoid, descending colon, and peritoneal-covered portion of the rectum. These diverticula are actual herniæ in the wall of the intestine, at the points of attachment of the appendices epiploicæ, with protrusion of the mucous membrane. They commonly contain fecal concretions; perforation is not an uncommon complication.

The author cites two personal cases, in one of which perforation had taken place leading into the bladder.

Operation aims at ligature of the pedicle of the diverticulum and invagination, but inasmuch as multiple diverticula usually exist, frequently imbedded in adhesions, and the disease occurs chiefly in elderly females, the operative risk is great. Medical treatment is of no avail. Diverticulitis should be considered as a possible factor in all pelvic inflammation of obscure origin.

Chapin. Comparison between Clinical Examination and Roentgenograms in Diseases of the Chest. (*Am. J. Obst. & Dis. Women & Child.*, Oct., 1917, Vol. LXXVI, No. 478.) (Ref. *Am. J. Med. Sc.*, Jan., 1918, Vol. CLV, No. 1, p. 143.)

Owing to the difficulty of keeping little children quiet during exposure it is often hard to interpret heart shadows. A twisting of the body may cause a rotation of the chest so as to exaggerate the heart shadow in any direction. Of 15 cases studied both by *x*-rays and by physical examination, 7 showed an agreement, or partly agreed, and 7 failed to show a correspondence in the conclusions reached by the two methods. In regard to the lungs a combined study was made in 97 cases. There was agreement in 77 and disagreement in 20 cases. Of the latter 5 gave evidence of lobar pneumonia that was not detected by physical examination; 2 gave physical signs of pneumonia, which were not confirmed by *x*-rays; 3 showed physical signs of bronchopneumonia not found in *x*-rays. As a general rule it was found that the *x*-rays would often give a shadow in the absence of physical signs in congestion, small consolidations, hilum infiltrations, interlobar pleurisy, miliary tuberculosis and mediastinal tumors.

Hamburger, Walter W. Roentgenological Studies in the Healing of Gastric and Duodenal Ulcers. (*Am. J. M. Sc.*, February, 1918, Vol. CLV. No. 2, p. 204.)

Hamburger for the past two years has studied gastric and duodenal ulcer by the following method:

"1. In addition to the regular routine of history-taking, physical examination, test-meal examination, etc., the patient is subjected to a thorough preliminary roentgenological study, including the registering of from six to twelve plates, taken at intervals after the barium meal.

"2. In the event that positive roentgenographic evidence of ulcer is thus obtained, the patient is put under medical treatment (the details of which do not concern us here) for from three to six weeks. Within this time and before discharge from the hospital the patient is again thoroughly studied roentgenologically, including the making of plates.

"3. The patient is asked to report back to the hospital at least every three months for a repetition of the roentgenographic studies.

"In other words, roentgenological examinations are made before, during, and after medical treatment, as often as every three months, for a period of one to two years or longer. These studies serve as a guide to the healing process, and as a contrast with the findings before treatment was begun."

Four duodenal and seven gastric ulcer cases were thus studied.

"Haudek, in 1910, described his classical Nischen Symptom, which was the demonstration roentgenologically of a small round projection (Ründliche Vorsprung) along the lesser curvature of the stomach. Haudek believed that this projection or pocket represented the accumulation of bismuth or barium in the crater of a penetrating ulcer. In certain cases the pocket or crater of bismuth was surmounted by a small air bubble which could be observed in the plate.

"Accepting, then, as definitely established, that the barium projection represents the ulcer crater, let us turn to a consideration of the changes in morphology of the niche during and after medical treatment. In certain cases the depth and width of the projection gradually lessens until, in the favorable cases, it has entirely disappeared, leaving a smooth, regular, lesser curvature outline. This disappearance of the niche can be followed accurately from week to week and month to month, and is usually accompanied with coincident improvement in the clinical findings, viz., disappearance of epigastric pain and distress; cessation of vomiting; disappearance of occult blood in stool and stomach contents; gain in weight, appetite, hemoglobin, and general well-being of the patient; gradual return to normal of gastric secretion and motility. Such ulcers may be said to be healing, and in the event that these objective and subjective changes continue satisfactorily, may, at the end of six to twenty-four months, be said to be cured, depending on the personal conservatism of the observer.

"Certain other cases, however, do not progress so satisfactorily, either because of insufficient dietary care on the part of the patient, inaccuracy in the details or duration of medical management, or because of other underlying organic disease, such as carcinoma, syphilis, or tuberculosis. In these ulcers the niche narrows only temporarily, later resuming its former contour or even becoming deeper, wider, and more irregular. Such patients demand either more accurate medical management, specific tuberculous or luetic treatment, or surgery—or all three.

"This method applied to cases of duodenal ulcer has not, up to the present, been productive of as many positive findings as in the case of lesser curvature ulcer. Notwithstanding it would appear that such repeated roentgenological examinations are of value and should be instituted as a routine in the medical treatment of all ulcers.

"1. This method is of value in the diagnosis, prognosis, control of medical treatment, and selection for surgical treatment of gastric and duodenal ulcer.

"2. The method is of value in studying the pathology of the healing process in both clinical and experimental ulcer. Thus far it is not of positive value in the differential diagnosis between ulcer and cancer, although in the future it may shed some light on the much discussed problem—the frequency of malignant degeneration of callous ulcer.

"3. In the use of the method the danger of mistaking normal peristalsis for penetrating ulcer and of the overlooking of the presence of small ulcer because of incomplete or insufficient examination must be borne in mind."

Boas, Ernst P. and Scholz, Thomas. Calcification in the Pineal Gland. (*Arch. Int. Med.*, January, 1918, Vol. 21, No. 1, p. 66.)

Many roentgenologists have puzzled over the significance of the dense particle which they see suspended in the mid-brain when examining stereoscopic plates of the head. This particle varies in size from a pin-head to a small pea and is located slightly above and 4

5 cm. behind the sella turcica. Boas and [Sc]holz were able by postmortem to demon[st]rate the basis of this roentgen finding.

"Roentgenologic examination of the skull [w]ith the patient in a lateral position presented [a] dense, somewhat irregularly outlined shadow [o]f about the size of a split pea, 4 or 5 cm. pos[t]erior to and somewhat above the tip of the [p]osterior clinoid process. In both lateral views [t]he shadow appeared of exactly the same size. [T]he cranial bones failed to show any abnormal[i]ty."

The following is from the necropsy protocol:

"The pineal body is slightly enlarged. It is [c]alcified in large part. The calcium is deposited [a]s a loose, spongy framework, chiefly in the upper half of the gland. A few small calcified plaques 1 or 2 mm. in diameter project from the posterior surface of the pineal gland into the third ventricle. There is no acervulus in the choroidal plexus or in the ependyma covering the trigonum habenulæ.

"Many sections were taken for microscopic examination. In the lower half of the gland the normal cellular structure persists. The nuclei are well preserved, large and vesicular, with a moderate amount of chromatin. There is apparently some increase in the fibrous stroma of the gland. Scattered here and there are many small grains of typical brain sand (*acervulus cerebri*). They stain blue with hematoxylin and are laid down in concentric lamellæ. They are approximately circular in shape but their margin is irregular. There is no tissue reaction about them, but they lie apparently free in between the glandular tissue. The upper portion of the gland is largely replaced by an irregular, blue-staining mass. On close inspection it is apparent that this mass has been formed by the fusion of innumerable small grains of acervulus. Under the high power the concentric rings of each grain can still be distinguished. The tissue between the adjacent granules stains less deeply with hematoxylin, and appears to be less deeply infiltrated with calcium. About the periphery of this mass of fused granules of brain sand there are many discrete granules similar to those first described. However, many of them have become agminated into small, mulberry-shaped masses. In one small area in the lower portion of the gland, rather wide, anastomosing trabeculæ of delicate, fibrous tissue enclosing many small capillaries divide the glandular tissue into imperfect alveoli. The blood vessels are normal. The blood vessels of the choroidal plexus are normal. Its epithelium is low cuboidal in type, with well staining nuclei. A few small granules of acervulus are present.

"Acervulus cerebri or brain sand is found very frequently in the pineal gland, in the choroidal plexus and in the neuroglia covering the commissura habenulæ. It is present as early as the seventh year of life and increases in amount with age. The concretions are sometimes mulberry-shaped, and are composed of calcium phosphate and carbonate. Krabbe, in his study of over a hundred pineal glands, saw these concretions very often. In studying serial sections he found that they are completely surrounded by parenchyma without being in contact with the connective tissue. In a few cases he observed calcifications in the connective tissue septa. These were very small and of an oblong shape. Marburg believes that brain sand is the first sign of involution of the pineal gland. The earliest deposition is in the commissura habenulæ. An increase in the size and number of the connective tissue septa, with calcification, may occur. Through apposition and fusion the corpora arenacea may assume many shapes. The size of the concretions varies from the size of a leukocyte to one third of the size of the gland. As far as Marburg could determine, age is the only factor predisposing to the calcification of the pineal gland.

"Whatever function the pineal gland may have is exercised before puberty. The pineal secretion is supposed to inhibit growth. With pineal disease this inhibition is removed and there is adiposity, general bodily overgrowth, with precocious sexual development, increase in size and development of the sex organs, and precocious change of voice in boys. After puberty the pineal gland undergoes involution, and so one would not expect symptoms from pineal calcification after adolescence."

BOOK REVIEWS

The Surgical Clinics of Chicago, Vol. I, No. 5, October, 1917. Octavo of 214 pages with 84 illustrations. Published bi-monthly by W. B. Saunders Company, Philadelphia and London. Price per year: Paper $10.00; Cloth $14.00.

This number of the Surgical Clinics is of special importance, containing several valuable clinics summarizing experiences gained in European military hospitals; a very complete index to the year's volumes; and of particular interest to roentgenologists, two clinics relating to radiotherapy.

The first, by Bevan, relates to a case of roentgen ray burn of the anal region, following roentgenotherapy for a distressing pruritus ani. The skin around the anus was very badly burned for an area of six or seven inches in length and two and one half inches in width. The author does not recall having seen an individual who has suffered more than this particular patient. Various consultants had agreed that a plastic operation was necessary, and some had given the opinion that a preliminary colostomy was advisable in order to place the parts at rest during the convalescence. Under anesthesia, the patient lying on the face with the buttocks well elevated, the damaged skin was freed through a longitudinal incision of generous dimensions, the mucous membrane of the rectum dissected up for a distance of three quarters of an inch, and the entire flap of damaged skin removed. This left the uninjured mucous membrane projecting about half an inch beyond the sphincter. The line of incision was then closed, without difficulty, by tension sutures of silkworm gut, and the mucous membrane sewed with a large number of fine silk stitches to the skin. The result of the operation was most satisfactory. The pain from the roentgen ray burn disappeared at once. The nervousness and desire for a moderate amount of morphin persisted for about two weeks. Three-fourths of the wound healed by primary intention. A small part, about one and a half inches in length, posterior to the anus, kept open, but healed within fifteen or twenty days completely. The author mentions his large experience in dissecting out roentgen ray burns from the breast in patients who were taking morphin to relieve the constant pain, and declares that immediately after the operation the pain entirely disappeared and the desire for morphin, in spite of the fact that large amounts had been used for a good many months, disappeared almost entirely with it. Several instructive illustrations accompany the article, and make much clearer the technic of the operation.

The second clinic of special interest to us is one on the treatment of carcinoma of the tongue with radium, by F. G. Dyas. Two hollow gold needles, each containing 35 mg radium, were buried in the lesion of the tongue and allowed to remain six hours. At the same time the cervical glands upon the same side were exposed to intensive radium applications for six hours, and upon the following day for eight hours. The needles were secured in the tongue by heavy linen threads passed through the eyes of the needles. One week later there was evident shrinking of the epithelioma, which had ceased to bleed and which was losing its cauliflower-like appearance. Two weeks from the first application the needles were again inserted for the same length of time as previously, and the same exposure was given to the cervical glands. Several weeks later radical removal of the cervical glands was advised and accepted by the patient. The author, although evidently hopeful of a final favorable outcome, recognizes that the case is still yet in the balance. However, when the safety and comfort of this procedure are contrasted with the mutilating and ineffective resection of one-half of the tongue, he feels that every surgeon should give the radium treatment a thorough trial before resorting to the tongue resection. The reviewer feels that he would not be doing his duty did he not point out that the statements regarding dosage of the "intensive radium applications for six hours" are exceedingly vague, and fail entirely to convey definite data enabling some one else to duplicate the treatment in a similar case, thus making results comparable. The reviewer also feels that the author of this clinic is too optimistic, considering the large number of published cases which have already been subjected to this form of thorough treatment.

J. T. C.

Willis F. Manges

[President, American Roentgen Ray Society, 1917-1918]

THE AMERICAN JOURNAL OF ROENTGENOLOGY

Editor, H. M. Imboden M.D., New York.

VOL. V (NEW SERIES) JULY, 1918 No. 7

FOUR CASES OF GENERAL CARCINOMA OF THE PERITONEUM WITH REMARKABLE RESULTS FROM DEEP ROENTGENOTHERAPY *

BY GEORGE E. PFAHLER, M.D.

PHILADELPHIA, PA.

THE surprisingly good results obtained from the application of deep roentgenotherapy will, I believe, justify me in placing these four cases on record. The results are brilliant in so far as they surpass every other form of treatment. In fact, nothing else seems to offer any hope whatever. This record will justify hope of prolongation of life and relief of symptoms in a class of cases which formerly were given up almost without effort.

CASE 1. Mrs. J. B., age 47, was referred by Dr. John B. Deaver, October 30, 1907. She had had a catarrhal condition of the bowels for twenty years. Fifteen years previously Dr. Deaver had removed the appendix. The bowel irritation continued, however. Eight years previously Dr. Deaver had operated for hernia and adhesions, and laceration of the cervix and perineum. One and one-half years before she was referred to me for treatment, Dr. Deaver operated and found the entire omentum involved by tumor tissue. It was entirely inoperable, and he made no attempt at removal. He released some of the adhesions which seemed to be producing intestinal obstruction, but advised against any further operation. Her general health was good. There was general abdominal tenderness and especial tenderness in the hypogastric region and right iliac fossa. In the right iliac fossa there was increased resistance. She received nine fractional doses during a period of two weeks. Cross-firing was used from two sides of the abdomen only, and the total dosage amounted to one erythema dose over the entire abdomen. She returned February 18, 1908, because of increased pains and symptoms of slowly developing intestinal obstruction. At this time there was a distinct mass to the left of the line of incision and considerable tenderness over the abdomen. Another course of treatment was given consisting of eleven doses, amounting to a full dose on each side of the abdomen, as only this amount of cross-firing was used. She returned for another course of treatment June 15, 1908, having had no symptoms of bowel obstruction during this interval of three months. The general tenderness had practically disappeared. The circumference of the abdomen was two inches less than at her previous visit, and the patient looked well. She returned again November 6, 1908, saying that she had been wonderfully well all summer. The

* Read before the Eighteenth Annual Meeting of the American Roentgen Ray Society, New York City, September 20–22, 1917.

abdomen was generally soft. Five fractional doses were given within ten days. She reported for examination October 11, 1912, apparently entirely well. She was in fine general condition, and said that she never felt better in her life, and, so far as she or I could tell, was in perfect general health. On January 20, 1914, she returned, at the advice of Dr. Deaver, for some treatment. At this time she had no definite symptoms, but treatment was given as a precaution against development of the disease. At this time general cross-firing was used according to our modern methods. She seemed to be in good general condition, was told to go home (for she lived about 200 miles from the city), and to report if any unfavorable symptoms developed. I received Christmas messages during the succeeding two years, but no complaints. I recently learned, indirectly, that she died March 1916—cause unknown.

In a sense this is an unsatisfactory report because we had no microscopical study, but the disease corresponds so closely to the other cases reported that I feel it can be included, and the patient lived in reasonable comfort during a period of eight to nine years.

Case 2. Mrs. D. MacF., age 57, was referred by Dr. Laura S. Chapin, December 8, 1913. This patient was operated upon by Dr. Barton Cook Hirst May 18, 1913, nearly seven months previously, at which time nothing was removed, because all of the intestines were matted together by malignant disease. The patient was sent to us for treatment for the relief of pain because, at that time, only large doses of morphine gave her relief. The attending physician had no hopes of relieving the disease. A course of twenty doses was given, according to modern technique, over the entire abdomen. At the end of a week she expressed herself as feeling very much better, was able to sleep without opiates, and her bowels moved without purgatives. There was some dermatitis after the first course of treatment and, therefore, the second course of treatment was not begun until April, at which time the improvement was very marked, the entire abdomen being soft, and only a small, palpable mass in the lower left groin. The third course of treatment was given during the latter part of May and the early part of June 1913. At this time all the disease had disappeared excepting a small mass in the lower left groin. Treatment on this area was given, consisting of four doses, March 31, 1914, and August 31, 1914. She was examined by Dr. Hirst on June 26, 1914, at which time Dr. Hirst could find no evidence of the disease whatever excepting a small mass about the size of a hen's egg in the lower left groin. He expressed himself as being surprised and delighted with the results. She had also been examined by Dr. Wm. L. Rodman and Dr. Stillwell Burns March 6, 1914. We all found the abdomen soft excepting this mass in the lower left groin which was about the size of a hen's egg. Her bowels moved regularly without purgatives. She was free from pain, and her general health was good. She neglected to come for treatment or observation after this, and on September 21, 1915, Dr. Samuel H. Brown reported to me that she had died of tumors in the brain, which were found at autopsy. The autopsy also showed a sinus of the abdominal wall, ptoses of the transverse colon and hernia, intra-abdominal adhesions, chronic interstitial nephritis, traumatic ventral hernia, adenocarcinoma (medullary) of the sigmoid, and metastatic carcinoma (medullary) of the frontal lobe of the brain on the right side.

As a result of the deep roentgenotherapy in this case, the patient lived in reasonable comfort for about a year, and certainly lived a year longer than she would have otherwise. She finally died of metastatic disease in the brain, and not from the disease in the area in which the treatment was given. While in the end the case was a failure, the improvement in her general condition, her general comfort, her relief from pain, and the disappearance of the palpable disease, would lead one to believe that, had she been treated at a time when the disease was reasonably localized, she might have recovered completely.

Case 3. Mrs. J. E. L., age 51, was referred by Dr. E. P. Zeisler of Chicago, Ill., and Dr. C. V. Warner, of Miami, Oklahoma, July 6, 1916. During October 1915 Dr. Eddie Meyer of Buffalo operated for ascites and obstruction of the bowel. This was found to be caused by pedunculated ovarian cyst that had become wrapped around the gut. He diagnosed the condition at operation as cyst and peritonitis. In four months she again became filled with ascites, and upon opening her up at this time, Dr. Meyer found the abdomen filled with colloid cancer. The pathological report by Dr. Charles A. Bentz is as follows: "The tissue examined consisted of two Fallopian tubes and a piece of omentum. The histological findings are papillary carcinoma of the tubes, with metastasis in the omentum." At the time of beginning treatment, there was general firmness and soreness in the abdomen, with some signs of fluid. A course of nineteen doses was given within four days, after which she returned to her home. There was no appreciable improvement at the end of a month, though, according to our original plans, a second course of twenty doses was given. After this she improved very much, though she had developed nausea and prostration following the second course of treatment. She returned for the third course of treatment October 3, 1916. At this time there was marked improvement. Her general health had improved, the abdomen was soft, there was no palpable disease, and no evidence of disease whatever in the abdomen. She returned for the fourth course of treatment December 11, 1916, at which time she appeared to be entirely well. Twelve doses were given in this fourth series, and she was sent home with the instructions to report if any symptoms whatever developed, for we believed her to be well. On March 20, 1917, Dr. Warner reports from Miami, Oklahoma, as follows: "She seems to be feeling pretty good, weighs about 126 pounds, and is greatly increasing in strength. Her color is good. Her digestion and elimination seemed to be all right. While here (Miami, Okla.), she had one ill-feeling spell. There was some pain in the region of the spleen and considerable tenderness there as well. It lasted for several days, but finally went away. She had been eating pretty heartily, and also had been on several long trips in the automobile."

This patient is apparently well more than a year after beginning treatment, and two years after her original operation. This, with a definite surgical and microscopical diagnosis of carcinoma with metastasis, is a result which is most gratifying.

Case 4. Dr. X. was referred by Dr. Wm. J. Mayo on June 13, 1916, for treatment of general carcinosis of the peritoneum. The patient was operated on May 25, 1916, by Dr. Wm. J. Mayo. Under date of June 6, 1916, Dr. R. W. Carmen of the Mayo Clinic wrote: "The *x*-ray examination showed a high cecum and slight filling defect in the sigmoid. These findings were thought to be due to an extrinsic tumor which is palpable in his right iliac fossa. He was explored by Dr. W. J. Mayo who found a general peritoneal carcinomatosis of unknown origin. The abdomen contained free fluid and great masses of colloid material attached to the peritoneum, omentum, etc. Microscopic section showed carcinoma."

Upon arrival for roentgenotherapy there was evidence of free fluid in the abdomen. There was a tumor in the right lower abdomen about the size of a large grapefruit, firmly adherent, with general firmness of the abdominal tissues. He gave a history of having had an attack of appendicitis six years previously, but no operation. Three to four years ago he noticed a swelling in the right iliac fossa. About three months before coming for treatment, this tumor, which had grown progressively larger, began to give pain, and the patient also began to have obstructive symptoms.

He was given a course of deep roentgenotherapy, through twenty portals of entry, within two days. After this course of treatment he developed some nausea, pain in the abdomen, and his temperature rose to 101, pulse 105. He returned for a second course of treatment July 5, at which time the tumor was only about two-thirds its original size, though he suffered from pain in the epigastrium. His weight on this date was 159. His weight before the operation was 170 to 177. The second course of treatment was given within five days. He returned August 7, two months after beginning treatment, with his weight 157, improvement in general appearance, but with the complaint of getting tired very easily. The abdomen was softer and the tumor decreased in size. A third course of twenty doses was given within three days' time. The fourth course was given from September 8 to September 14, 1916, after which he returned to his home in St. Louis, where he was under the treatment of Dr. Ernst. On October 7, 1916, the patient writes: "Feeling very well. Weight 162 pounds. Very little pain in the abdomen, though mass seems as large as ever." He was treated nearly once a month by Dr. Ernst until July, when Dr. Ernst left for Europe, and on August 9, 1917 the patient called to see me, more than a year after beginning treatment, at which time he looked perfectly well, had gained in weight, and had been attending to his practice since February 1917. Palpation of the abdomen showed nothing abnormal excepting slight induration in the right groin along Poupart's ligament. This did not have the sensation of a mass, but only some increased firmness.

The outcome of this case can, of course, not be predicted, but surely more has been accomplished by this thorough treatment than could be accomplished otherwise, and with persistence, close observation and close coöperation on the part of the patient, we may be able to make these temporary recoveries cures.

Technique.—In the treatment of these patients, the aim should be, of course, to cover the entire abdominal cavity, including the liver, and there should always be an *x*-ray examination of the chest to see whether the disease may have spread to the chest. In none of these cases was there any evidence of metastasis in the chest. The abdomen is divided into from twenty to thirty areas so that every part of the abdomen receives treatment anteriorly and posteriorly. Most of the treatment, however, should be given anteriorly, because of the greater facility in reaching the disease.

With our outfits we have been using 40 milliampere minutes, with a focal distance of 8″, and with a constant voltage equivalent to a 9″ parallel spark gap. These rays should be filtered through 6 millimeters of aluminum or glass. I believe that, generally speaking, it is inadvisable to crowd the treatments as close together as has been done in these cases reported, for one is very likely to obtain constitutional symptoms in the form of nausea and prostration. At least a week to two weeks should be used to give such a course of treatment, and if this plan is followed, nausea and prostration should be eliminated.

Conclusions.—1. General carcinomatosis of the peritoneum will sometimes yield remarkably to the influence of deep roentgenotherapy.

2. The prognosis, however, must always be most guarded, because this is metastatic carcinoma, and as such is liable to make its appearance elsewhere in the body, even though marked response is obtained from abdominal treatment.

3. Colloid carcinoma appears to be more responsive to roentgenotherapy than other forms of abdominal carcinoma.

ROENTGEN DIAGNOSIS OF DISEASES OF THE CHEST *

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THE subject indicated in the title of this paper is so extensive that it ould be impossible to more than touch ghtly on the various points in the time llotted to this purpose.

EXAMINATION OF THE CHEST.—In makıg this it is always wise to proceed acording to a certain routine in order that ne may not be misled by the history of he case or other elements into overlooking ome important point upon which the enire diagnosis may rest.

In our clinical work, therefore, we make t a rule in every examination of the horax to note the following points:

(a) Heart—size, shape, position and action.

(b) Aorta—size, position, dilatation, aneurysm, calcification.

(c) Lungs—apices.

1. Illumination of enforced inspiration (light reflex).
2. Relative distensibility.

(d) Diaphragm.

1. Degree of visibility.
2. Curvature.
3. Excursion (compare sides).
4. Fixation (adhesions).

(e) Mediastinum.

1. Size.
2. Shape.
3. Presence of opaque bodies.
4. Tumors.
5. Aneurysm.
6. Adenopathy.
7. Persistent thymus.
8. Substernal thyroid.

Following this general survey we now proceed to examine in detail. We look (1) for the shadow of the trachea, which upon the screen appears as a bright band marking the median line and fading behind the aortic arch. If there be any deviation of the tracheal shadow, we desire at once to know the reason for the displacement, and suspect pressure, which requires explanation. (2) Further down we notice the hilus shadows on either side (well marked on the right and hidden on the left behind the heart) cast by the bronchi and great vessels and the numerous lymphatics about the roots of the lungs. (3) Toward the periphery the lungs become more transparent but we are able to trace out the shadows cast by the tree with its accompanying lymphatics and vessels. If the alveoli are healthy in all portions of the lungs, the air will be equally diffused. (4) Increased radiability (showing bright upon the screen and black upon the plate) may indicate a tuberculous cavity or a bronchiectatic dilatation, emphysema or pneumothorax, while decreased radiability might result from pneumonia, lung suppuration, thickened pleura or pneumonokoniosis, syphilis or malignancy. (5) A decreased area of radiability surrounding a more or less circular area of increased radiability would suggest an abscess cavity.

EXAMINATION OF THE LUNGS.—In this we study not only lung tissue but the pleural cavity and the diaphragm. Thus in the study of a case of lobar pneumonia by means of the *x*-ray (which study is being made more and more in the military hospitals abroad) we might expect to find the following phenomena present:

Lung	*Pleura*	*Diaphragm*
	FIRST STAGE	
Light shadow over one lobe	Increase in pleural shadow	Visibility lowered and excursion limited
	SECOND STAGE	
Dense shadow of one or more lobes	Increase in pleural shadow	Excursion and visibility lost

*Read before the American College of Physicians at Pittsburgh, Pa., December 27, 1917.

	THIRD STAGE	
Irregular, ill-defined areas of density involving a lobe or lobes	Clearing	Excursion and visibility returning

The above table is suggested by Crane's excellent article on the skiascopy of the chest which appeared more than eighteen years ago. I mention this point in order that you may see that there is little new in the examination of the chest by means of the *x*-ray.

Now let us consider for a moment the appearances which we might expect in bronchopneumonia. We will find that both lungs are affected; irregular shadows are over both lungs; visibility of diaphragm is slightly impaired; excursion of diaphragm is unimpaired.

In pulmonary œdema, on the contrary, the screen appearances of the thorax are very unusual. If the œdema is extensive we will find that heart and aorta shadow is lost; diaphragm shadow is lost; all chest landmarks are lost.

Emphysema will show an increased radiability of the lung on one or both sides, confined to the emphysematous areas. Atelectasis, due to blocking of the bronchus, perhaps from foreign body, will show a decreased radiability of the portion of the lung supplied by that part of the bronchial tree, the main trunk of which is blocked.

Lung Tumors.—The primary tumors of the lung most often seen are the sarcomata and the appearances are very striking. In the advanced cases one or several globular masses of rather uniform density may be seen to invade the lung tissue. The tumor wall is sharply defined, the demarcation between tumor and lung being easily observed. This is in contradistinction to carcinoma of the lung. The remainder of the lung tissue may be perfectly healthy. These tumors attain considerable size, from one to four inches in diameter, and may give rise to very few pulmonary symptoms, unless so situated as to press on some of the great vessels.

Carcinoma of the Lungs.—This is usually secondary and quite prone to metastasize from the breast or prostate. It occurs frequently and gives an appearance of very slight lung suppuration, but without the bronchial marking. The lung tissue involved resembles the bony tissue in a case of periosteal sarcoma. The disease appears at the hilus and radiates out into the parenchyma of the lung. In early stages it appears as though interlobular, but later may involve the lung very extensively.

Diseases of the Pleura.—These are quite easily diagnosed by means of the *x*-ray. A visible pleura is always pathological. We may differentiate: acute pleurisy with effusion, chronic pleurisy, empyema, hydropneumothorax, pyopneumothorax, and interlobular pleurisy.

Pleurisy with Effusion.—The lung retracts and a dark shadow is seen with sharp upper border, which border may change shape with position of patient, if time is allowed. (Only true with incomplete effusions.) Pyothorax is the same as above except for a darker shadow. In complete left pleural effusion the heart is displaced to right, the diaphragm shadow is effaced in erect posture, but can be seen if the patient is placed in the Trendelenburg position. The dark shadow rarely extends to the apex. Differential diagnosis between complete pneumonic consolidation and complete pleural effusion is almost impossible with the *x*-ray.

Chronic Thickening of Pleura.—There is a diffuse haziness of a part of one side of chest or lessened radiability. The diaphragm excursion is normal.

Interlobular Pleurisy.—This is simply an encysted pleurisy, wedge shape, base outward and pleura above and below thickened.

Hydropneumothorax and Pyopneumothorax.—There is a dark shadow in chest; the diaphragm is lost; there are changes with position of patient; the upper border is very clear; the level of fluid is seen on shaking patient (waves); there is very great increase of radiability above the shadow.

Pneumothorax causes a striking appearance on the screen or plate if the pleural sac has been free from adhesions, so that the lung is free to retract when the negative pressure is relieved. The entire half of the thorax may appear as though the lung had been removed. Close examination, however, will show a contracted retracted lung lying against the mediastinal shadow.

Many mistakes are made in the diagnosis of conditions within the pleural cavity. It is sometimes very difficult or even impossible to differentiate between opaque fluid in the pleural cavity and an unresolved pneumonia involving the entire lung. This condition is by no means rare and will sometimes require the aspirating needle in order to clear up the diagnosis.

Pulmonary abscesses seldom extend to the periphery of the lung and require very careful localization. It is very unwise to examine a patient for the determination of the presence of a pulmonary abscess after coughing and expectorating pus. It is much better to wait and give the abscess cavity a chance to become filled with pus, at least partially, and then examine in the erect posture or semi-recumbent position. Areas of lung suppuration without cavitation resemble portions of pus-drowned lung, such as are seen after the blocking of a bronchus by a foreign body has continued for a long period of time.

In all examinations of the chest by means of the x-ray it is well to remember that you are differentiating various physical conditions of the lungs and endeavoring to interpret these in terms of pathological entities. Very frequently the interpretation cannot be made accurately, and no attempt should be made to so interpret the findings without careful correlation with the other clinical findings, history, etc.

If one has had considerable experience in examination of the diseases of the thorax, he is inclined to rather thoroughly scrutinize the region of the diaphragm in every case and to carefully observe the degree of visibility, the form and the excursion of the diaphragm.

Pulmonary Tuberculosis.—This is diagnosed by the x-ray only in so far as we care to interpret certain physical conditions (which are thus beautifully shown) as tuberculous, and assume that these conditions are always caused by the bacillus of Koch. Personally I would hesitate to make a diagnosis of pulmonary tuberculosis in any but the most advanced stages by means of the x-ray findings alone. Taken in conjunction, however, with the physical signs, temperature and weight record and history, trivial x-ray findings may, when so associated, acquire great significance and enable the all-important early diagnosis of tubercular infection, in many cases, to become an accomplished fact. It is, of course, needless to state that we do not see the tubercular bacilli with the x-ray. I have, however, been asked that question. Neither do I believe that we see a peculiar shaped habitation of the bacillus, as one might expect to see muskrat homes. Nor do I believe that there is any strictly pathognomonic pulmonary change attributable solely to the tubercular bacilli. The fact remains, however, that there are several rather characteristic pulmonary changes which we have learned by experience to expect to see in patients suffering from tuberculosis and have come to attribute to the disease. The earliest of these changes is the so-called "fan" so well described by Dunham, best seen in thin chests and early cases. This should only be studied in excellent stereoscopic plates.

Dunham says:

"The characteristic tuberculosis plate marking consists of a fan-shaped density with the base of the triangle toward and near the pleura, the apex toward the hilum and connected to the hilum with a heavy trunk. The pathological lesion within the lung which causes the fan-shaped density is a cone that has its base to the pleura and its apex toward the hilum. The density within this fan-like area varies greatly. The radiating linear markings may either be interwoven and broadened, studded, obscured by a filmy cloud effect, mottled, matted together or entirely blotted out. One of the most striking characteristics of the tuberculous picture is the varying degree of change in the different trunk-groups in contrast to the general homogeneous change in diseases which might simulate tuberculosis, also the lack of continuity with which the trunks may be involved. Thus we may have the vertebral and second interspace trunks on the right side involved and only the first interspace trunk on the left side. Further it is very striking to notice the constancy with which early or slight lesions in the adult are limited to the trunks of the lower lobes.

"If the fine linear markings of a given trunk are fuzzy or are faintly obscured by a cloud effect and the fan appears to be wide open, active tuberculosis is suggested. On the other hand, if the linear markings beyond the trunk and the fan are partially closed, a healed lesion is suggested. This condition is emphasized if it is accompanied with heavy, coarse interweavings which reach to or near the periphery. The heavy trunks between such areas and the hilum are usually broad and dense."

Practically, this fan-shaped appearance is that which would be caused by any low grade inflammatory process which has spread by continuity of mucosa. In advanced cases can be seen: Dunham's fans, lung suppuration, tuberculous adenopathy, thickened pleura, cavitation and local pneumonias. The degree of activity of a tuberculous lung lesion is inversely proportionate to the distinctness of outline or limiting border. If the outline is sharp, disease is quiescent but if it shades off into outlying tissue it is active. This cannot usually be told on the screen, but one should use low unit radiation for fluoroscopy and should make stereoscopic pairs for final study.

For brief periods of screen observation and for plates the patient should not breathe (diaphragm is indicator, if visible) and the patient must not move. If disease is active, tuberculous areas will be smoky, foggy, hazy, blurred and indistinct. If disease is quiescent, the plates will show: sharp demarcation, sharp contrast, dense small shadows, no fog, smoke or haze. Dense shadows of regular outline and sharp demarcation denote healed process.

Differential Diagnosis.—Localized lung suppuration resembles alveolar tuberculosis, but it is confined to one or more areas, the fan-shaped area is larger, it does not extend to the periphery of the lung, the whole process is denser and patients are very ill.

Hilus Tuberculosis.—This is primarily a disease of childhood and is a peribronchial tuberculo-adenopathy. Hilus glands may break down, liquefy and break through into a bronchus, and by extension give rise to an alveolar tuberculosis. On the other hand the disease may never go so far and rarely does. If the outlines are indistinct, homogeneous and blurred, the process is active. If a dense, clear-cut outline shows in the plate, the glands are probably calcified, healed in and quiescent.

Warning.—Any infectious disease of childhood with bronchial irritation or inflammation will enlarge the peribronchial glands, but these will usually subside as convalescence progresses.

Foreign Bodies in Respiratory Passages.—The foreign bodies may consist of anything small enough to get in by inspiration. They may be located from the nose downward. In examining for them never be satisfied with the screen examination solely. The favorite location is behind the heart shadow in the right bronchus. Always make a lateral view and two anteroposteriors to locate a foreign body which is transparent to the *x*-rays. In any case note the history of the case and the area of atelectasis or lung suppuration, with foreign body at handle of fan, on the roentgenogram. If small enough to go through the larynx, the foreign body may be found in the trachea, bronchus or lung. It may be expected to gravitate downward until it reaches a bronchus whose size refuses admission.

The foreign body may be opaque or rnsparent to the x-ray, but requires calization irrespective of this fact. On eral occasions a foreign body supposed be in the lung has been found in the se and on many occasions in the bowel. Te screen is not of much avail in this parular instance, and it is much more satactory to make very rapid plates of the est, making two anteroposteriors and a leral.

Even if a foreign body be transparent to te x-rays, it may reasonably be expected cause irritation at its seat with some relting inflammation and possible blocking the bronchus, resulting in atelectasis d later a localized suppuration.

My associate, Dr. Grier, has published this JOURNAL the results of our experince in the examination of very many ses of foreign bodies of various types in ie air passages. It is, therefore, unnecesry for me to add anything to what he as said.[1]

THE HEART.—Roentgen examinations of ne heart are performed for the purpose f obtaining the following data: size, shape, osition, condition of aorta; presence or bsence of pericarditis.

Size.—It seems to me that clinicians hould be interested in this, if only to determine whether or not a heart is of suffiient size to take care of the circulatory equirements of the individual under examination, without being expected to unluly exert itself. This is simply a problem n hydraulics and I am quite certain that ny observer will in a short time have his ttention called to this fact.

On making a rapid fluoroscopic observaion of a heart, having previously examined he individual and taken his blood pressure, he observer should be able to state vhether or not, in his judgment, any given ieart is sufficiently large for its work. If he heart is oversize, it is from dilatation r hypertrophy. If it be hypertrophied its behavior, its muscular action, its excurion, its apical retraction, will immediately proclaim it such. Similarly if it be dilated the very lack of the foregoing characteristic muscular activity will tell the observer of that fact. A dilated heart gives the impression of a chronic diastole. When a healthy heart, whether hypertrophied or not, contracts, the apex retracts. The activity of the heart is determined by the retraction of the apex and by the diminution in its size or by its change in area and in position. The change in position is due to its systolic rotation on the great vessels on which it is suspended, in conjunction with its rate of contraction and expansion.

The only way to learn anything about this particular branch of medicine is to carefully and intelligently examine the heart by every means practicable, then study the same heart before the screen. In this way one may acquire the ability to interpret for himself the visualization of the heart in action, so beautifully seen upon the screen.

Shape.—The shape of the heart varies greatly. It is easily possible, however, to designate it as transverse, vertical, globular, drop, or compressed. Drop-heart has no pathological signification. It is usually small and occurs in patients having long trunks and general visceroptosis. The transverse heart, on the other hand, is a distinctly dangerous cardiac condition. It is observed most frequently in those men whose abdomen exceeds in circumference their chest, who are what are commonly known as "stomach athletes." These are the types recorded in the daily print as dying of acute indigestion or cardiac failure immediately subsequent to a $7.00 banquet.

Position.—A displacement of the heart is, of course, immediately observed. Pleurisy with effusion, particularly right-sided pleurisy may cause considerable displacement. Congenital dextrocardia is always worthy of comment, but the most marked cardiac displacements are those observed as a result of a rearrangement of the thoracic contents, due to old chronic fibroid phthisis.

Pericarditis with effusion is very fre-

[1] Roentgen Examination of Foreign Bodies. G. W. Grier, M.D.

quently overlooked and very often diagnosed as a simple cardiac hypertrophy. It is well to remember that the reëntrant angle, which is found by percussion and which seems to have disappeared upon percussion in this condition, has not actually disappeared but is rather accentuated when the heart is examined upon the screen. This confusion is bound to cause mistakes. The diagnosis of pericarditis with effusion is rather better made by the fact that a portion of the heart shadow, its auricular shadows and the shadows of the great vessels at the root of the heart are almost lost due to the distension of the pericardium with fluid. Moreover, the cardiac activity is apparently very greatly reduced, because the apical retreat is no longer noticeable.

The various changes in the contour of the heart consequent to valvular insufficiency would require an afternoon for their discussion. Moreover, they have been already beautifully described in roentgen literature. They will not, therefore, be further considered.

Condition of Aorta.—Considerably more attention should be paid to determination of aortitis than has been done in the past. The writer believes that an early determination of aortitis with proper treatment thereof would result in an increasing rarety of aneurysm. Any deviation in size or shape of the aorta requires explanation, but it does not necessarily mean aneurysm. The size, shape and position of the arch is best studied before the screen and no diagnosis of aneurysm should ever be made until the superior portion of the arch has been studied in the lateral position. Syphilitic aortitis may be frequently diagnosed upon the screen by marked increase in the density of the descending aorta.

Expansile pulsation of aneurysm mean an impulse synchronous with the hear beat. It must be remembered that trans mitted impulse is imparted to any tumo in the mediastinum which may be in con tact with the aorta. The following tabl also notes the differences between tumor of the mediastinum and aneurysm.

Aneurysm	*Tumors*
1. Regular outline, spherical	1. Outline irregular o spherical
2. Pulsatile and expansile	2. Pulsatile but not ex pansile
3. Painful when producing pressure	
4. Atrophy of bone	
5. Bruit marked	5. No bruit
6. Cardiac dyspnœa	6. No cardiac dyspnœ
7. Cardiac hypertrophy	7. No cardiac hypertro phy
8. Cough brassy	
9. Shadow continuous with aorta	9. Aorta can be differen tiated sometim from tumor
10. Density high	10. Density may be low irregular
	11. Often metastatic
	12. Rapid onset

No mention has been made of mediast nal abscess, the result of caries of the cer vical or dorsal spine and when such diagnosis is made it is usually an acciden

The writer realizes that many book could be written upon the subjects touche upon. The idea of this paper is simpl to reawaken the internist to the value o the fluoroscope and plate in the examina tion of the chest as a means of stimulatin his acuity in other methods of physica examinations and as an advantage—tha of having all the possible evidence in an given case. No roentgenologist can mak successful studies of the chest unless he b enough of an internist to appreciate all th various forms of pathology which may b found therein.

APPLICATION OF THE X-RAYS IN DEFINING AND STUDYING KIDNEY TUMORS*

BY PAUL EISEN, M.D.

CHICAGO, ILL.

DURING the past few years the clinicians of the North Chicago Hospital ·e furnished me an exceptional opporlity to examine a large number of kid- tumors by means of the roentgen ray, l I desire to bring the results of my obvations before you, in order that we y profit by the findings in this series of es and also by your discussion.

The following number and variety of es have been examined:

ases of hypernephroma,
ase of polycystic kidney,
ase of solitary cyst, of very large size,
ase hemorrhagic cyst,
ase polycystic kidney combined with hydronephrosis,
ase pyonephrosis of large size, without stone,
ases pyonephrosis, with multiple stones,
ase tuberculous kidney with calcareous deposit,
ase tuberculous kidney, with abscesses not ruptured,
ase tuberculosis of the kidney with fistulous tract,
ase tuberculosis of the kidney with perinephritic abscess of both kidneys,
cases tuberculosis of kidney with psoas abscess,
cases tuberculosis of kidney with metastatic glands and peritoneal fluid.

The kidney tumors which have given definite x-ray findings were those which were palpable. In fact, they were mostly so large that the suspicion came up whether or not the tumors were of renal origin. Their size varied from that of a double normal kidney to tumors filling half of the abdomen. In these cases, the masses were plainly visible with the patient lying supine on a hard flat table. Although their renal origin was usually diagnosed, it is extremely gratifying to have the diagnosis verified by the aid of the x-rays. At the same time, the roentgen ray examination furnished details not ascertainable clinically. As a transperitoneal extirpation was performed in all but one case, the other kidney was also examined at operation and the abdomen generally explored.

To predetermine the suitable x-ray method of examination in each case is impossible. The clinical findings will often suggest a certain method of roentgen ex-

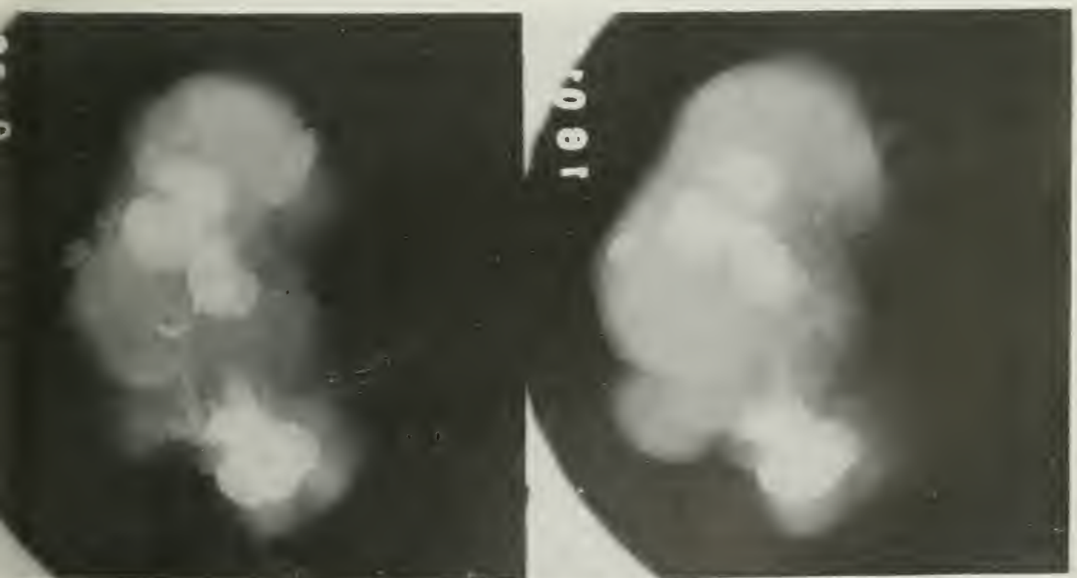

FIG. 1. PYONEPHROSIS WITH STONES. NO PREVIOUS X-RAY EXAMINATION

* Read at the Annual Meeting of the Western Section of the American Roentgen Ray Society, Feb. 22, 1918.

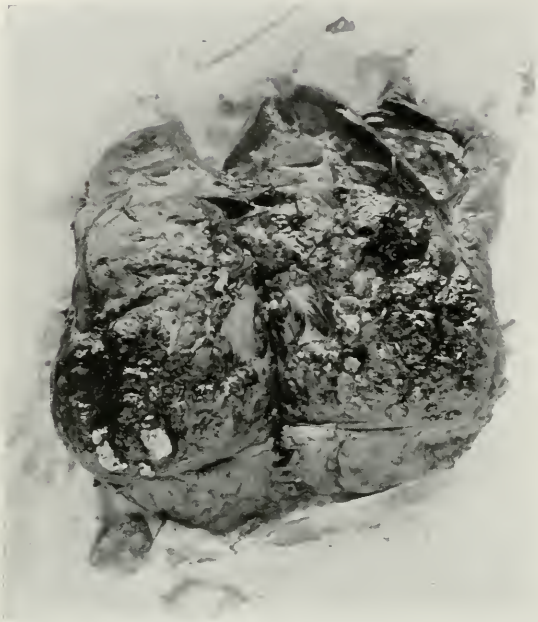

Fig. 2. Hypernephroma

amination and the result will suggest further clinical examinations, until a final conclusion can be drawn or the diagnosis left open, to be revealed at operation.

For example: A woman had a large bean-shaped tumor easily palpable in the right hypochondrium, protruding from underneath the liver and extending down below the navel. It appeared to be the kidney, but a very distended gall-bladder could not be ruled out. Therefore, preceding the barium enema examination, a ventral plate was taken for gall-stones. While the plate was being developed, the barium enema was given and the fluoroscope revealed the transverse colon neither displaced downward, as it should be by a large gall-bladder, nor was the hepatic flexure displaced downward, as might be expected from a kidney tumor. In fact, the bowel crossed in front of the tumor. The plate revealed a typical kidney stone, filling the pelvis and calyces. After a cathartic, stereoscopic dorsal plates of the kidney confirmed the diagnosis of stone in the pelvis of the kidney. Later more careful urinary analysis gave confirmatory findings of blood and pus taken by catheter from the right ureter. The left side was free from stone. The pyonephrotic kidney, not having had any function, was removed.

Fig. 3. Hypernephroma of Lower Portion of Left Kidney. Collargol Injection

This experience shows the necessity of dhering to the routine measure which we enerally follow, of first taking a plate of ny tumor present in the abdomen. The late will generally show the correct size nd often the upper outline and general hape of the kidney tumor. It will also how up any stones, calcareous deposits nd other foreign substances, and even when negative, may be of value. In a case where this was not done, the removed kidney was rayed, showing multiple stones hat were first felt at operation, while renoving a pyonephrotic kidney. If the other kidney also contained stones, the fact is not known. The clinical findings of pus oozing out of the affected ureter, with the other kidney functionating, and a large palpable and ptosed kidney, justified the surgical course taken. But the omission of taking a plate before operation gave the surgeon some anxiety as to the presence of stone in the other kidney. In one case of tuberculous kidney, calcareous deposits in the same were evident and confirmed the other clinical findings of tuberculosis. In another tuberculous case, the enlargement of the kidney was of itself of diagnostic value.

Fig. 4. Hypernephroma

After taking plates, the method thereafter to be employed should be the one giving the quickest and most definite results, with the least harm to and handling of the patient. If the kidney tumor is a pyonephrotic sac with stones, it may be sufficient, by inserting a shadowgraph catheter, to show the approximate relationship of the stones to the ureter. If the cys-

Fig. 5. Barium Enema. Displacement of Splenic Flexure

toscopic examination reveals a fairly functionating kidney, the exact localization of the stones by stereoscopic pyelography is the method of choice, for it localizes the exact situation of the stones in either the pelvis, calyces or kidney substance, and besides prescribes the surgical steps to be taken for removing the stones. Inflation with air into the renal pelvis is not practised, because the air may be confused with air in the bowel. The localization of the stones, as stated, may determine the path of opening the kidney, but the functional test of the kidney will alone determine, with consideration of the functional condition of the other kidney, whether or not the kidney should also be removed. In other cases, however, the x-ray findings of stones in both kidneys may influence the surgeon in determining the question of extirpation.

Given fistulous sinuses, the obvious step next to be taken is the injection of the same with bismuth paste, as published by Dr. Emil Beck (*Surgery, Gynecology & Obstetrics*, May, 1916). The stereoscopic study of their ramifications will show them leading directly to the kidney pelvis. With this method, abscesses of the kidney substance, perinephritic abscesses, and psoas abscesses, can be directly traced to a diseased kidney. It is then very easy to differentiate these cases from tuberculous spondylitis with psoas abscesses.

A similar method, opening the abscess before a fistula has formed, and after due time injecting bismuth paste into this opening after draining off the pus, may disclose very nicely the underlying condition and be of no harm whatever to the patient. In a recent publication, I showed such an enormous pyonephrotic sac made clearly visible by this method, showing distinctly its size, configuration, outline and extent, by simply injecting a weak concentration of the paste into the drainage tube. The paste probably helped to sterilize the sac before draining away. The injection was made under inspection on the fluoroscopic table, the so-called method of external pyeloscopy, which was extremely useful in this case, showing the

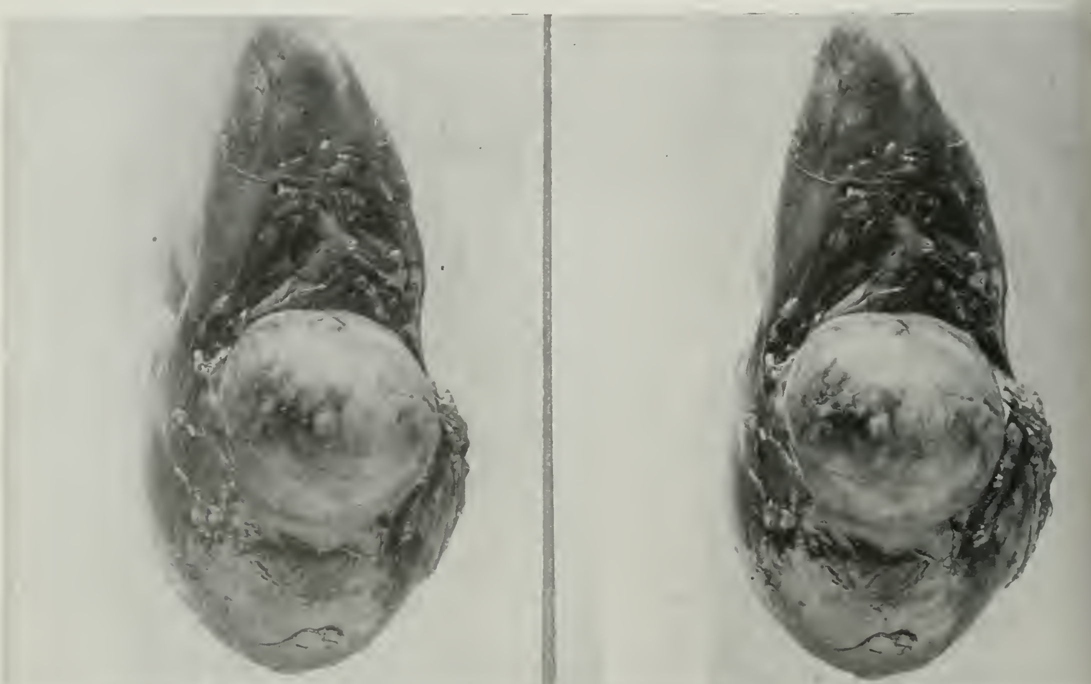

Fig. 6. Hypernephroma

[illegible] to extend far below the drainage open- [illegible] into the true pelvis. Later, the whole [illegible] was removed. In another case of hy- [illegible]nephroma, with practically a normal pelogram, pyeloscopy with a silver salt [illegible]ution was unsatisfactory, stereoscopic pelography alone assuring the accurate [illegible]tail necessary to form an opinion. Even t[illegible]en the pyelograms were inconclusive, [illegible]ile other x-ray methods proved a valu- [illegible]le aid. The enlarged kidney was well [illegible]tlined in plates, and in stereoroentgeno- [illegible]ams of the barium enema, the displace- [illegible]ent of the splenic flexure was an invalu- [illegible]le sign.

In neoplasms and congenital anomalies [illegible] the kidney, especially when not pal- [illegible]ble, stereoscopic pyelography, when feas- [illegible]le, is the method of choice. However, the [illegible]moved kidney tumor should also be in- [illegible]cted with bismuth paste and these injec- [illegible]on stereograms compared with the pye- [illegible]grams taken before operation. As the [illegible]aste will enter, with proper technique, the [illegible]mallest ramifications of the arterial sys- [illegible]em, the exact relationship of the pel- [illegible]is of the kidney to cysts in the substance [illegible]ay be outlined. In this way, I have gained valuable information in cases of solitary and polycystic kidney, hypernephromata, hydro- and pyonephrosis and tuberculosis. In the stereoscopic plates of these injected kidneys we learn to recognize, much better than in pyelograms, the characteristic normal and abnormal appearance of the pelvis and calyces and understand the pyelograms all the better, even when they show incomplete filling due to growth formation. Single pyelograms may suffice in many diseased conditions of the kidney, but in tumor formation, stereoscopic pyelograms are essential. When these are negative, as in the case I cited, often other x-ray methods may be found of aid. In an injected case of a removed hypernephroma you see very instructively how little of the kidney tissue is left. Compare this with the stereoscopic photograph of the kidney after section. Only the upper border of the kidney is left, the whole mass otherwise is tumor formation.

In this and in a few other cases, the injection of the colon with a barium enema was also of considerable diagnostic help to us. The displacement may be only slight and then invariably only forward, but

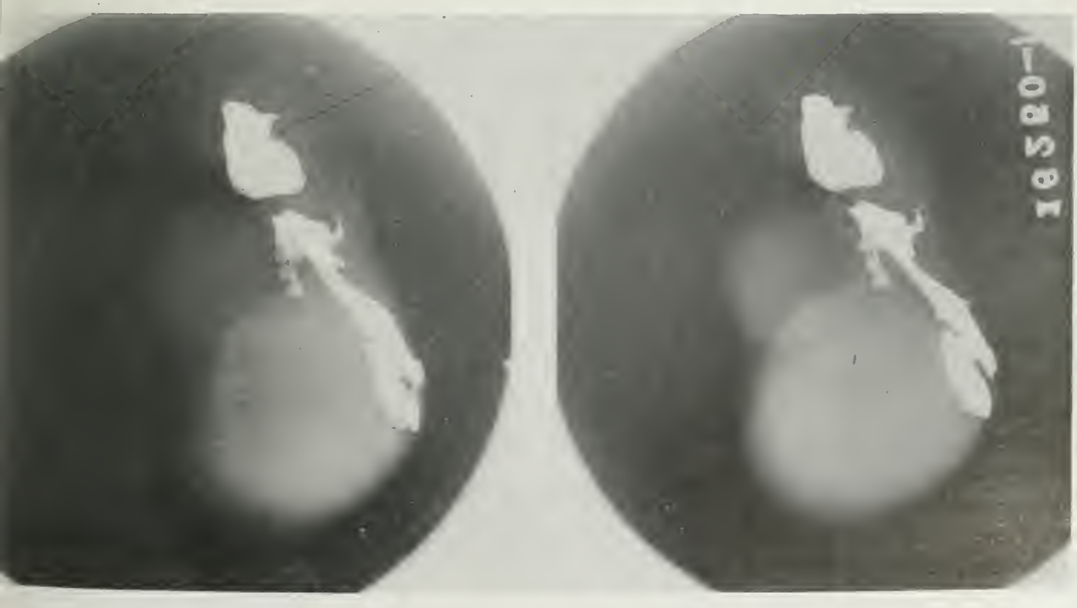

Fig. 7. Hypernephroma of Upper Portion of Kidney. Bismuth Injection of Specimen

stereoscopic plates will bring this out. Of more value is the displacement downward, of the splenic flexure more than of the hepatic. This has proven not only of great value in showing the retroperitoneal position of the tumor, but in two cases it helped us rule out tumor growths of the bowel. In another case where cancer of the stomach was suspected, the barium meal showed the stomach displaced upward and to the right by an extragastric mass. But this mass also shoved the descending colon way over to the median line. In only one other case of tuberculous peritonitis, with enormous retroperitoneal glands, did I see a similar displacement of the descending colon. Metastatic tumors originating in the retroperitoneal space would give similar findings. In one case of large tuberculous kidney, the barium meal proved very confusing, showing a constant napkin ring-like stricture in the descending colon, with gas distention above. The enema showed no stricture, which must have been therefore simply a broad based segmentation.

This case of tuberculosis was afterward treated with good results with *x*-rays. Two other cases of tuberculosis, previously cited, were also treated, but were too far advanced, it seems, and the results were negative. The one case of hypernephroma was also treated with *x*-rays, also with negative results, as the section photograph shows you. The one case of abscess in the kidney, with extirpation of the same, was treated afterwards with bismuth paste to help heal the sinuses, but was also given *x*-rays. To-day, the patient is in perfect health, has gained over 50 lbs., and the sinuses are closed. But whether this was due to the one or other method of treatment, I am unable to say. True cancers of the kidney that are inoperable should at least be given the benefit of the rays, if only to stop the hemorrhage and relieve the pain. I have no experience with such a case.

OPEN SAFETY PIN IN AN INFANT'S STOMACH

To the Editor:—The report of an open safety pin in an infant's stomach in The Journal, Dec. 22, 1917, might lead to the impression that an operation is always necessary in such cases. I therefore report the case of an 8 months old baby who swallowed a 1½ inch open safety pin, November 21, about 2 p. m., and later passed it. Roentgenograms taken at the request of the attending physician, Dr. Corliss Keller of Hamilton, Ohio, showed the pin to be in the stomach. Thirty-six hours later the pin was in the same position, and as the separation of the open ends of the pin, as shown in the roentgenogram, seemed to be considerably greater than the diameter of an infant's pylorus, I advised bringing the child to a hospital for operation. Several more pictures were made at the hospital, and at the end of fifty-two hours the operating room was ordered to be made ready. A final picture, however, showed that the pin had apparently passed from the stomach. Operation was then advised against, and in the following thirty-six hours the pin was watched by means of the fluoroscope as it traveled through the intestinal tract, and it was passed at the end of ninety-six hours. Only during the first twenty-four hours did the child show any clinical symptoms. The pin was open at least three fourths of an inch; but as the blunt end evidently engaged the pylorus, the probabilities are that the pyloric sphincter closed the pin sufficiently to allow it to pass. In the majority of instances one can count on the passage of a foreign body through the intestine if it has been able to pass through the pylorus.

D. W. Palmer, M.D., Cincinnati.

(*Ref. J. Am. M. Ass.*, Feb. 16, 1918, p. 480.)

BARIUM STASIS IN BILE AND PANCREATIC DUCTS *

BY R. A. PAYNE, M.D.

and

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N a recent article in the *Archives of Radiology and Electrotherapy* of London, ase, of Battle Creek, discussing the diagosis of lesions in the upper abdomen, alled attention to several cases which ad recently come under his observation which there was a stasis of barium found the ducts leading from the duodenum the gall-bladder and pancreas. This henomenon had been observed during he course of routine gastro-intestinal *x*-ray ork. Case suggested that instances noted e placed on record in order that a proper nterpretation of the findings might be nade after sufficient data was accumulated.

To the best of our knowledge this is the irst time that attention has been called o a possible more or less continuous patncy of these ducts at their entrance into he duodenum. Textbooks and current iterature discuss the anatomy and the nechanism of these valves. Attention has been directed to the proof of a definite muscular sphincter at the ampulla of Vater and to the Law of Contrary Enervation as controlling this sphincter and adjusting its action with reference to the actions of the musculature of the gall-bladder and the ducts. Opposed to this, we have the distinctly mechanical theory that the action of the valve here, through the effect of intravisceral pressure, closes the duct where it passes obliquely through the layers of the bowel wall. These points have been discussed at length, but there seems to have been little question that the resulting action of the forces of closure, whatever they may be, has been an effective closure of the duct opening. The prevalent thought is that the bile and pancreatic juices are dammed back by the valve action, and that they are ejaculated into the duodenum on proper stimulation; moreover, that, lacking this action, a distinct symptomatology will result.

On this basis, we have the theory advanced that, without proper valve action and without the storage reserve after cholecystectomy, the constant dribbling of the juices through the ampulla will, through continuous hormone stimulation, result in an achylia gastrica. Again, we have the theory advanced that in certain cases the bile ducts dilate to take on the function of the gall-bladder. It is evident, therefore, that the idea of the continued patency of these ducts is a new anatomical conception.

In view of the above facts, it has seemed justifiable to us to place on record five cases which have recently come under our observation, together with complete enough case histories to be of value in determining the relative diagnostic value of the findings when sufficient cases are on record. Three other cases have been observed, but the material is not complete enough to report on them at the present time.

PATIENT NO. 1. Female; age 26 years; married six years; housewife; one child four and a half years old; family history negative; robust in childhood; has always been constipated; menstruation painful. Two years ago cystic left ovary and appendix removed. Never recovered strength after the operation.

Present Complaints.—Weakness, fainting, hot flushes.

Constipation, heavy dragging sensation in stomach.

Backache and aching in legs.

*Read before Meeting of Portland City and County Medical Society, February 5, 1918.

FIG. 1. CASE I. IMMEDIATE AND TWELVE HOUR PLATE

Plate shows marked ptosis of organs with barium hanging in diverticulum in the region of the second portion of the duodenum

General toxic symptoms included headache, stupid feeling, lack of ambition.

Physical Examination.—The patient is a nervous, hysterical woman of marked asthenic type, with straight back and angel-winged scapulæ; she has a long, narrow abdomen with the lower pole of the stomach in the pelvis, and the cæcum is palpable on vaginal examination; the heart tones are of quick, toxic type; the urine is normal; the white blood corpuscles 14,000, with a normal differential count; hæmoglobin 95%. An analysis of the stomach contents showed total acidity of 79. The systolic blood pressure was 106.

Roentgen-ray Examination.—September 26, 1916, the points in the physical examination were confirmed. Patient showed a marked midline ptosis of the stomach and the transverse colon. The cæcum was long and low and a small six-hour residue was found in the neighborhood of the duodenum. The significance of the latter was not recognized at the time. The patient left the hospital November 19, 1916, in a much improved condition.

On November 19, 1917, the patient returned to the office. Her general health had remained much improved. She had gained in weight up to 150 lbs.; she felt well all summer, but lost 10 lbs. in a trip to Chicago and in nursing her boy through an attack of measles. The nervousness returned, consequent to this strain. She now complains of chills, a coated tongue, gas in the bowel and loss of appetite; and is losing weight.

On repeating the fluoroscopic screen observations, the position of the organs appeared to be about the same as on leaving the hospital. A small diverticulum was found on the mesial side of the second portion of the duodenum. A barium residue remained in this diverticulum for twelve hours, and was evidently the site of the six-hour stasis noted in the previous examination. There was no localized tenderness over the diverticulum.

PATIENT NO. 2. Female; age 66 years; married forty years; the mother of four children. The family history is negative;

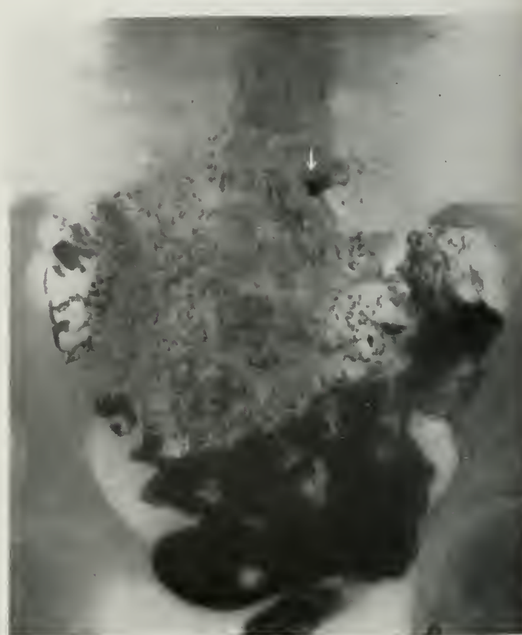

FIG. 2. CASE I. SIX HOUR PLATE WITH BARIUM RESIDU[E] IN THE REGION OF THE DUODENUM

ıe menopause was established at forty-ve, preceded by a nervous breakdown. Veight 102½ lbs.; height 5 ft., 3½ in. perations: Hemorrhoids removed fifteen ears ago.

Present Complaints.—She had a recent old, followed by pleurisy in the right side. he is now weak and very much exhausted. he belches and discharges gas from the olon one to two hours after eating, es-ecially at night. There is a tendency to onstipation.

Physical and Roentgen-ray Examina-ions.—These show the patient to be of a narked asthenic type. Lungs show diffuse ibrosis in the right middle lobe. Stomach s low and atonic; bulbus fills sharply. Duodenal angle is low but not tender. A liverticulum is present on the mesial aspect of the second portion of the duodenum, in which a barium residue remains for twenty-four hours. Here there is localized tender-ness. There is some ileal stasis; the cæcum s large and mobile and there is a slight leocæcal regurgitation. Chemical examination of the blood, stools and stomach contents is negative. Urine examination shows some casts and epithelial cells and white blood cells.

Fig. 4. Case III. Immediate and Twelve Hour Plate

Shows barium hanging in duodenal diverticulum

Fig. 3. Case II. Immediate and Twelve Hour Plate

Heavy barium deposit in diverticulum on the mesial aspect of the second portion of the duodenum

Patient No. 3. Female; age 42; widow; seamstress; family history is negative. Her menstruation was profuse and irregular last year; she has had typhoid fever and occasional sore throats, and had a nervous breakdown fourteen years ago.

Present Complaints.—Constant dull pain and soreness in the pit of the stomach for the past year. Has had some belching recently. A constant backache for past three months.

Constipation with much gas in the bowel.

There is pressure on the bladder and a frequent desire to urinate.

She is run down and under weight; weight 85 lbs.; height 5 feet, 4 inches.

Physical Examination.—The patient was nervous and of asthenic type. Skin showed considerable pigmentation; the middle lobe of the thyroid was somewhat enlarged. The heart borders were "out" slightly; there were aortic and mitral murmurs;

Fig. 5. Case III. Six Hour Plate. No Stasis Present

At a later screening when the organs had been returned to a more normal position by treatment there was a six hour stasis in the sagging diverticulum

there was tenderness in the epigastric region; the right ovary is hard and tender; there a small fibroid in the fundus of the uterus.

Roentgen-ray Examination.—The chest showed moderate hypertrophy of the left ventricle, and dilatation of the descending aorta. The stomach was low, showing deep peristalsis. Bulbus of the duodenum was dilated; the second portion showed lagging of barium. At a later screening, this lagging in the second portion was definitely connected with a diverticulum on the mesial aspect of the duodenum. There was no sagging of this diverticulum and the barium emptied out quite rapidly. The cæcum was adherent to the colon, and the appendix was partially patent.

Indican was present in the urine. Aside from this, the remainder of the examinations, including blood Wassermann, were negative.

Under treatment the position and tone of the organs improved, coincident with a general improvement in health. On the last screen examination, with the duodenum considerably higher, there was a sagging in the diverticula. The barium residue remained here for twelve hours. There was also a slight localized tenderness.

Patient No. 4. Female; age 41; housewife; married twenty-seven years. There were three children; two of these died in childhood. The family history is negative. She was never strong in childhood, but complained of frequent stomach disorders. She was subject to tonsillitis and influenza. Operations: Ten years ago the right kidney was anchored; right oöphorectomy and plication was performed; a cyst was removed from the left ovary and adhesions were broken up. Two years ago ligation of thyroid arteries was performed for toxic goiter.

Present Complaints.—Attacks of gas in the stomach, pain in the stomach and sense of pressure through the chest. Considerable nausea immediately after eating.

Goiter and nervousness since fourteen years old. Much better since ligation two years ago.

Fig. 6. Case IV. Shows Appearance of Residue i a Sthenic Type of Patient

No constipation; passes considerable atus; she has attacks of mucous colitis; rinates frequently. She is subject to severe eadaches in occiput and vertex.

Patient is weak; feels dull and stupid; nd has no strength or endurance.

Physical Examination.—Patient was a ery nervous woman of marked asthenic uild. She showed postural scoliosis with ome bony changes. Skin was dry. Eyes—Palpebral angle was slightly widened; pupils reacted sharply to light and distance. Teeth showed pyorrhea and apical abscesses. Thyroid enlarged, size of half an orange, hard. Loud bruit was audible over gland. Cervical and inguinal lymph glands were enlarged. Chest was flat. Examination showed drop heart with considerable hypertrophy. Tones were rapid and toxic type. Pulse tracing showed simple tachycardia. Abdomen had loose flaccid walls; general ptosis of organs. There was a marked tremor present. Abdominal and patellar reflexes were present. Laboratory examination showed a very low hydrochloric acid content in the stomach.

Roentgen-ray Examination.—The patient exhibited a very low stomach with active peristalsis. Bulbus was large and very low; was very tender above duodenum angle, which was low. Barium entered diverticulum on mesial side of duodenum just below angle. Remained in diverticulum for over six hours.

Patient No. 5. Male; age 68; married forty-one years. There are four children. He is engaged in the telephone business. The family history is negative. He had typhoid thirty years ago. He has been jaundiced three times. No operations.

Present Complaints.—Patient has attacks of severe cramping pain in upper abdomen. First attack two years ago. During the past year he has had five attacks of typical gall-stone colic: Cramping pain referred to back; rigidity of upper recti muscles, especially marked on the right side; vomiting. Temperature up to 102°. Required morphine to alleviate pain.

Physical Examination.—The patient is

Fig. 7. Case V. Six Hour Barium Residue in Sthenic Patient

Operation revealed gall-stones and pus in gall-bladder and a dilated common duct with a chronic inflammatory condition in the head of the pancreas.

found to be a strongly muscled, well-built man, 5 feet 8 inches in height, and weighing 161 lbs. Pupils reacted promptly to light and accommodation. Slight arcus senilus present. Cardiac dullness slightly widened at the base. There was a slight relative spasticity to the upper right rectus muscle. Liver and gall-bladder not palpable.

Urine showed considerable indican. Blood count normal, white blood count 7950. Stomach contents showed a total acidity of 40 with no hydrochloric acid. Roentgen-ray findings were negative with the exception of a shadow on the mesial side of the second portion of the duodenum, discovered on the plate but not noted in the fluorescent screen examination, and a six-hour residue in this locality.

This case went to operation with a pre-operative diagnosis of gall-stones.

Operative findings: A small contracted gall-bladder, walls thickened and covered with adhesions, containing one stone and pus; the pancreas enlarged and very hard; the cystic duct thick; the common duct somewhat dilated; a small abscess extending from the gall-bladder into the substance of the liver.

We have, therefore, these five cases in which we have had a definite barium shadow appearing on the mesial side of the second portion of the duodenum. Under the fluorescent screen it has been possible to definitely trace the continuity of this shadow to the opening into the duodenum. There has been a barium stasis in this locality, in some cases, up to forty-eight hours. In the first four cases the phenomenon occurred with practically no localizing symptoms. There was, in these cases, no history that would point to the possibility of any ulcer, past or present, which might account for such a diverticulum. In the fourth case there were definite gall-bladder symptoms, and operation disclosed a dilated common duct with no other diverticulum showing to account for the barium seen on the *x*-ray plate.

We feel justified, therefore, in the assumption that the explanation of the presence of the barium in this locality lies in the patency of the ducts leading from the gall-bladder and pancreas.

From a comparison of these cases, also, it would seem that there may well be a double etiology that would result in this condition. The first three cases recorded are of a distinctly asthenic type. The relaxation of the supporting mesenteries and of the visceral musculature extends to the duodenum, and on this also is suspended a part of the weight of the sagging stomach. Whether the closure of the ducts be due to definite muscular sphincter action or to the action of intravisceral pressure, it is conceivable that the sagging of the duodenal walls may, in certain cases, cause the duct openings to be agape, allowing the duodenal contents to enter.

The fourth case is a distinctly different type. Sthenic and with a history of repeated severe attacks of gall-stone colic, it is possible that a stone passed down the bile and common duct and, before release, dilated the duct and injured the mechanism of the valve. It has been commonly accepted as a fact that the infection of the gall-bladder and pancreas takes place through the blood and lymph, and that infection ascending through the ducts is rare. The ready passage of material from the duodenum into the distal end of the ducts, and the stasis of the material in the ducts for many hours would greatly increase the opportunity for an ascending infection to the gall-bladder and, possibly, through the walls of the duct into the pancreatic tissue.

If further observation of these and other cases should show that the condition of patency may be a temporary one, that nature in time can restore the competency of the duct openings, we may have to revise our theories as to the most common method of infections in these organs.

The most important point with reference to our everyday work is that a stasis of six hours or longer, in the region of the duodenum, does not necessarily mean the presence of a penetrating lesion at this point. The recognition of this fact and the careful examination of the mesial aspect of the second portion of the duodenum, in such a case, may save the patient the risk and the operator the humiliation of a fruitless operation.

REPORT OF A CASE OF OSTEOMA OF THE FRONTAL SINUSES

BY GEORGE F. THOMAS, M.D.

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COMPACT osteomata of the frontal sinuses are quite rare. They are nodular ivory-like tumors of great density and most frequently appear between the ages of 16 to 20. They usually are of slow growth, but in the present case the growth was quite rapid. They may attain great size, and penetrate into the brain cavity. Cases have been reported of spontaneous detachment of the mass, which then acts as a sequestrum.

The case reported below is of interest because of the rather rapid growth of the tumor, and its recurrence after removal, apparently *in toto*.

History.—Patient was hit over left eye by a swiftly thrown baseball in July, 1914. He did not lose consciousness and although he suffered considerable pain, he continued at school. The discoloration about the eye gradually disappeared. About a month later, the patient noticed some ptosis of the left upper lid; a swelling appeared above the eye and pushed it downward and outward. The patient suffered no pain or headache but soon began to complain of double vision.

FIG. 1. LATERAL VIEW. SEPTEMBER 1, 1914

Roentgen-ray Examination.—A roentgen-ray examination, made September 1, 1914, showed a very dense growth involving all of the left frontal sinus, extending into the orbit and upward above the frontal sinus and beyond the median line somewhat over the right orbit and into the right ethmoidal region. There was considerable invasion of the left ethmoidal region. The tumor was

Fig. 2. Front View. September 1, 1914

Fig. 3. Lateral View. July 31, 1915

sharply demarcated from the normal bone structure by a thin bordering zone of absorption, probably due to the pressure of the new growth.

Operation.—September 12, 1914, by Dr. J. M. Ingersoll of Cleveland. An incision was made through the left eyebrow and one at a right angle to it through the middle

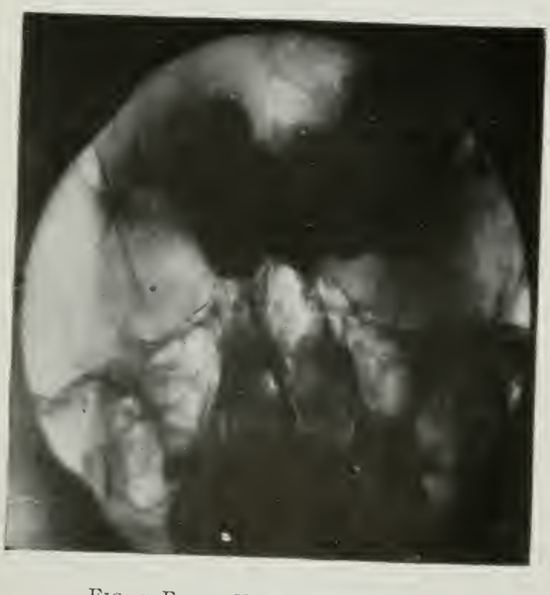

Fig. 4. Front View. July 31, 1915

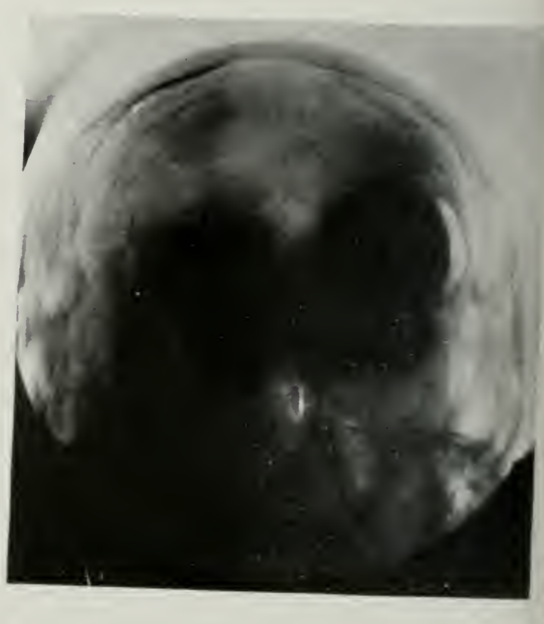

Fig. 5. Front View. July 5, 1916

the forehead. The anterior plate of the ontal bone was found detached and showg signs of necrosis. Upon removal, an irgular ivory-like mass was found extendg over the areas as indicated by the x-ray ates. The whole mass was removed, leavg the internal plate of the frontal bone tact. The bone around the frontal sinus as found to be quite vascular and somewhat spongy. The patient made a good recovery and on September 21, 1914, the eyes were nearly level and the patient had good vision. There was a little thickening and swelling over the left eye.

Fig. 6. Lateral View. July 5, 1916

Second Roentgen-ray Examination.—The patient again presented himself for an x-ray examination on July 31, 1915. The tumor had recurred and the plates showed that it was larger than at the time of the first examination in July, 1914. It extended outward beyond the orbit and inward and backward into the brain cavity, reaching almost as far as the sphenoidal sinuses. There also was a projection into the right frontal sinus with a finger-like protuberance into the right orbit.

Examination of the stereoscopic plates indicated that there were two large masses of the growth present, springing from a common stalk, extending backward into the brain cavity, but apparently not involving the cribriform plate or the crista galli. On the left the tumor appeared constricted where it passed through the posterior frontal plate, expanding after it entered the brain cavity.

Third Roentgen-ray Examination.—July 5, 1916. Examination of this date showed that the tumor had increased considerably in size.

A CASE OF MULTIPLE ABSCESSES OF THE LUNG WITH SPONTANEOUS CURE

BY GEORGE W. HOLMES, M.D.

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BOSTON, MASS.

THE following is an abstract from the clinical record of the case reported. The diagnosis is based upon these findings and the roentgenograms. It was the general opinion of the Medical Staff that the processes were due to definite abscesses. This is one of a series of six cases of spontaneous recovery from lung abscess.

Some of the cases followed tonsillotomy, and in these the findings were more typical, but the series of plates taken were not as complete. It is, of course, possible that this particular case represents a pneumonic process due to some unusual infection.

At the present time, two years after his illness, the patient is apparently completely well; no abnormal signs are found in the chest by physical or roentgen examination.

Patient.—Young adult (medical student).

Family and Previous History.—Negative except for tuberculous glands removed by operation when the patient was ten. Average weight for the last four or five years, 153 pounds; last June, 146 pounds.

Present Illness.—Two weeks ago while at Plattsburg Training Camp, the patient developed a slight cold which gradually became worse, and a slight cough which developed with a moderate amount of greenish sputum expectorated. He returned home and had chilly sensations and felt uncomfortable for two days, but did not go to bed. Then he had a day of severe pain in the right chest,

FIG. 1. PLATE TAKEN OCTOBER 10, WHEN PATIENT SHOWED PRACTICALLY NO PHYSICAL SIGNS

Sharply defined area of dullness below clavicle on right is distinctly visible. Note absence of mottling and the thickening of markings running from it to hilus.

creased by cough. Next day he felt etter and began work at Massachusetts eneral Hospital, but gave up in one day.

Physical Examination. Lungs.—In the ght chest below the clavicle were nuerous coarse crackling râles. Breathing

or so. There was no hemoptysis. Patient's condition showed little or no change except for relative decrease of temperature with persistence of symptoms. There was slight dullness, increase at right apex with râles, and increased voice and whisper.

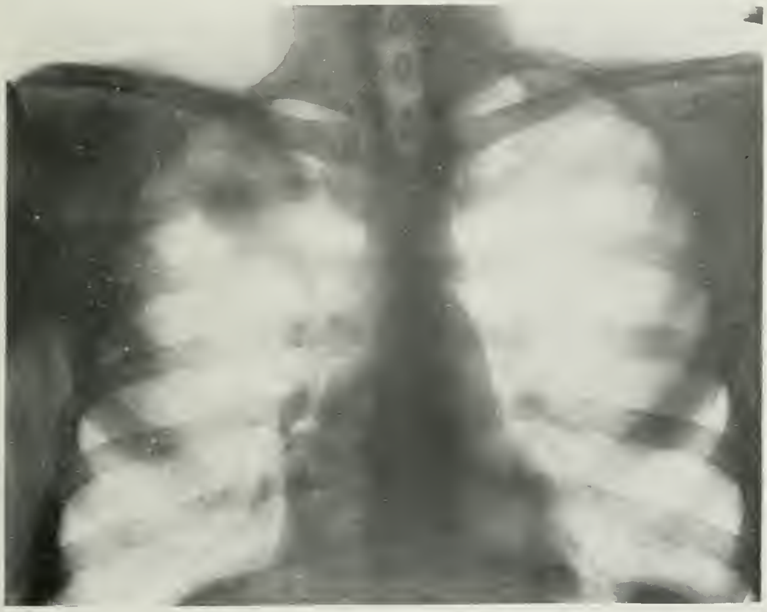


Fig. 2. Plate Taken October 16, After Patient Had Begun to Raise Considerable Amount of Sputum, but Still Showed Only Slight Physical Signs

Note area of diminished density in center of dull area (previously noted), suggesting cavity formation.

was vesicular. There was no increased whisper or spoken voice; no dullness.

October 5.—Consultation by Dr. F. T. Lord.—The right lung behind was slightly dull throughout, slightly more than physiologic dullness, probably. There was no other sign. The process started as an acute infection of the upper parts of the respiratory tract and was probably not tubercular. Pleural infection was probably present.

October 6.—Earache; drum reddened but not bulging; relieved by hot applications.

October 10.—Complaint was *malaise* and fever. There was considerable cough, with greenish mucu-purulent sputum, an ounce to two ounces in twenty-four hours. The cough was worse in the morning, when after starting it might last an hour

November 2.—During the previous two nights the patient's temperature rose to 100° without accompanying symptoms. No pulmonary signs were made out.

November 21.—There was some increase of right-sided dullness below the clavicle without increase of signs. Temperature was 99°. The sputum was gradually diminishing in daily amount.

November 27.—During the night of November 27 the patient seemed to feel something give way in his chest. Following this he coughed up about two ounces of foul purulent material. Following the evacuation of this abscess the sputum was slightly blood-tinged. The temperature was normal; the patient felt perfectly well.

December 5.—The sputum was very

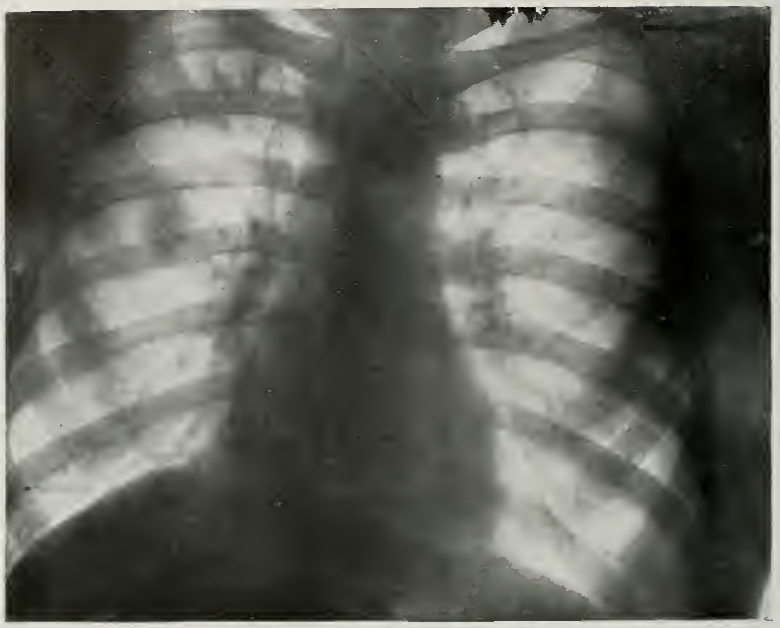


Fig. 3. Plate Taken November 6

Process below clavicle on right has largely disappeared. There is a ringlike area still present which suggests cavity. Near right midchest between third and fourth ribs, there is area of increased density resembling somewhat process below clavicle in its early stage. Lung markings running from both areas are thickened.

Fig. 4. Plate Taken November 22

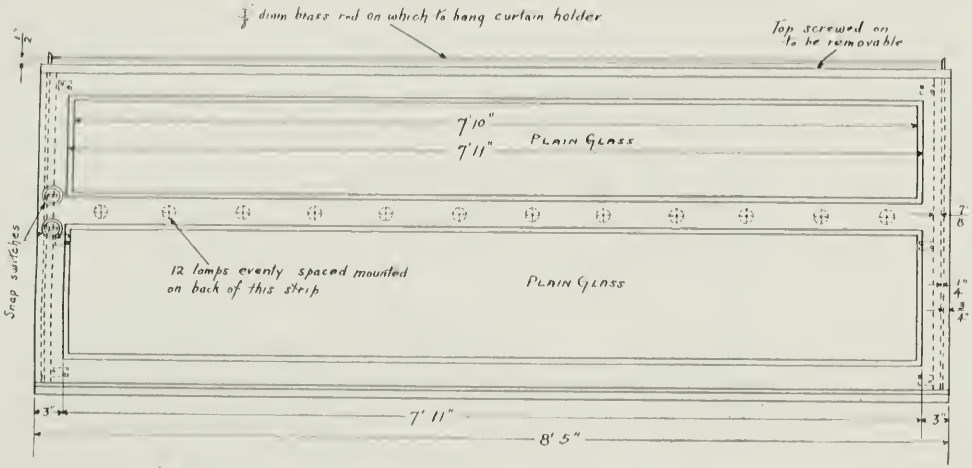
Area of early process has almost completely disappeared. The second process, however, has increased considerably in size and density and now has practically the same appearance as the first, during its early stage.

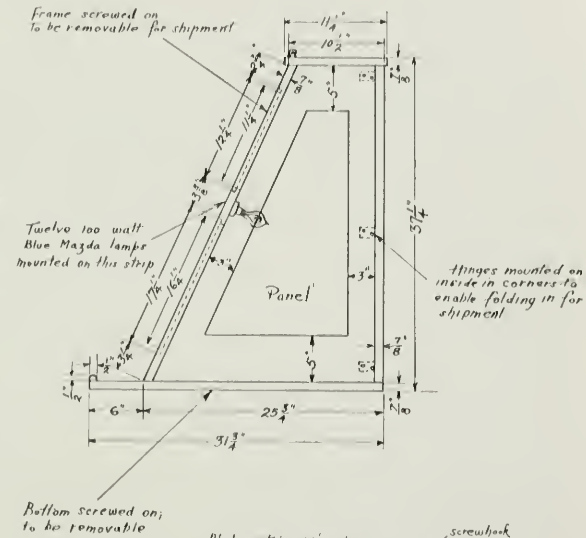
Fig. 5. Plate Taken November 29
On November 27 patient raised about two ounces of purulent material streaked with blood. This plate shows marked decrease in size of area of dullness in right midchest. It also shows suggestion of cavity formation.

Fig. 6. Plate Taken December 5
The second process is now disappearing; only slight increased density in area involved. Patient felt practically well.

scanty. The patient felt fine; had no temperature. Treatment was discontinued—the patient was relegated to his home.

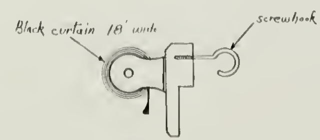
Diagnosis.—Lung abscess (multiple).



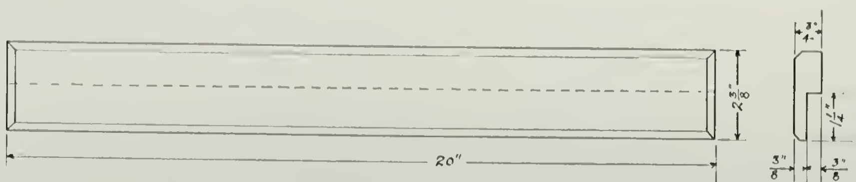


Note:-
Lamps to be wired in two independent circuits of six lamps each, controlled by two snap switches as shown, so arranged that each switch controls every other lamp.

Interior of viewbox to be painted flat white.



Assembly curtain holder



Curtain holder. 4 required

VIEWING SCREEN

Designed by
J. S. SHEARER

Built by
H. J. BOOL CO., Ithaca, NY

This viewing screen can be made in any desired length. It can be mounted on a plate filing cabinet or on saw horses. Ventilator holes are provided to prevent excessive heat. It is so constructed that it can be readily knocked down for shipment.

A SIMPLE ILLUMINATOR

BY J. S. SHEARER, M.S.
Major, Sanitary Corps, U.S.N.A.
ITHACA, N. Y.

IT IS many times desirable to have a considerable number of plates in view t comparison and in many cases the il-l ninators provided for this purpose have ne unfortunate features.

Among these may be mentioned:

1. Incandescent lamps, themselves vis-e through the ground glass or other dif-sing material, give bright spots very try-g to the eye, often obscuring vision.

2. The lights are frequently so placed as be invisible but with a tremendous loss illumination because of improper posi-on, boxing in, etc.

3. Diffusion of light is accomplished in any cases by inflammable material.

4. The interior of the boxes are very fficult of access for painting or cleaning.

The accompanying drawing shows an uminator designed by the writer which as been built by the H. J. Bool Co. of haca, N.Y. for use in several installations. may be constructed in units of any de-red length and by using hinges on the nd pieces can be shipped knock-down if esired. For permanent hospital installa-ons it is usually mounted on top of a iitable cabinet for the storage of plates, nd the top may be utilized, conveniently for the same purpose. Diffusion of the light is to be accomplished by simply keeping the inside of the box clean and painted with a flat white. Be sure to avoid a gloss finish. The lamps will not be visible, if properly placed as shown, to a person of ordinary height standing before the screen.

The front frame is removable and the wiring is carried in a metal conduit or cleating. The lamps should be connected to the sources of supply by a flexible con-nector and plugs, so that the entire front can be removed for cleaning. Clear glass may be placed in front against which the negatives may rest, and no tracing cloth, muslin, ground or opal glass is needed. It is best to wire the lamps so that one half of them may be used in case of thin nega-tives. Holes close to the front above and below furnish ample ventilation, even if the lamps are in continuous use.

It is desirable to have the curtains at-tached in such a way that they may be drawn down and leave no crack—or at least only a crack between them. This may be done by mounting one curtain nearer the top of its mount than the other and notching the supports so that they come close together.

THE AMERICAN JOURNAL OF ROENTGENOLOGY
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Chairman Publication Committee,
American Roentgen Ray Society.

Gentlemen:

The press of duties connected with my work in the Expeditionary Forces, together with the impediments attending compliance with the necessary Army regulations, make it exceedingly difficult, and practically impossible, for me to contribute at all regularly to the editorial work with which I have been entrusted. It is with very great reluctance that I feel obliged to urge that I be allowed to resign. This letter you will please consider as a tender of my resignation from the editorship of the Journal. I feel that in retaining me as editor thus far, since the beginning of the war, the Society has paid me a very high compliment, and I have tried earnestly to express my appreciation of this compliment by tangible work for the Journal.

Very sincerely yours,
James T. Case,
Major, M.R.C.

American Expeditionary Forces,
France,
May 22, 1918

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June 1, 1918

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rie, Alexander Howard	Montreal, Canada
iggles, Howard Edwin	San Francisco, Cal.
lby, John Hunter	Washington, D. C.
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eaver, Louis S.	York, Pa.
ilson, Robert	Montreal, Canada
ulick, Jay Donald	Philadelphia, Pa.

Dr. James T. Case, now Lieutenant Colonel, National Army, and Senior Consultant in Roentgenology to the American Expeditionary Forces, France, has resigned the editorship of the Journal. This resignation was entirely due to the pressure of military duties and to the fact that several thousand miles of ocean with an unbelievably slow mail service made further editorial duties impossible. The writer is in a position to know just how pressing are the military duties borne by Colonel Case. For this reason the resignation must be accepted, but it cannot be accepted without the attempt to pay at least a partial tribute to the work of this gifted physician, surgeon and soldier.

Under his guidance the American Journal of Roentgenology now occupies a foremost position in the scientific world. This position is due largely to the genius and brilliancy of Case and to his enormous capacity and love for literary work. His complete familiarity with roentgenological literature, his linguistic ability, and his genius in abstractive work have made the abstract department of the Journal extremely valuable. His original researches so freely and carefully described have gone far toward establishing the merit of the Journal in foreign countries.

In addition to his literary achievements Colonel Case is a recognized internist and a member of the American College of Surgeons. Blessed with abounding health and endless energy he is now giving himself freely to the United States Army service overseas.

At the request of the Publication Committee, Dr. H. M. Imboden has accepted the editorship. The writer bespeaks for Dr. Imboden the help of every member of the society who possesses any literary ability. Since the abstract department is one of the most valuable features of the Journal this must be kept up to the same high plane. Case's familiarity with the literature was largely due to the hours spent in the abstraction of the articles upon their appearance. Such work will be found to pay every one who performs it. The man who has abstracted an article for publication will find that he has absorbed the gist of it in his abstraction.

The members of the American Roentgen Society owe to Colonel Case a great debt for the efforts which he so freely put forth in the past in behalf of our Society and its Journal.

George C. Johnston.

TRANSLATIONS & ABSTRACTS

MERRITT, E. A. *X*-ray Work at a Base Hospital. (Report made to the Surgeon General, Washington, D. C.)

"This laboratory began work November 1, 1917, and has since that time been in continuous daily operation. The scope of the work may be judged from the fact that our serial numbers are now at the thousand mark, and in our records the same number is used for a soldier regardless of the number of times he is returned, also they do not include roentgenoscopies. A conservative estimate, therefore, would place the number of plates and roentgenoscopies at well above two thousand. We have been given a free hand in the matter of administration and our judgment stands as to the indications for or against examination in any case. A considerable number have been refused because of lack of sufficient data for us to proceed on, or the condition has been so evident as to render an examination superfluous.

"The advantages of having a modern roentgen laboratory with every division are beyond question; so also are the benefits which accrue to the medical officers attached to this service, where the opportunities for advancement and improvement are dependent alone upon temperament and ambition.

"We are called upon to make examinations in practically every branch of roentgenology although the chest cases are first in importance and are of vital interest to the soldier and the service alike. In tuberculosis, as a check on clinical examinations and for the purpose of furnishing either positive or negative evidence and a permanent record, as well as demonstrating unsuspected lung involvement, the roentgenogram is of inestimable value and occupies a distinct and important place in the medical service. Captain Faber, the base hospital specialist in tuberculosis, has submitted some two hundred and fifty men for examination, and we feel that this department has profited materially because of the close cooperation between us. Practically every form of phthisis pulmonalis has passed through our hands, from the violent diffuse type to those with extensive fibrosis and calcification, and a considerable number have been returned to duty or discharged upon evidence furnished. Examinations of those cases which have developed after measles have been particularly instructive and helpful to both the ward surgeons and the special examiner.

"Some fifty or more pneumonia cases have been referred to us for roentgenoscopy or plates. The former is by far the more satisfactory and, if one's interpretation of the findings are dependable, the plate is unnecessary, inasmuch as the beautiful, "contrasty" shadows are only to be demonstrated upon a screen and the finer elements are not essential in diagnosis in this class of diseases. As a matter of fact this is sufficient reason for not resorting to roentgenograms, but the added argument of a suffering, dyspnęic patient is conclusive.

"An epidemic of streptococcic infection, terminating most frequently in a unilateral pleuritis and often associated with pericarditis, has given us an opportunity to study practically all of ninety-seven cases. The physical findings have been misleading. The clinicians have found that tubular breathing and breath sounds are as a rule transmitted through a considerable amount of thin streptococcic fluid. These cases have, therefore, presented combined symptoms and findings of lobar pneumonia, empyema and bronchopneumonia with fluid. As soon as any suspicion of the presence of fluid is aroused, the patient is brought to the laboratory, and, if a positive report is made, he is referred directly to the surgical service. There no time is lost in instituting drainage. We have also assisted materially in locating encapsulated fluid, permitting the surgeon to determine the point of election for resection without subjecting the patient to a preliminary aspiration. In this connection a number of cases have come from the wards after having had the most careful and painstaking examination, with a diagnosis of lobar pneumonia which we have changed to fluid or negatived entirely. Central pneumonias, of which we have had four, have all been accurately determined in this laboratory; three of them being debatable diagnoses. These are simple statements of fact with no attempt to discredit clinicians or assume false positions ourselves.

"It has been our custom to follow all cases to operation, convalescence or autopsy, and while there have been errors they consist in ie majority of instances only in the extent ad exact location of lung tissue involved and ave not been inaccurate enough to constitute failure to establish a correct diagnosis.

"The technique of roentgenoscopy consists having the patient brought to the laboratory n a wheel litter and, if very ill, the mattress nd all bedding is transferred to the table ithout disturbing him in the least. In some ther cases the patient is lifted by means of ne sheet or blanket without mattress. For ur protection the face of the patient is covred with two layers of gauze. We use sufficient mperage and voltage to permit of brilliant lumination. The examinations are brief. An ssistant makes notes at an adjoining desk which supports a small box containing a faint ed light. This sufficiently transilluminates a paper on the ground glass cover to permit of ccurate notations in a room otherwise dark.

"Practically all of the pneumonias have been examined in the presence of the chiefs of service or members of their staffs, and we have had, therefore, the benefits of sharp criticism and friendly counsel.

"The liver shadow has been adopted as a standard of density for the purpose of record and our reports consequently read, 'density of one, three-fourths, one-half, one-fourth or smokey,' as the case may be, naming the location with reference to known anatomical landmarks. The roentgenoscopic shadows in lobar pneumonia are definite, dense and decisive and in connection with other conditions are frequently more accurate than any other method of examination.

"It would naturally be inferred that the bulk of our work, or rather the greatest number of plates, are of bones and joints, teeth and sinuses, and it is no exaggeration to state that all of the various specialties are included in our daily work.

"In the genito-urinary service we have located but three cases with urinary calculi and to demonstrate the democratic character of our clientele it may be related that two of these patients were 'buck' privates and the other a Brigadier General.

"We are privileged to supply our own buttermilk for the gastro-intestinal cases, but the results justify the trifling sacrifice.

"In the realm of therapy we have discouraged the ward surgeons from sending cases, for our equipment is not ideal in this respect. However, the four cases we have attempted have all been successful and embrace a blastomycosis of the face, a favus of the pubic region, a chronic extensive folliculitis of the beard and a case of multiple and numerous venereal warts, which had proved rebellious to all forms of medical treatment. This last case was referred to us at our suggestion in the hope that the condition could be cured without the extensive surgical removal which was contemplated.

"Frequent heart examinations are made at the request of the cardio vascular specialist and all cases of pericarditis with suspected effusion are referred to us, inasmuch as we have demonstrated the absence of this condition when the physical signs were positive. A skin ink suggested by Capt. E. H. Skinner, M.R.C., has been invaluable for tracing the outlines in such cases.

"Many cases of suspected malingering have been shown to be real sufferers and the converse is true, but not to so great an extent. It is conceded of course that many bone and joint conditions defy any attempt of the orthopedist to establish the presence or absence of pathology, making the roentgen laboratory, therefore, a court of last resort.

"No new facts have been developed, excepting possibly the superiority of screen examinations to roentgenograms in acute diseases of the lungs and the absolute necessity for a roentgen laboratory with every considerable body of troops.

"We have attempted to standardize technique, believing that uniform high grade roentgenograms are essential. Certain factors as time, distance and amperage we keep constant, varying the voltage to meet the requirements of the several parts and types of patients. In the dark room the developing is done entirely according to time and temperature, factors which likewise remain constant. The results are undoubtedly satisfactory and permit of little criticism. All plates are diagnostic and the photographic results are far superior to the haphazard methods of other days and are in keeping with the precise methods of other departments of the army.

"In the beginning we had many annoying troubles, one of which was warming the developer when the buildings were without steam heat, but this was overcome by placing heated bricks beneath the tank for a sufficient time to secure results. The same or rather similar bricks were placed inside the 'hypo' tank to reduce its size.

"Now when the temperature of the developer requires raising, we permit a stream of hot water to play against the side of the tank, accomplishing the desired result in a few minutes. The plumbing necessary to this important item was installed by the laboratory force unassisted by union labor.

"A complete report covering in detail every phase of the duties of a roentgenologist attached to a cantonment laboratory would be both lengthy and tiresome. Suffice to state that we have worked as hard and with as satisfactory results as any other branch of the medical service and have established the most cordial relations with other departments of the service."

Pinch, A. E. Hayward. The Therapeutic Value of Radium. (The annual report for 1917 of the London Radium Institute. Ref. *Brit. M. J.*, March 23, 1918, p. 348.)

The annual report for 1917 of the London Radium Institute differs from its predecessors inasmuch as in place of any detailed account of the 603 cases treated in that year it provides summaries arranged under various heads of the conclusions drawn from the experience of the six and a half years which have elapsed since the institution was founded. During that period 40,000 treatments have been given to nearly 5,000 patients, of whom about half were suffering from malignant disease (including rodent ulcer). Each section is illustrated by cases. It was not found practicable to state the later results of all the cases treated, and as an alternative it was decided to select from the after-histories of those patients who could be traced a series of cases of cancer and of sarcoma which were apparently cured, if the test of immunity for more than three years is held to justify that term. Some such test is the only one that can be applied, and three years is the period usually accepted by surgeons. We regret that the limitation of space prevents us from giving a detailed account of all these remarkable cases, but we understand that a copy of the report will be sent, post free, to any medical practitioner who will apply to the Secretary of the Radium Institute, 16, Riding House Street, Portland Place, W. 1. The report, which is the work of Mr. A. E. Hayward Pinch, F.R.C.S., medical superintendent, who acknowledges his indebtedness to the assistant medical superintendent (Dr. J. E. A. Lynham), opens with a reminder that in judging the results recorded it must be remembered that the policy of declining to treat operable cases of malignant disease, rodent ulcer alone excepted, has been rigidly followed, save only in those instances in which patients have absolutely declined to submit to operation.

Epitheliomata.—The after-results of radium treatment of epitheliomata of small size, and affecting glabrous surfaces, when taken at an early stage and before lymphatic infection is evident, have been encouraging, and it is considered that when patients decline to submit to removal by excision the treatment may justifiably be resorted to. The results with epitheliomata of mucous membranes (mouth, tongue, fauces, or esophagus) have been disappointing. In the mouth disappearance or fibrosis of a small primary lesion may be obtained, but sooner or later lymphatic involvement occurs. In the esophagus definite temporary improvement may be obtained, the stricture becoming more patent, so that the patient is able to swallow solid food for six or nine months, or even longer. Some patients treated for epitheliomata of the vulva and vaginal mucosa remained apparently well for many months.

Carcinoma of the Uterus.—The larger number by far of these cases presented themselves at a stage when the disease was very far advanced, so that there could be no hope of apparent cure; but arrest of hemorrhage, diminution of discharge, healing of ulceration, lessening of induration and relief from pain, were almost invariably obtained. Some patients responded much more speedily and completely than others, but in almost every instance distinct benefit was observed, and the rate of progress of the disease greatly retarded.

Case 1337.—A woman, aged 46, who had undergone two partial operations in September and October, 1913. She received radium treatment in December, 1913, and in January and March, 1914. The disease was arrested, and the patient rapidly regained health and strength. In January, 1918, her medical attendant reported that she was quite free from any recurrence of the carcinoma.

Case 382.—A woman, aged 68, with extensive cervical and vaginal cancer, declared to be inoperable by the surgeon consulted. She received treatment in February, April, and October, 1913, and in March, 1914. Great local improvement ensued, and from March to the end of September, 1914, she was apparently quite well, but in October symptoms of kidney disease appeared, and she died of uremia in January, 1916. There had been no recurrence of the local trouble.

Case 5348.—A woman, aged 34, with inoperable carcinoma of the cervix. She was treated at intervals varying from two to six months, the last time in July, 1916. In February, 1918, her general condition was good; she had gained in weight and was equal to all her household duties. There was extensive fibrosis of the vaginal walls.

Carcinoma of the Rectum.—The results here were not constant or uniform, but in some instances growths regarded as inoperable were so much improved, their size and vascularity being so lessened and the degree of fixation so diminished, that they were removed, and the patients remained free from recurrence. This, however, has not frequently happened, and in the majority of cases the most that can be hoped is healing of ulceration, diminution of the rate of growth, checking of the hemorrhage, and postponement of the date at which colostomy becomes imperative. The best results were obtained where the growth was annular, spongy, and situate in the upper half of the rectum. The plaque-like, infiltrating growth was not found so amenable.

Case 225.—A man, aged 70, underwent excision of the rectum for malignant disease in 1901. A recurrence in April, 1912, was excised; a second recurrence in October, 1912, was declared inoperable. He then had a hard carcinomatous ulcer immediately inside the anal opening, with much surrounding induration. He received radium treatment in October and November, 1912; the ulceration healed, and the growth was replaced by fibrous tissue, which caused stricture necessitating occasional dilatation; the patient when last seen, in January, 1918, was in good general health.

Case 35.—A man, aged 35, received radium treatment in October, 1911, for a large ulcerated carcinomatous growth in the lower half of the rectum, declared to be inoperable. The ulceration healed, and the growth became reduced in size and much less fixed. Early in December Kraske's operation was performed, and the patient was given a course of prophylactic irradiation. He made a good recovery, and the latest information, in February, 1917, was that he was in perfect health and leading an active and busy life.

Case 752 is another example of malignant growth of the rectum pronounced inoperable, but after radium treatment successfully submitted to operation. He died from granular kidney and uremia about a year later, but there was no evidence of recurrence of malignant disease.

Case 1997 was that of a woman, aged 40, with extensive inoperable cancer of the rectum. She received radium treatment in January, April, and October, 1916, and January, May, and November, 1917. When last seen, in January, 1918, the disease was apparently quiescent, and there had been no rectal hemorrhage since the previous August.

Carcinoma of the Bladder.—Inoperable cases tolerant of intravesical applications may be advised to undergo radium treatment, as sometimes apparent cure results. Definite improvement in the symptoms is usually evident in about three weeks, and in the most favorable cases healing of the ulcer, with the transformation of the carcinomatous material into a fibrous mass, takes place.

Carcinoma of the Breast.—Cases of carcinoma of the breast form the largest class applying to the Institute; all those in which operation was at all practicable were invariably advised to submit to operation, so that those treated were nearly all in an extremely advanced state with extensive lymphatic involvement. In some instances great improvement followed radium treatment, especially in cases in which the disease was chiefly superficial, and confined to the skin of the operation area and the axillary and supraclavicular glands. Superficial ulceration unaccompanied by much subjacent induration often healed rapidly and completely after a radium exposure of eighteen to twenty-four hours. If the deeper lymphatics are involved and the lungs, or any of the abdominal viscera affected, little can be looked for beyond possible retardation of the rate of growth and the prevention of extensive ulceration. Cases of atrophic scirrhus in patients over 60 years of age may be kept in check for an almost indefinite time by radium irradiation repeated every three or four months.

Case 1125.—A woman, aged 47, underwent in July, 1911, amputation of the right breast, with clearance of the axilla; in June, 1913, there was recurrence in the axilla. She was treated with radium during February, 1914, and by April the induration which had been present in the right axilla and in the left supraclavicular fossa had disappeared. In January, 1918, she wrote that she was better than she had been for many years.

Case 151.—A woman, aged 64, underwent Halsted's operation in June, 1911. There was recurrence in February, 1912. She received radium treatment in March and April, 1913, and in January and March, 1914. When last examined, in April, 1917, no indication of any malignant trouble could be detected.

Case 854.—A woman, aged 51. Right breast removed May, 1912; recurrence in scar September, 1913. She first received radium treatment in November, 1913; it was repeated in February and April, 1914. When last examined, in January, 1918, no trace of the disease could be found.

Case 5003.—A woman, aged 48. Excision of the right breast in 1906; clearance of the axilla in 1909 for glandular recurrence; several operations for nodules, the last in 1912. In 1913 there were multiple recurrences, and a further operation was declared impracticable. She received radium treatment in January, March, and April, 1914; when last examined, in October, 1917, no trace of the disease could be detected.

Sarcoma.—The results of radium treatment of sarcoma are said to be on the whole more satisfactory than those of any other form of malignant disease, with the exception of rodent ulcer. The treatment must be vigorous, the tumors being treated whenever practicable both by the insertion of emanation tubes and by external radiation. The best and most rapid results were obtained in lymphosarcomata; the disappearance of the tumors when the dosage was correct is said to be little short of marvelous. Sarcoma of the tonsil and postnasal space have responded extremely well. The response of periosteal sarcoma has been good, but not so uniform, though the percentage of recurrence has been slight and cases are recorded in which the patient remained free from any manifestation of the trouble for a period of more than four years. Melanotic sarcoma usually proved unamenable, but in one case of melanotic sarcoma of the choroid and in another of the skin of the back complete disappearance of the primary growths was observed. The former case (a woman) has remained well for two years, but the latter (a male, 21) died fifteen months later from secondary deposits in the brain and lungs.

Case 50.—A man, aged 41, treated for a large and rapidly growing recurrence of lymphosarcoma of the neck. He received fourteen treatments from October, 1911, to January, 1912. The growth had disappeared at the end of February, and in January, 1917, the patient was seen free from recurrence, and in excellent health.

Case 4901.—A woman, aged 32, with a large periosteal sarcoma of the right thigh, for which amputation at the hip-joint had been suggested. Microscopical examination showed that it was a spindle-cell sarcoma. She received radium treatment during February and April, 1914. Improvement was very rapid, and the patient at the date of the report was in excellent health.

Case 567.—A woman, aged 62, with a large rapidly growing sarcoma of the clavicle. Radium treatment (June, 1913) was followed by rapid disappearance of the growth. When examined in January, 1918, there had been no recurrence.

Case 4905.—A woman, aged 32, with rapidly growing recurrence of sarcoma of the nasopharynx. She received radium treatment in 1912, and at the last report (March, 1917) was in excellent health.

Case 140.—A girl, aged 15, round-cell sarcoma of the superior maxilla with recurrent sarcoma following operation for a growth in the antrum. Radium treatment was begun in February, 1912; at the end of June all signs of recurrence had disappeared, and when last seen, in March, 1917, she was in excellent health.

Mediastinal Tumor.—Some remarkable results have been obtained in mediastinal tumors causing dyspnea, venous congestion, and disturbance of the sympathetic and recurrent laryngeal nerves. It was considered probable that the majority of these growths were lymphosarcomata, as this would account for the favorable influence that radium rays exerted upon them.

Lymphadenoma.—The response of lymphadenoma of recent origin, with enlargement of the spleen or mesenteric glands, to radium treatment may be rapid. In some cases, especially those treated in the early stages of the disease, the patients can go on for eighteen months or two years without further treatment, but the majority require the irradiation to be repeated at intervals of four to six months.

Rodent Ulcer.—Of rodent ulcer it is said that cases which have not received previous treatment with carbonic acid snow, ionization, or x-rays, and in which the lesion does not exceed 3 to 4 cm. in diameter and does not implicate cartilage, bone, or mucous membrane, can almost invariably be cured by one or perhaps two exposures with powerful unscreened applicators. The tissues must be irradiated well beyond the margin as appreciable by sight or touch, and a long exposure given; otherwise recurrence will usually be noticed within twelve months. When the mucous membrane, more especially the nasal, is affected it appears almost impossible completely to eradicate the disease unless the area involved is very small. Advanced cases of old standing, with great destruction of the cheek, nose, and upper lip, involvement of the nasal mucous membrane, and perforation of the hard palate, could only be slightly benefited, but such severe cases, often seen during the first two or three years of the work of the Institute, have now become rare, probably because the efficiency of radium treatment of rodent ulcer in its early stages has been more widely recognized.

The report also contains a note upon the effect of radium in checking menorrhagia and metrorrhagia accompanying fibroid disease of the uterus. Among other conditions treated with greater or less success are to be mentioned papillomata of the bladder, lupus, vulgaris and erythematosus, keloid, lichenification of the skin, pruritus, and nevi. When used in exophthalmic goiter radium may at first cause exacerbation of all the symptoms, but usually within six weeks or two months tachycardia lessens, the tremors diminish, the exophthalmos becomes less noticeable and the restlessness and irritability decrease.

Lisser, H. Syphilis of the Lung. (*Am. J. M. Sc.*, March 1918, Vol. CLV, No. 3, p. 356.)

The close similarity of pulmonary syphilis and tuberculosis has been emphasized in the last few years. The fact that syphilis not uncommonly attacks the lungs has been tacitly assumed to be a recent clinical finding due to modern refinements in the art of diagnosis. Lisser throws an interesting side light on the history of this subject which he divides into three periods. The first period began with Paracelsus in 1500 and ended with Laennec in 1880.

"These three hundred years included the most fanciful conceptions, utterly lacking in precision, unfounded in any accurate research. It sufficed in those days, for a pulmonary affection to follow a venereal infection, whether gonorrheal or syphilitic, for the pulmonary lesion to be declared of venereal origin. Cases were seriously reported in which the suppression of a gonorrheal discharge was followed by a so-called venereal phthisis, which in turn vanished upon the reappearance of the urethral discharge. In comparing the large number of cases of pulmonary syphilis reported during these three hundred years with the comparatively small number reported in the last one hundred years, the elder Fournier speaks of 'the credulity of our fathers and the incredulity of our contemporaries.' In fact, there existed in this older epoch absolute confusion, a few simply believing in a predisposition on the part of syphilitics to contract phthisis, while the greater number firmly believed in a real venereal phthisis, identical in signs and symptoms with all other phthises, but differing as to cause. Laennec, however, in differentiating pulmonary tuberculosis as a distinct disease, opened the way to the recognition of a true pulmonary syphilis."

Concerning the frequency of the disease the author puts himself on record as believing that "an investigation of a large series of autopsies upon syphilitics would, I think, go far to dispel the prevalent ideas as to the rarity of lung syphilis." He is, however, candid and may be quoted thus:

"In autopsies upon 97 cases of acquired syphilis, Chiari discovered one case of syphilis of the lung. Peterson, in 88 autopsies of acquired syphilis, found 11 cases of pulmonary syphilis. In 1884 Hiller collected reports of 84 autopsies showing syphilis of the lung, but Councilman regarded only 28 of these as definitely syphilitic. On the other hand, Fowler, in searching through all the London museums, found only 12 cases, while in 1905 the Army Medical Museum at Washington, consisting of

13,000 specimens, did not contain one instance of this disease.

"Certain groups of clinicians, however, considered the disease much more common than generally supposed. Satterthwaite thinks that lung syphilis is greatly underestimated by the general practitioner and 'almost unknown to many syphilographers.' Pankritius, who in 1881 wrote one of the most important monographs on the disease, with a very complete review of the literature, found it by no means unusual; likewise other German authors, as Schnitzler and Grandidier, and of the French clinicians, Fournier, Lancereux and Dieulafoy. On the other hand, clinicians of a more strictly pathological bias still insist upon the rarity of pulmonary syphilis. Thus Osler, in twenty-five years' experience, cannot recall above half a dozen. Stengel suggests that this difference of opinion depends largely upon the point of view of the observer, whether as a clinician or as a pathologist, the former believing that this condition is comparatively common, the latter that it is very rare. This may be due in part to the failure of the pathologist to recognize syphilis. It is by no means simple to differentiate between pulmonary syphilis and pulmonary tuberculosis not only at the bedside but in the pathological laboratory."

Concerning the Wassermann reaction and the roentgen rays he says:

"Negative Wassermanns in syphilitics are by no means uncommon, and a positive Wassermann merely indicates that the patient has syphilis but not that the pulmonary condition is luetic. However, in those cases in which history signs and symptoms are all lacking, a positive test may at least lead to a suspicion that the phthisis has a specific etiology. It might have been hoped that the roentgen rays would give us some sort of characteristic picture which would permit a definite recognition. However, roentgenographs are disappointing in the sense that they do not provide us with an exclusively unique picture. But they are of value in a negative sense, for they decidedly help to exclude pulmonary tuberculosis. The roentgen ray plate of a leutic lung is quite unlike that of a Koch infection, but it is not unlike many other pulmonary conditions, all of which result in peribronchial thickening. Gummata do present striking shadows, but have to be differentiated from malignant growths. We may conclude then that even to-day our knowledge of pulmonary syphilis and our ability to diagnose it leaves much to be desired."

"The importance of a correct diagnosis was many years ago summed up by Virchow when he said, 'Some patients die of so-called pulmonary tuberculosis for the lack of antisyphilitic treatment.'

"Balzer said, rather neatly, that the prognosis for a patient suffering from lues of the lung depended upon the intuition or clairvoyance of his physician. If the condition is recognized the treatment is simple, startling in its results, in some cases almost miraculous. Even patients that have been reduced to a state of great enfeeblement and cachexia, whose condition would appear to be desperate, are restored to normal in an astonishingly short time."

Seven cases are reported fully, illustrated by roentgenograms. One case with comments may be quoted.

"Case VII, No. 25262.—A German, unmarried, aged thirty-six years, came to the medical clinic of the University of California Hospital July 27, 1916, complaining of cough. His family history and past history are of no significance. He denied venereal disease and no history of secondaries could be elicited.

"His illness, which consisted purely of coughing with copious mucopurulent expectoration, dated from a month and a half previous. He had no fever, night-sweats, chest pains, or hemoptysis. He had lost 25 pounds during this time, weighing 155 pounds August 1, 1916.

"Examination showed a strongly built, moderately nourished man, looking somewhat older than stated age. Pharynx disclosed a number of grayish ulcers, with slightly raised borders, surrounded by a reddened areola. There was general glandular enlargement; cervical, axillary, epitrochlear and inguinal. There were squeaky inspiratory and expiratory râles over both sides, with possible diminished resonance over both apices behind, but without further signs. Otherwise the routine physical examination was quite negative.

"Roentgenogram of the chest showed what we at first interpreted as an 'old central TB.'

"Sputum was examined on several occasions without finding any bacilli of Koch.

"Wassermann in blood serum positive two plus, denoting a definitely positive test.

"Antisyphilitic treatment was begun at once, consisting of weekly injections of 20 per cent. mercury salicylate, potassium iodide, gr. 25

i.d., and intravenously arsenobenzol. One week after the first mercury salicylate injection he had gained 7 pounds and the cough had almost disappeared, sputum less, and only an occasional râle discoverable. In the first two weeks of treatment before giving arsenobenzol he gained 18 pounds, felt "new altogether," and certainly looked like a different man. From August 1 to October 25 he received ten mercury salicylate injections, potassium iodide and three full doses of arsenobenzol. His weight was 155 pounds August 1; it was 190 pounds October 27, a gain of 35 pounds. His cough has disappeared, and consequently his sputum; and his chest is clear. Yet, another roentgenogram of his chest, taken October 13, shows no change from the picture seen in Fig. 9.

"This case resembles Case V in several particulars. Both were considered tuberculous; both had negative sputa; both had positive Wassermann; both made remarkable clinical recoveries under antisyphilitic treatment, in the disappearance of both signs and symptoms; both show a roentgen ray picture after treatment, indistinguishable from the picture taken before treatment. Are the shadows on the plate, scar tissue, the result of healing a syphilitic lesion? When a luetic ulcer of the skin is cured a scar remains. It is the scar-tissue contraction of a healed syphilitic stomach which often requires operative interference to restore function completely. Possibly this is the explanation for the persistence of roentgen ray shadows after the symptoms have vanished, of which they were supposed to be the cause. If such be the correct interpretation it would be unreasonable to expect a perfectly clear plate after treatment."

In stomach cases syphilis may simulate cancer just as in chest cases syphilis may simulate tuberculosis. In both cases the differential diagnosis is of the greatest importance to roentgenologists.

Davis, E. L. A Roentgen Study of One Thousand Chests, at Camp Devens, Mass. (*J. A. M. A.* May 25, 1918.)

The examinations were of men between the ages of twenty-one and thirty. In practically every case reported the findings have been substantiated by the pathological and clinical findings. Roentgenograms were made of every case and screening was resorted to whenever it was found necessary. Table I indicates the conditions found.

TABLE I

Occurrence of Pulmonary Disorders

	No.
Individuals examined	1,259
No disease found	405
Tuberculosis	368
Chronic bronchitis	49
Bronchopneumonia	61
Lobar pneumonia	258
Fibrous pleurisy	124
Interlobar pleurisy	3
Pleurisy with effusion	25
Hydropneumothorax	3
Empyema	7
Emphysema	2
Enlarged mediastinal glands	1

In discussing tuberculosis the writer claims that it is demonstrable in its earliest stages *depending upon careful technique and the keenness of the interpreter.*

"The most definite signs of active pulmonary tuberculosis as seen on the roentgenogram are soft, fuzzy, flaky shadows in the areas occupied by the linear markings of the normal lungs. When these shadows are found at the periphery and are mottled as if broken up with shadows indicative of peribronchial thickening leading to them, we consider them characteristic of the acute, active tuberculous lesions. The soft shadows are interpreted as tubercles with areas of congestion about them, and the thickening of the trunks as lymphatics draining the infected area. Soft mottling in the apexes with peribronchial thickening leading to it we consider the most definite sign of active phthisis presented on the roentgenogram.

"When, however, the shadows appear dense and are accompanied by nodular, well-defined, clean-cut peribronchial thickening which extends to the periphery, we consider them indicative of healed, or at least inactive, tuberculosis."

"With regard to the relative frequency of occurrence of the tuberculous lesion, the lungs may conveniently be divided into three areas:

"1. The upper region from the apex to the hilum is considered the tuberculous area. In this region by far the greatest number of infections are found. Ninety-three per cent. of the positive cases studied showed the lesion in this region; in 53 per cent. of these the lesion was in the right upper lobe; in 28 per cent. the lesion was found in the left upper lobe; in 11 per cent. there were lesions in both upper lobes.

"2. The middle region from the hilum to the fifth rib in front is considered the intermediate region in which tuberculosis is occasionally found. Less than 10 per cent. of our positive cases showed tuberculosis in this region.

"3. The lower region from the fifth rib to the diaphragm is considered the nontuberculous area where lesions are rarely found. Among all the 368 positive cases, only five showed shadows consistent with tuberculosis in the lower lobes. Two of these had lesions throughout all parts of both lungs; one had lesions in the upper, middle and lower lobes on the right side; one had lesions in the upper and lower lobes on both sides; one had a doubtful localized area of infection in the right lower lobe not verified by the clinicians."

"I do not consider opacity in one of the apexes as compared with the other a significant factor in the interpretation of pulmonary tuberculosis. This difference in opacity may be caused by a variation in penetrability on the two sides due to asymmetrical density of the sternomastoid muscles, to thickened pleura, or to a contracted apex."

Dense hylus shadows are not considered as indicative of tuberculosis and the fan-shaped shadow has not proven reliable. In some cases the roentgen signs are almost sufficient in making a diagnosis even though the physical signs are wanting, but as a rule the combined method is the most desirable.

"In examining roentgenograms of pneumonia patients made shortly after resolution, shadows are seen which appear strikingly similar to those found in pulmonary tuberculosis. I believe that these shadows are caused by sheets of fibrin that are deposited on the pleura at the time of infection. Moreover, when the lobar pneumonia is complicated with a streptococcus infection, on the postpneumonia roentgenograms, along the ascending trunks and in the apexes, there appear shadows identical with those that occur in pulmonary tuberculosis. These gradually disappear and are not found after several weeks. It is important not to make the mistake of interpreting these shadows as tuberculous lesions, and in order to guard against the possibility of such an error the examiner should know definitely whether or not there is a history of recent pneumonia."

Lobar Pneumonia

Two hundred and fifty-eight cases were studied.

The signs of lobar pneumonia are as follows:

"(1) marked accentuation of linear shadows from the hila to the apexes, which we propose to call vascular congestion; (2) marked enlargement of the heart shadow; (3) typical shadow of the localized area of consolidation in the lungs and (4) high diaphragm on the affected side.

"1. The vascular congestion appears especially in the upper lobes as soft linear markings with distinct bifurcations, which are different in appearance from the thickened ascending trunks of bronchitis and the peribronchia thickening of tuberculosis in being thicker smoother, showing more definite branching and being always definitely bilateral.

"These shadows are interpreted as due to the congestion of blood vessels along the bronchi. They have the characteristic appearance of congested blood vessels, and depict what may be conveniently called an acute congestion of the lungs. These shadows also represent a thickening of the lymphatic vessels in increased drainage. The vascular congestion was found in all the 258 cases examined, excepting four one a very early case not studied further, one a case of the abortive type quickly resolving and two peculiar cases which showed neithe the thickened ascending shadows nor the enlarged heart but only the area of consolidation nontoxic cases.

"The markings in question appear early in incipient pneumonia, and disappear early in resolution. They persist occasionally in case in which no consolidation appears. In such instances these shadows persisting in the uppe lobes and extending into the apexes are ap to be confused with the shadows indicative of tuberculosis. Their persistence sometime for months makes their interpretation all the more confusing.

"2. The heart is found to be enlarged both to the right and to the left. Only the right auricle the left auricle and the left ventricle are distinguishable on the roentgenogram. Enlargement to the left is probably due to increase in size of the right ventricle overlapping the left ventricle, and the apical impulse is assumed to be that of the right ventricle rather than of the left ventricle, so that the enlargemen to the left is due to the shadow cast by the right and left ventricles together.

"The enlarged heart has been found in every case studied except two."

The causes of enlarged heart are attributed pulmonary consolidation, hyperpyrexia and xemia, but this sign has been found before nsolidation.

"It is possible that the enlarged heart occurs other toxemias, though this has not yet een conclusively demonstrated. However, ith vascular congestion in the upper lobes, is enlargement is a definite sign of beginning bar pneumonia. This is clearly demonstrated cases in which there are definite clinical gns of pneumonia, but in which no consoliation is found. In these cases the roentgen iagnosis is made on the two signs in question."

The heart enlargement has been found to ersist for several weeks in some cases after he other signs have disappeared physically, linically and roentgenologically. No indication s found of valvular disease, but, when the paients return to duty, they are found short of breath and have a rapid pulse.

"Weekly examinations of fifty such cases have been made extending over eight or ten weeks. It was found that in 50 per cent. of these cases the heart continued to enlarge slightly during the first, second and third weeks following discharge from the hospital, after which it gradually assumed its normal proportions. In the other 50 per cent. the heart was found to have decreased in size slightly each week until the normal size was reached, or to have remained unchanged in size for several weeks, finally diminishing gradually to the normal size. The unexpected increase in size of the already enlarged heart during convalescence was probably due to the fact that a strain was put on the heart too soon; but it has been impossible to secure satisfactory data on this point. None of these men were assigned to active duties during this time, but it is possible that they participated in exercises to an extent sufficiently strenuous to embarrass the already weakened cardiac muscles. There is now being developed at this camp a series of graduated exercises for recuperating pneumonia patients, the purposes of which are to strengthen these weakened hearts and to determine more definitely when the men are actually fit for vigorous duty.

"3. Consolidation in the lung shows as a definitely localized homogeneous patch varying in density from complete opacity to translucency. The consolidation may originate near the median line, in which event it may or may not extend to the periphery, or it may be found at the periphery not extending to the inner border of the lung.

"The location of the consolidation in the 258 cases studied is summarized in Table III. Of the 258 cases examined, thirty-one showed no consolidation in any part of the lungs, though the clinical symptoms were definite for lobar pneumonia, the crises appearing early. No physical signs of consolidation were made out. In these cases the vascular thickening and the enlarged heart were found to be just as typical as in the cases with definite consolidation. Several examinations at intervals of two days showed that no consolidation ever appeared. These findings are in accordance with the idea that the symptoms of pneumonia are dependent more on toxemia than on the extent of pulmonary involvement.

"In several cases consolidation was shown roentgenographically before it was demonstrable by physical signs.

"The extension of the consolidation from a small patch to a larger one and from one lobe to another was observed in several of our cases.

"Several examinations of the same cases at intervals have led us to believe that the variation in amount of tissue involved in consolidation, and the change in location of the consolidated tissues, may be readily demonstrated roentgenographically.

"4. The diaphragm on the affected side, as in other pulmonary disorders, is usually relatively higher than on the unaffected side. For some time the diaphragm on this side remains impaired in its excursion. In some cases after resolution the diaphragm appears irregular on the affected side, appearing to have a fixed point. Roentgenoscopically the diaphragm is fixed or else it has a limited excursion as compared with the nonpathologic side. In some cases, distinct bands of adhesions have been seen extending from the pleura to the diaphragm, limiting its motion."

In some cases the diaphragm is found higher on the unaffected side than on the affected side. This was most noticeable when effusion developed on the side opposite to the consolidation.

Fluid with Lobar Pneumonia

"In the presence of consolidation it is difficult to determine when fluid is present in sufficient amount to demand aspiration. The fluid does not appear the same on the roentgenogram as in pleurisy with effusion, when the patient is roentgenographed in the prone position. Instead of the typical S-shaped shadow found in simple pleurisy with effusion, the fluid in pneumonia seems to gravitate to the posterior part of the thorax, giving only a very faint shadow over the entire side, which may easily escape detection. This appears to be due to the fact that the portion of the lung solidified by the pneumonia makes compression of the lung impossible; and owing to the resistance offered by this mass, the fluid spreads out over the whole thorax. The difficulty thus presented has been obviated to some extent by making the roentgenogram with the patient in a semiupright position. The fluid then gravitates to the lower part of the chest and may be more readily seen. In case the fluid is purulent, as in empyema, reasonable time must be allowed for it to gravitate.

"In our series of lobar pneumonia, pleuritic effusion occurred early in many cases, often by the second or third day. Thickened interlobar pleura is often seen and may be so dense as to suggest fluid between the lobes."

Bronchopneumonia

"It has been quite generally supposed that bronchopneumonia is a bilateral disease. Our study has shown that it is more commonly unilateral. This is shown by reference to Table IV.

"Signs of vascular congestion in the upper lobes are not so marked and certainly not so constant as in lobar pneumonia.

"The heart is sometimes slightly enlarged, but never to the extent found in lobar pneumonia, and often not at all."

Summary

"I. Pulmonary Tuberculosis—

1. Pulmonary tuberculosis is demonstrable on the roentgenogram even in its earliest stages. It is difficult to describe concisely the appearance of shadows that will enable the roentgenologist definitely to interpret active and inactive tuberculosis. One can only describe what in general is seen in well-defined cases. The specialist instinctively learns to detect these shadows by individual methods.

2. The lungs may be divided into three regions with regard to the occurrence of pulmonary tuberculosis: the upper region, in which tuberculosis is commonly found; the middle region, in which tuberculosis is sometimes found, and the lower region, in which tuberculosis is rarely found.

3. Consultation with conscientious clinicians has led to the conclusion that many cases of chronic fibroid tuberculosis give very indefinite if any, physical signs.

"II. Lobar Pneumona—

1. Lobar pneumonia and bronchopneumonia are easily distinguishable on the roentgenogram.

2. Lobar pneumonia gives the following roentgen signs:

(1). Vascular-lymphatic congestion in the upper lobes.

(2). Enlarged heart.

(3). Localized consolidation.

(4). High diaphragm.

3. Vascular-lymphatic thickening appear early and disappears early, though its occasional persistence may be confused with tuberculosis shadows.

4. Pneumococcemia shows definitely on th roentgenogram when there are symptoms o pneumonia without consolidation, suggestin that the seriousness of the attack depends mor on the toxemia than on the extent of pulmonar involvement.

5. The heart is involved before definite sign of consolidation appear.

6. The cardiac enlargement persists for som time after all signs of involvement of the lung have disappeared.

7. Consolidation may begin at the roots o at the periphery.

8. High diaphragm on the affected side is suggestive, but cannot be considered a constant sign

"III. Bronchopneumonia—

1. Bronchopneumonia is more commonl unilateral than bilateral.

2. The heart is usually not enlarged in bronchopneumonia.

3. Bronchopneumonia is often overlooke on physical examination, as the symptom may be indefinite and noncharacteristic."

A very apt comparison of the difference i appearance between bronchopneumonia an lobar pneumonia is made when the author say that the former appears "to have been smeare on the plate with a worn-out brush," while th latter suggests being "blown on the plate wit an atomizer." In bronchopneumonia the hear is usually not enlarged.

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ADDRESS BY THE PRESIDENT*

IT IS a privilege which few presidents enjoy to welcome to their own city the members of the American Roentgen Ray Society. Although New York, at this time, is unable to lend itself to the royal hospitality shown to this Society by Major Gray, when we met at Richmond, still, we most heartily welcome you to our city.

Prior to our participation in the war, we commenced to arrange a program for the meeting, and, when I look back at those plans, I am disappointed at the quantity we now offer you. A roll call of the sixty men who, by regular attendance and the active part they have taken in the Society for several years, might be considered the backbone of the Society revealed the fact that more than forty were in the Service, and to have an annual meeting without Brown, Case, Hickey, Hill, Skinner and a great many others who are somewhere in France or preparing to go there seemed futile. Personally, I felt that it was a mistake, but, lest I might unconsciously be influenced by my own disappointment at having a small meeting, I accepted the opinion of the majority of the Executive Committee and then attempted hurriedly to complete the program.

The ruling of the Surgeon General that no leave of absence would be granted has prevented members of the Society in the Service from attending the meeting, except those near enough to attend during the twenty-four hours which has been granted by their commanding officers. Therefore, it was decided to limit the scientific sessions to one day and two half days, and to concentrate as much of the program as possible into one day, particularly that portion bearing on military roentgenology.

It is the ambition of each president to do something for the improvement of our Society, of which we are all proud, or to accomplish some remarkable personal achievement which will lift the science of roentgenology one step higher, as our last president did when he presented the roentgenocardiograph. At the beginning of my term I thought of two problems, one or the other of which I wished to work out during the year. One of these was the perfection or, at least, making practical the use of the moving parallel slots for the elimination of the secondary or scattering rays from the body, and of the indirect rays, either from the posterior surface of the target in the Coolidge tube, or from the glass wall of the gas tube.

The deleterious effects of each of these groups of rays have been considered in publications during the year by Dr. Coolidge and Major Shearer.

The other problem was a mere dream, too nebulous to even mention.

When one of the speakers at last year's

* Delivered at the Eighteenth Annual Meeting of the American Roentgen Ray Society, September, 1917.

meeting mentioned the fate that had befallen Moseley, who had accomplished so much in the classification of rays in their relation to atomic weight, it occurred to me how unfortunate it would be if war should interfere even with the solving of the problems I had in mind, much more if it should interfere with our whole work of life.

I arranged for the transfer of the moving slot machine from the experimental room to my regular operating room, but fate and the slowness of the electrician would have it that before this transfer was complete, in the twinkling of an eye, all was changed. A member of this Society in the early hours of dawn, during the Atlantic City meeting, aroused me and asked, "Cole, what would you do in case of war with Germany?" Whether or not he has done anything since for the service of his country, he at least diverted my mind from the moving parallel slot into other channels. I wondered what I could do, and I asked others. Finally on March ninth I decided to write a letter to each member of the American Roentgen Ray Society. Out of 198 members 129 responded very promptly. Within a week, as President of a national society, I received a letter from Dr. Martin and Dr. Simpson of the Council of National Defense, inquiring about the roentgenological resources of the country, particularly the personnel, and asking me to appoint a committee. Much of the data which they desired was already assembled, and I appointed the following committee: Drs. Caldwell, Manges, and Holmes, representing respectively the three societies of New York, Philadelphia, and Boston, with Dr. Van Allen as Chairman of the Executive Committee. Dr. Caldwell was unable to serve and, at my request that he select an alternate, he chose Dr. Jaches. The Committee met and formulated a report, embodying recommendations of which the following is a résumé:

Realizing that the number of men and equipment available from the members of the American Roentgen Ray Society were quite inadequate and that it was desirable that further resources be recruited, the Committee recommended *first*, that the various states should be divided into groups—each group to have a committeeman to canvass it for available roentgenologists who were not members of the American Roentgen Ray Society—*second*, that schools of instruction in military roentgenology should be established in accessible geographical centers. The course of instruction in these schools should cover the entire field of military roentgenology. The instructors in these schools should be volunteers from the roentgenologists of standing in the vicinity. The men applying for instruction in these schools should be qualified for the Medical Reserve Corps. *Third*, that one or more issues of The American Journal of Roentgenology should be devoted exclusively to educational propaganda concerning military roentgenology. The subject matter of these issues should be in accord with the plans of the Council of National Defense. *Fourth*, that a manual of military roentgenology should be compiled and issued in concise form. This manual should consist of: a description and drawings of standardized x-ray equipment recommended by the Council; a standardized technique for radiography and fluoroscopy and a standardized technique for the localization of foreign bodies.

This report was submitted to Dr. Simpson of the Council of National Defense. He considered that some of the recommendations were not within the scope of his Committee and he personally accompanied me to the Surgeon General's Office. There some of these recommendations were made to Colonel Fisher and Major Noble, who heartily approved of them and offered every possible aid in putting them into effect.

Most fortunately, one of the members of our Society, Major Christie, reëntered the Service and was assigned to the Surgeon General's Office to take charge of assembling the roentgenological resources of the country. Everything appeared to be going smoothly, and it seemed as though there would be at least eighteen months for the training of roentgenologists and the assembling of apparatus. I happened, however, to be in Washington on a day that will probably go down in history as one of the greatest days in the annals of the war. I was calmly sitting in the office of the Council on National Defense, waiting for Dr. Simpson, when I heard a distant rumble, rapidly becoming louder—General Joffre had entered Washington and was passing down Pennsylvania Avenue on his way to the White House. The office boy pricked up his ears and said, "This ain't any ordinary parade, I'm going out to see it." As a result of that rumble, which shook the country from coast to coast and from the Lakes to the Gulf, Captain Hill, the first member of this Society to go, silently slipped away to somewhere in France just two weeks and one day, almost to the hour, from that moment. From then on many of the men whom we have known almost as brothers began to slip away, not with the blare of trumpets, but, simply dropping the hoe in the middle of the row, they answered the call to service. Some of you may think they have gone to "coushie" jobs in roentgenological laboratories away back from the firing line out of the reach of the grim reaper, but the very first page of history records the dangers to which these men are subjected by the unprecedented fiendishness of the adversary.

The Committee on Preparedness of the American Roentgen Ray Society, after outlining a program, appointed an Advisory Committee composed of many representative roentgenologists of the country, and before the final plans were completed there was a meeting of the Advisory Committee at which most of these matters were considered. This Advisory Committee was so representative that Johnston in his characteristic way remarked, "You might think this was a meeting of the American Roentgen Ray Society, but it is not." In the latter part of June a conference was held for about two weeks at Cornell University Medical College. It was attended by the roentgenologists who were to be instructors in the schools of roentgenology throughout the country. At that time we considered the subjects which should be taught at the various schools, the methods of localization and the types of apparatus best suited to the military service. We also considered the question of roentgenographing the chests of recruits in the National Army. The Committee unanimously adopted the following report which was submitted to the Surgeon General:

It is the belief of the committee that a combination of a careful clinical and roentgenological examination of the chest gives the most accurate information on which to base acceptance or rejection of applicants for military service. That the roentgenological study will aid not only in the elimination of pulmonary lesions but also in the discovery of various concealed heart, aortic and mediastinal lesions, which might be overlooked.

The committee also believes that it is practicable to make a roentgenological examination of the chest of each recruit at a cost which will be amply repaid by subsequent decrease in the incidence of tuberculosis in the service and consequent lessening of pensions incident to the war.

The committee, therefore, recommends that an *x*-ray examination be made of each accepted recruit and that such cases as show roentgenological evidence of the presence of a sufficiently important lesion be held for further observation.

The examination will also serve to eliminate the question as to the presence of disease in cases which might otherwise be rejected for supposed tuberculosis, because of the history or deceptive physical signs.

Prior to this time Dr. Coolidge, in his characteristic far-sighted way, realized the necessity of a field apparatus and, even before the Committee on Preparedness ha taken up the work, was already carrying on research work on an equipment which has proven to be one of the most remarkable developments of the year. This is the Coolidge Delco outfit, which is so well known that it need not be described. Captain Steiner of Unit No. 15 took the first one of these with him as an auxiliary apparatus and at the time I last heard from him he was using it exclusively.

There have been established throughout the country nine schools for training men in military roentgenology, with the following men as instructors in charge of these schools. We are hoping to have a report of the work that many of these men are doing at the dinner to-morrow night.

Boston: Major Arial W. George.
Philadelphia: Major Willis S. Manges.
Baltimore: Major Frederick H. Baetjer.
Pittsburgh: Major George C. Johnston.
New York: Major Leon T. Le Wald.
Richmond: Major Alfred L. Gray.
Chicago: Captain E. S. Blaine.
Kansas City: Capt. E. H. Skinner
Los Angeles: Capt. William B. Bowman.

A "Manual of Military Roentgenology" has been written by Major Philip W. Huntington, Majors Hickey, Le Wald, Manges and Shearer, Doctors Bowen, Dunham, Law and Pfahler, and has been edited by Major Manges. This manuscript is in the printer's hands at the present time and will, I hope, soon be published.

Another problem which has attracted considerable attention throughout the country is the roentgenological examination of the chests of the troops. Some work has already been done under the auspices of the Subcommittee on Tuberculosis of the Council of National Defense, of which Dr. Hermann Biggs is Chairman and Drs. Baldwin, Brown, and Miller are members. They have given this subject most serious consideration.

The first one hundred men examined were members of the 12th Regiment, N. Y. N. G. These men were examined stereoscopically in one direction and with a plain plate in the other direction. This was done especially to determine whether or not the single plate would reveal the diagnosis in the majority of cases. These plates were first examined as plain plates and later examined stereoscopically, and while we all appreciate the value and beauty of stereoscopic plates, yet the work of making and interpreting stereoscopic plates is about five times as great as that of making and interpreting a single flat plate, and in only one instance did the subsequent study of the stereoscopic plates alter our previous interpretation of the flat plate.

The results of this examination of one hundred men was so astonishing that we hardly believed that it would be duplicated in a larger series. Through the influence of Dr. Biggs, arrangements were made for the examination of 1000 men of the 69th Regiment, N. Y. N. G. This work was done exclusively by the students and faculty of the New York School of Military Roentgenology, and an attempt was made to combine speed with accuracy. An apparatus was constructed for the purpose of making rapid exposures and was loaned by a prominent manufacturer. A full report of this work was sent to the Subcommittee on Tuberculosis.

The examinations—one plate to a case—were made at the average of one in twenty eight seconds. Six hundred and forty plates were developed by one man without assistance between 3 p. m. one day and 5 p. m. the next day. These plates were then interpreted before the class in military roentgenology at about the rate of two per minute. That is, the plates were divided into three groups: normal, tuberculous, and doubtful. The doubtful cases were then studied more carefully, allowing about one minute for each case, by two or three men who determined when some of the doubtful cases should be considered normal, and others considered definitely tuberculous. A very simple classification, even more simple than that previously reported, was adopted for the classification of these cases (Fig. 1). The lesions represented by the squares above the shaded area are practically normal and of no clinical significance. Those below the shaded area are definitely pathological and should be rejected, while those which fall within the shaded squares are doubtful cases and should be held for further clinical and roentgenological observation.

These same 1000 cases were examined clinically, independently of the *x*-ray examinations, by a board of special examiners, and a comparison of the roentgenological findings and the results of the clinical examinations were made. This comparison will sometime make an interesting item in the history of the war.

Another little side issue is the development of a caliper for assisting in the localization of foreign bodies and, particularly, in conveying the information from the roentgenologist to the surgeon. In the development of this I was greatly assisted by the members of the class, particularly, Captains Ashbury, Borzell, Bromer, Jaches, and Lieutenants Moore, Mayer and Powell, who were members of a camping expedition when the Coolidge Delco apparatus was tested out. Captain Ashbury will give more details of this expedition tomorrow at the dinner.

In spite of my disappointment at the size of the program, I wish greatly to express my appreciation to those who have contributed to it, especially to those who on rather short notice, after they thought there would be no meeting, have prepared papers.

Now, gentlemen, there is just one thing that will make this meeting worth while. It is *not* the papers you are going to hear, nor the opportunity to present the result of your year's work before the national society. It is *not* the spirit of fellowship because, with so many absent members and our minds on other things, the meeting will lack the *esprit de corps* for which it is noted—on a certain day last spring things ceased to be as they were and they never *will be* as they were again.

We are now living in the most eventful year in the history of the world.

Last May many boys went to Plattsburg as boys, but they came back as men—men who realized the seriousness of the problem they had undertaken. Yesterday,

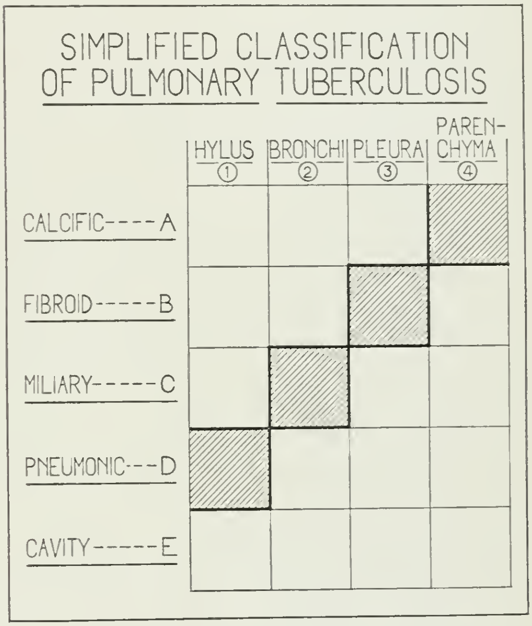

Fig. 1.

while I was thinking over what I was to say, the boys of the new National Army marched past. There were boys singing and laughing and shouting. I was reminded of a sentence in an old grammar, a sentence used for analyzing, which is as follows: "Hands that last year bore stains of fruits and flowers now bear redder stains of war." Those boys can never go through what lies before them and come back boys. When they come back they may shout and sing—some of them—but it will be the shout and song of victory and not the shout of the simple boy.

Many of you have regularly attended these meetings in years passed and have contributed to them, you have derived from them a wealth of knowledge, experience and enthusiasm which is not accessible through any other channels. You have acquired this knowledge and experience, you have qualified, and now your country needs your service. Many men in other walks of life are sick at heart because they have nothing to offer their country and they envy you and me because we have something to give. Major Le Wald, in advising two young men regarding the service, simply said, "One is more likely to regret the things that he did not do than the things that he did do." Unquestionably there are some among you who have real good sound reasons, not excuses, for not rendering service to your country. They are to be pitied, for they are deprived of the satisfaction of service, beside which all other things fade into oblivion. Sometimes I feel like a shirker myself or, perhaps, more like a man who was drafted for the Civil War and hired some one to go in his place.

I had joined the Roosevelt Hospital Unit No. 15 and expected to go with them to France, but I had to make the choice between that and what I have attempted to do here. Therefore, my associate and friend, Captain Steiner, went in my place. And when Hickey, Case, Brown, and Hill and Steiner and the other members of this ever-increasing roll of honor return, I shall feel that they have served their country more actively than I have, unless the opportunity presents to relieve Captain Steiner, or to serve in some other capacity somewhere in France. The time when your services are required will soon slip by and then it will be too late. When Captain Squires returns from the most dangerous post yet assigned to an American roentgenologist to greet his young wife and a baby born on the day he sailed, a baby he has never seen, will you be able to look him in the eye and feel that your excuse for not serving is a real good reason?

Lewis Gregory Cole

ROENTGENOTHERAPY OF TUBERCULOUS PERITONITIS

Weil remarks that of all the methods of treating tuberculous peritonitis, systematic utilization of sunlight and sea air seem to have the most testimony in their favor. But both require the suitable environment which is within the reach of comparatively few. On the other hand, with the roentgen rays we can apply the chemical rays anywhere, even to outpatients. He has been applying roentgenotherapy systematically since 1914, using large doses of very penetrating rays, filtered. Some of the children had the fibrous form of peritonitis and some the form with ascites. In every case in which there was not already generalization of the disease in the lungs or pronounced cachexia, a complete cure was rapidly realized, with complete restoration of the general health. He uses a Coolidge tube, a 5 mm. aluminum filter, a 20 cm. spark, and a 1.5 or 2 milliampere current. The exposures are repeated about monthly, but he reduces the strength a little each time to ward off skin trouble. This technique does not entail radiodermatitis nor generalization of the tuberculosis. After the first series there may be a recrudescence of the fever and persisting malaise, but this reaction was never serious in his experience, and he never allowed it to interfere with his giving the effectual dose of 12 or 14 H units in the course of four successive days on the four quarters of the abdomen. In case of much debility the series can be fractioned to spread out over ten or twelve days. (*Paris méd.*, Oct. 13, VII, No. 41, pp. 289–304.) (Ref. *J. Am. M. Ass.*, Dec. 8, 1917, p. 2003.)

THE PRODUCTION OF A TRUE OPTICAL VIEW BY MEANS OF THE STEREOSCOPIC ROENTGENOGRAPH

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and

ELLIOT D. SMITH, A.B.

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IN THE article on the "Stereoscopic Radiograph as an Aid to the Surgeon," read before the Chicago Medical Society, January, 1911, I said: "The stereoradiograph overcomes practically all the shortcomings of the single plate. The fusion of the two pictures into one, by means of the stereoscope, builds up a plastic, translucent body resembling a glass model, in which all the structures can be plainly distinguished. The magnification of shadows, which is the fault of single radiographs, due to oblique exposures, or to unequal distances of lesions from the plate, is corrected in the stereoscopic radiograph because the latter *produces a true optical view*."

To explain by psychology, how mere shadow pictures can produce so remarkable a result is the purpose of this paper.

Let one begin with the simplest example possible of how a shadowgraph can produce an image corresponding to that of actual observation. Suppose a coin is placed at a unit distance from the observer, who looks at it with one eye only. Such a case is illustrated by Fig. 1. The light from the object, as shown by the narrow solid lines, passing through the lens of the eye, produces upon the retina of the eye an inverted and much reduced image of the object. In the figure this image is shown by the heavy line *ab*. The dotted line indicates the course of that light which falls upon the fovea. If now, by placing a sensitized plate directly behind the coin, and by putting a light in the position that was occupied by the lens of the eye, an exposure is made, the shadowgraph produced (shown by the circle labeled "picture," in the figure) will be quite analogous in form and size to the coin. Hence if this shadowgraph be observed at a unit distance from the eye, the image produced on the retina of that eye will correspond exactly with the image of the coin.

Suppose now that the coin be placed at one half instead of a full unit distance from the eye. This case is illustrated by Fig. 2. As the diagram clearly indicates, the effect on the eye is to produce an image twice the size of that produced in Fig. 1, with the coin at unit distance. If, as before, the plate be put at a unit distance and a shadowgraph made, this shadowgraph will be a circle of twice the radius of the former shadowgraph which was equal in size to the coin. Hence the image produced by its observation at the unit distance will be twice the size of that produced in Fig. 1 and so equal to that produced by observation of the coin at half-unit distance. This is really more evident from the diagram than any description can make it. There will thus be no apparent difference between the coin observed at half-unit distance and this second shadowgraph observed at full-unit distance. Analogously, at whatever distance the object is placed, if the distance of the plate is the same for both exposure and observation, the shadowgraph will invariably give an accurate image of the coin.

Let us now turn to binocular vision. Before trying to solve the problem of an artificial production of a "true optical view" by shadowgraphs, let us consider the natural process of obtaining it. Taking for illustration the observation of two coins, one at full and one at half-unit distance from the eyes, let us assume that the eyes focus on the further coin. (Object 1 in Fig. 3.) The images of the center of this object, as the dash lines in the diagram indicate, will fall on the fovea of each eye. In each eye, also, object 2 will be imaged

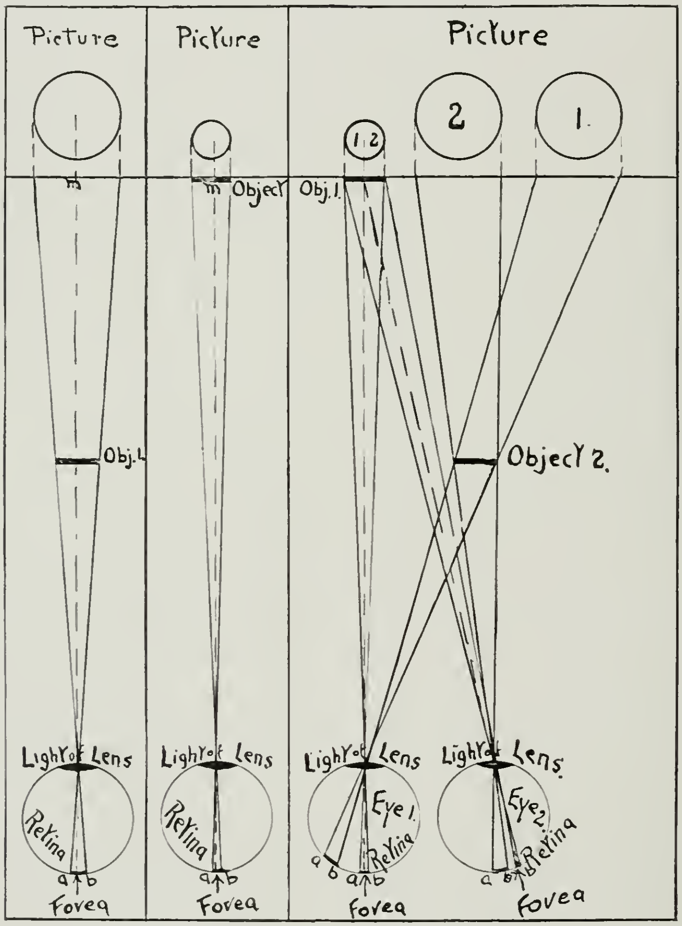


Fig. 2. Fig. 1. Fig. 3.

slightly to the right of the fovea. Fig. 3 illustrates this quite clearly, where the heavy lines *ab* in each eye indicate image 1 and image 2, respectively. Here, as previously, the images of the nearer coin are the larger. But the mind, in converting the stimuli received from these images on the retinas into perceptions, introduces distance from the eyes, and proportionate size of the objects determined by their distance. We have learned by reaching out and touching objects, by walking up to them, by comparing new distances with ones thus discovered, by numberless similar experiences, to associate the different amounts of convergence of the eyes necessary to bring the image of an object simultaneously upon the two foveas, with definite special distances from the observer. The making of this actual convergence even is soon unnecessary. Objects imaged elsewhere than on the fovea demand convergence or divergence to focus the two foveas on them, in proportion to the amount of the difference between the distance of the image from the retina in one eye and this distance in the other, that is, in proportion to what I will call the "difference in fovea distances." This physical fact is clearly evident from the diagram. Experience teaches the mind to associate these "differences in fovea distances" with definite amounts of convergence or divergence of the eyes, which is at once interpolated into a perception of actual distance from the observer. Thus in Fig. 3 the fovea distance *ba*, in eye 1, being greater than the fovea distance, *ba* in eye 2, the difference is positive, that is, the greater fovea distance is in the eye where the image is on the "outside" of the fovea. Plainly this positive difference indicates a convergence, not a divergence of the eyes; a shorter, not a greater, distance of the object from the observer. When this difference is negative, the reverse is true. Through the ceaseless practice of daily life these "fovea differences" become very accurate indicators of special distance. In a similar manner, the mind has learned to discount the size of the image in proportion to its distance from the observer. Thus to return to our illustration, though the two coins cast images of very different sizes on the retinas, they appear as coins of the same size, but at different distances from the observer. This seeing of objects in their actual size and distance, is the essence of the *true optical view.*

Let us now return to our shadowgraphs. Let us introduce a plate at unit distance, as in the monocular work. By first making a shadowgraph with the light in the position formerly occupied by the lens of eye 1 and then making another on a new plate, with the light in the position formerly held by the lens of eye 2, we will obtain two shadowgraphs, each of which, if viewed at unit distance by its proper eye, as our previous exposition has shown, will produce in that eye an image exactly analogous to that which real objects would produce. This can readily be seen from Fig. 3. Hence if we can make two successive roentgenographs with the light first in the one position of one eye and then of the other, and if we can arrange these pictures so that each eye will see only the roentgenograph proper to it, and yet each eye have the image of the same object on its fovea, we will simultaneously *have produced* images on each of the eyes which are exactly like those produced by the actual objects. The effect, consequently, must be the production of a "true optical view" with the objects appearing in proportion to their actual size, and with the distance from the eyes clearly observable. To obtain the two required roentgenographs is simple. The *x*-ray tube is placed on a sliding carriage. Without moving the patient and carefully changing the plates so as not to disturb him, two exposures are made. Between exposures the tube is moved the distance between the eyes. The two plates, when developed, are set facing each other, with a rectangular-prism reflector midway between them. The observer then places his eyes close to the intersection of the mirrors forming the prism. This apparatus is illustrated in Fig. 4. The lines A-B are the shadowgraphs of the coins, made with the light in the position of eye 1 of Fig. 3. The lines A_2-B_2 are those made with the light in the position of eye 2 of Fig. 3. As shown by the narrow solid lines in Fig. 4, the light coming from the shadowgraphs is bent by the mirrors so that each eye receives the light from its proper plate as if it had come from somewhere very nearly in front of the observer. Considering only one eye, by slightly altering the angle of the prism or the direction of the eye, any desired image can be brought upon the fovea. Let us assume again that one image of the center of the small coin is so placed. This is indicated by the dash line in the figure. The amount of convergence or divergence that the other eye will have to undergo, in order to bring the corresponding image on its fovea, is, therefore, determined by the position of the mirror-prism in regard to the plates—the further back it is moved from the line joining the center of the two plates, the greater will be the convergence, and the further forward the greater the divergence. If it is brought so far forward as to demand a divergence, the eyes will not respond, and we will get no fusion of the two images. By a very slight motion of the mirror backwards and forwards across the line joining the center of the plates, we can produce an angle of convergence that will cause the object to appear to be a few feet from the observer. With this constant apparent distance, the apparent size of the object, since it varies in proportion to the size of the image cast on the retina, will difference of fovea distance is the same then the near object will appear the same distance in front of the far one, and of the same proportional size.

Thus, I artificially produce a true optical view: a view characterized by seeing things in proportion to their actual size and arranged according to a third dimension.

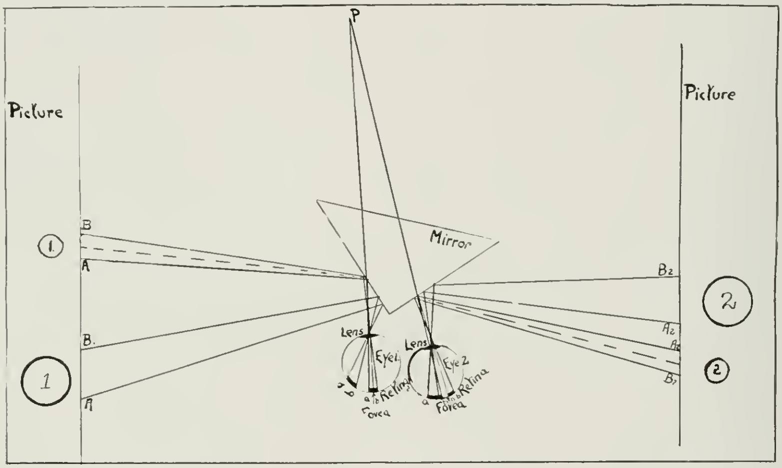


FIG. 4.

vary inversely as the distance the light must travel from the plate to position of the observer. This is evident from the discussion of monocular vision.

Granting these technical adjustments, it is plain that we have satisfied the requirements laid down before, as necessary to produce images on the retinas of the eyes exactly like those produced by actual vision and have, hence, produced "true optical view." To illustrate this, I have drawn Fig. 4 to the same scale as Fig. 3 and have arranged the apparatus so that the angle of convergence of the eyes is the same in both cases. In this case, as can be seen at a glance, the images on the retina in Fig. 4 are the same as those corresponding in Fig. 3, not only in proportions but also in absolute measurement. The potential convergence necessary in turning the foveas from the far object to the near is in both figures measured by the difference between the areas, *a-b* eye 1 and *a-b* eye 2. If in both cases this

One point, however, must not be forgotten, namely, that the plates must be properly placed before inspection. The pictures must be viewed in the same position in which they were taken. In other words if a body be taken dorsoventrally, it must be viewed dorsoventrally, otherwise we obtain a false or pseudoscopic view. What should appear near in that case appears remote and vice versa. Objects which appear at a distance are also greatly magnified. The reason for this is almost self-evident when we compare Fig. 5, in which the plates have been turned over, with Fig. 4. With the exception of this inversion the situation illustrated by the two figures is quite similar. The result is, that the size, retinal distances, etc., of the images correspond in the two cases, but the potential convergence in Fig. 5 is negative instead of positive. The excess difference in fovea distance is on the inside of the left side, not the outside. To turn the foveas toward he *near* object here, requires divergence nstead of convergence. The large shadow nstead of appearing the nearer, thus ppears the more remote. Hence its relative ize is greatly magnified, causing it to appear like a large moon in the sky.

Thus, if our roentgenographs are reversed in position, instead of a true

the sensitive plate. The four coins appear to be lying directly upon the wire screen. In viewing the stereoscopic pair by means of prisms or a hand stereoscope, all four coins return to their normal size, but their relative distances from the screen are at once apparent. They appear in front of the screen, approaching the observer. This then illustrates a *true optical view*, which

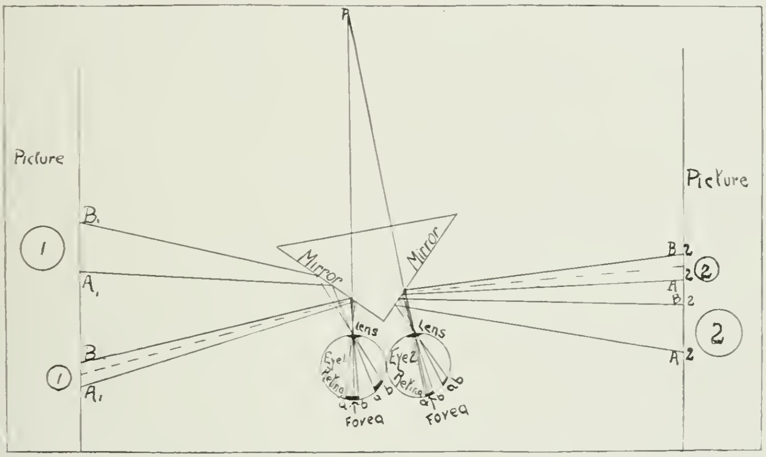


Fig. 5.

stereoscopic effect, we obtain a pseudoscopic view. I cannot illustrate this better than by showing here again the coin experiment which I published some eight years ago.

COIN EXPERIMENT SHOWING STEREOSCOPIC AND PSEUDOSCOPIC VIEWS

A convincing illustration of correction or shadow distortions is seen when this stereo is viewed. It represents four coins (American half dollars, which, of course, are all the same size) placed side by side on a wire screen, each coin, however, being placed at a different level from the screen, supported at the different heights by various thicknesses of cotton. The first coin lies directly on the wire screen; the second, an inch higher; the third, two inches, and the fourth, three inches above the screen.

Examining a single plate we note that each coin is of a different size, due to the magnifying of the shadow, on account of the various distances of the coins from

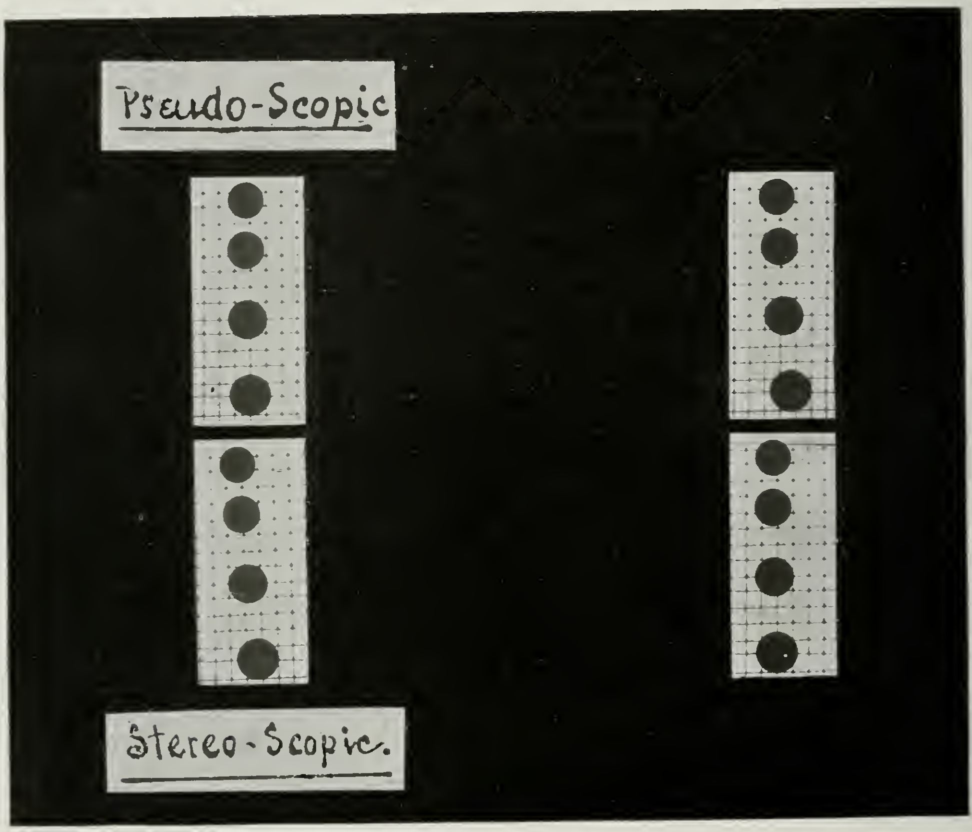
corrects all the distortions of the single plate. (See lower set.) One must, however, take into account that even in the stereoscopic view a certain relative difference in the size of the four coins is to be expected, such as we always observe by looking at two objects of the same size, when one is a little nearer to the eye than the other. Coin No. 4 is three inches nearer to the observer's eye than coin No. 1, and, therefore, must appear a trifle larger.

If the plates are transposed by shifting the right to the left and the left to the right, a *pseudoscopic view* is obtained. The coins appear to be receding from the observer, behind the wire screen, and their shadows, as they recede, subtend greater angles at greater distances and, therefore, are greatly magnified, giving an entirely false image. (See upper set.) It is thus very important to view the roentgenograms in the same relation in which they were taken, in order to avoid these distortions. Of course, in roentgenograms which do not show much depth, as, for instance, a foot or a hand, this distortion is not noticeable, but in the chest or the pelvis the distortions are so great that they may mislead us in our diagnosis.

It is of the utmost importance that the plates are to be properly placed in the stereoscope. It makes quite a difference whether we put our plates into the stereoscope with the glass side out or in. It also makes a great deal of difference which plate is to our right and which to our left. The two exposures, which are made with the shifting of the focus of the tube of some six centimeters (the pupillary distance) represent our eyesight. Plate No. 1 represents the left eye, plate No. 2 the right eye, and thus they are placed in the stereoscope in the same relation, so that when reflected upon the mirror the left eye will see plate No. 1 and the right eye will see plate No. 2. It is therefore necessary to mark the plates while they are taken.

If these principles of physics are observed, the objects roentgenographed will be represented in the stereoscopic view in their actual sizes and not by distorted shadows. We can by this method estimate the length of objects, such as needles, even if they lie transversely or anteroposteriorly and, on the single plate, are represented by a very short rod or a mere dot, when, in fact, they are many times the length they appear to be, judging their size from the shadow of the single plate. Their length can be estimated by comparing the relative size of the objects surrounding them, such as bones or other structures.

Stereoscopic roentgenography has become popular in the last few years because surgeons and roentgenologists have be-



Stereoscopic and Pseudoscopic Views of Coin Experiment.

ome convinced that the interpretations om the stereoscopic set are much easier nd more reliable than those from the ngle plate. The magnification of shadows o the loss of their intensity, which is due o the distance of the objects roentgenoraphed, makes the single plate in many nstances almost worthless, yes, even less han worthless. They may at times lead o false deductions and consequently o false treatment. In the stereoscopic picture we not only obtain the third dimension, we obtain a great deal more: the magnification and distortion of the shadows due to oblique exposure and the overlapping of shadows are corrected.

These experiments and the practical application of the stereoscopic method of diagnosis for the past twelve years have taught me their advantages, and I wish again to urge the more extensive application of the stereoscopic method.

USE OF RADIUM IN NONMALIGNANT UTERINE HEMORRHAGE

The authors report quite gratifying esults from the use of radium in selected ases. They think that it has a distinct ield and that its judicious use will often bviate the necessity of operation.

"The nonmalignant conditions of the uterus causing menorrhagia or metrorrhagia may be grouped as follows:

1. Cases in which there is little or no demonstrable pathologic change in the uterine wall, no history of infection, and in which the uterus is apparently normal in size and position, with normal adnexa. In such cases, the bleeding is in all probability due to some disturbance of the internal secretions, especially of the thyroid or of the ovary. This condition is often encountered in young girls about puberty.

2. The menopause.

3. Chronic metritis (or rather the increase of fibrous tissue in the uterine wall subsequent to chronic metritis).

4. Hypertrophy or hyperplasia of the endometrium, especially when so marked as to be adenomatous or polypoid in character.

5. Fibroids, adenomata, or adenomyomata of the uterus.

6. Chronic endometritis, especially after incomplete abortion.

7. Passive congestion of the uterus, as in retroflexion or prolapse."

Of the first three groups radium may be used in exclusion of surgery. Groups 4 and 5 may require surgery, while others yield to radium. Groups 6 and 7 require operation.

Ten cases were treated in groups 1 and 2. The bleeding in all had persisted for years. All had been curetted from one to six times without relief. One had had 23 and one 28 *x*-ray treatments. Nine were given intra-uterine treatments; the average dose was 1000 milligram-hours. The treatment failed in one patient. In two others it was necessary to repeat.

Eighteen cases were treated in groups 3 and 4. Most of them gave a history of previous pelvic infection, usually puerperal. Thirteen had been curetted from one to four times, and several had had operations on the uterus and adnexa without relief. One had *x*-ray treatments without relief. In several cases radium treatment was followed by amenorrhea. Two patients had a recurrence of bleeding about one year later. Three suffered from marked menopausal symptoms; while 5 were similarly affected, but the symptoms were light and transient.

The best treatment for fibroids was found to be in relatively large doses; 1500 to 2000 milligram-hours were used. (*South. M. J.*, Nashville, June, 1918, p. 449.)

EVERYDAY PROBLEMS OF A ROENTGENOLOGIST

BY FRANK S. BISSELL, M.D.

MINNEAPOLIS, MINN.

THE roentgenologist of to-day is probably a transitional type. He represents a stage between the pure technician with little medical knowledge and the highly specialized diagnostician whose fund of special knowledge is a compound of an important part of every other specialty. In his present transitional stage, much is demanded of him, for which his preparation is inadequate. The result is that he is often discredited when he attempts too much, or is found inadequate to the requirements of his specialty when he attempts too little.

Roentgenology is probably the purest consulting specialty in medicine, because all information derived by the roentgenologist passes through the consulting physician to the patient. Hence, benefits accrue directly to the physician and only indirectly to the patient. Again, since the intercourse of the roentgenologist is to a great extent with highly trained specialists, he must indeed be well informed on many subjects, if he is to serve his most useful purpose and justify the continued existence of his chosen specialty.

The Gall-bladder.—As an humble follower of our colleague George of Boston, the writer has made a sincere and not totally unsuccessful attempt to make consistent diagnoses of cholecystitis and cholelithiasis by means of the serial roentgenogram. From a statistical standpoint results have been disappointing, since the cases found roentgenologically negative but surgically positive have considerably outnumbered those found positive and confirmed. Likewise from the standpoint of "conservation of raw materials" it is doubtful whether the lavish expenditure has been justified by the results obtained. The roentgenologist knows no greater satisfaction, however, than that of proving conclusively the presence of gall-stones or a thickened gall-bladder, and it is to be hoped that persistence will be rewarded by such improvement in technique that negative roentgen findings may be accepted as more conclusive.

Whether or not it is possible to visualize the normal gall-bladder remains a moot question—in the opinion of your essayist—but it is a question upon which the roentgenologist should maintain an open mind.

In gall-bladder diagnosis there is often available a certain amount of indirect evidence, offered by the gastric examination. Thus, with signs pointing to a lesion in the upper abdomen—such as pylorospasm, atypical gastric peristalsis, or a six-hour retention of a Reider meal, and an absence of all direct signs of gastric or duodenal ulcer—a preferential or possible diagnosis of gall-bladder disease may be offered to the referring physician. Such a diagnosis, however, should be given only to the physician and should always be a qualified one. While direct evidence is far more conclusive it is not always available, and your essayist is one who believes that a roentgenological opinion may properly be based upon all the evidence offered.

The Appendix.—Whether the normal appendix should always fill, or should never fill; and what its characteristics should be when filled, are questions upon which there are as many opinions as authors. Likewise, the technique employed in the examination of the appendix has never been standardized. It is obvious that when men of wide experience differ so radically upon so simple a problem there must be important differences in their technique. Among factors which may be of importance are (1) the menstruum in which the barium is served, (2) the intervals allowed to elapse between examinations, (3) the amount of manipulation of the cecum, (4) the use of the barium clyster before or after the meal.

The reflex influence of the diseased or

lherent appendix upon the muscular nction of the stomach may be of some nportance. In certain cases of doubtful iology one observes a spasmodic contraction of the pars pylorica, an irregular type gastric peristalsis or a six-hour retention the barium-carbohydate meal, unacounted for by disease of either the stomch or gall-bladder. These signs may point appendicitis, pericecal adhesions or eal stasis of inflammatory origin.

Gastric Ulcer.—Is it proper for the roentenologist to make a negative diagnosis of hronic gastric ulcer? While it is frequently onceded that a simple florid ulcer, of the nore acute type, may manifest no roentgen vidence of its presence, failure to detect chronic indurated ulcer is generally egarded an inexcusable *faux pas* on the part of the roentgenologist. The writer is nclined to align himself with those who believe that such an ulcer may in certain stages of its existence entirely escape the eye of the roentgenologist. Two brief case reports may serve to support this contention.

Mrs. J. S., 36, was examined *fluoroscopically* on May 20, 1917. There was at this time a deep niche on the lesser curvature, accompanied by an apparent hourglass constriction of the stomach.

She was rerayed after seven months and her stomach then appeared roentgenologically negative. The spasm and the niche had disappeared and the stomach seemed normally mobile although she still complained of modified ulcer symptoms.

Mrs. O. A. T. was rayed on October 27, 1917. The only sign found was a small but typical pathognomonic niche on the lesser curvature. When reëxamined only two months later no niche could be detected, but there was marked tenderness to pressure at its former site.

Both of these cases should still be classified under gastric ulcer, although, under efficient treatment, the craters had been obliterated and other manifestations ameliorated. In the absence of a pathognomonic niche or accessory pocket, a positive diagnosis must be only tentative, and should have the support of clinical history, symptoms and laboratory findings. A negative diagnosis, on the other hand, should mean only that there are no roentgen manifestations of a lesion. With these limitations, an examination by a competent and experienced roentgenologist is of infinite value from the standpoint of diagnosis, prognosis and therapy.

Duodenal Ulcer.—The recognition of duodenal ulcer requires greater experience than does that of any other lesion of the gastro-intestinal tract. The negative diagnosis in the presence of a perfectly normal cap is easy and practically conclusive. So, too, is the positive diagnosis in the presence of a typical cap deformity, or an overwhelming abundance of indirect evidence. But what shall we say of those cases which fail to qualify in either of these classes? If there is no cap, there can be no cap deformity, and hence there is an absence of the only pathognomonic sign of duodenal ulcer. Yet some of these are undoubtedly ulcer cases while others are equally without doubt gall-bladder cases. Still others may be accounted for as anatomical peculiarities. Hence, neither a positive nor a negative roentgen diagnosis can be made. Such cases are exceptional and doubtless many of them could be cleared up with patient perseverance and a large series of roentgenograms; but at this time the writer is merely attempting to emphasize some of the practical difficulties of everyday practice, and there is often an economic barrier to an ideally complete examination.

When roentgen manifestations are atypical or inconclusive, greater reliance must be placed upon the case history and clinical laboratory findings than is necessary or advisable when they are definitely negative or positive in character. The differential diagnosis between chronic cholecystitis with periduodenal adhesions and chronic duodenal ulcer is occasionally a difficult one.

The Thorax.—Above the diaphragm it

is again the atypical case which makes us pause. If all cases were true to type, a wealth of experience would not be required to develop a roentgenologist. He who has learned to recognize in Hodgkins the well-circumscribed mass of mediastinal glands, may fail to properly classify the masses of peribronchial lymph-nodes within the lung field. Certain cases of carcinomatous infiltration of the lungs are very typical while others so closely simulate early tuberculosis that great care must be exercised to avoid error. A lung abscess may be so situated that it cannot be mistaken, or it may be near the pleura and be called empyema, or it may be concealed within a pneumonic process and pass as pneumonia.

In the chronic empyemas, the writer has sometimes found it difficult to state with assurance whether there is pus within a mass of adhesions and folds of thickened pleura, in a lung area which is relatively air-free, or whether he is dealing with a postinflammatory organized exudate. Even the exploratory needle is not infallible, but the zeal of many clinicians to discredit the roentgenologist leads them to rely upon the negative exploratory puncture with unjustified faith.

The Mediastinum.—One might write a monograph upon the roentgen anatomy of the mediastinum and he who read such a monograph and studied the collected roentgenographic data would be confused by the infinite variety of the normal. Hence, slight variations from the normal may not be recognized as such and a roentgenogram which represents the normal in a certain type of individual may point to a pathological process in another. The diagnosis of aneurism of the arch at a well-developed stage may be simple and conclusive, but the writer knows of no established roentgen sign of aneurism of slight degree, which can be considered reliable. In the experience of the writer an aneurism which can be positively diagnosed roentgenologically always offers definite clinical signs. These may, however, have escaped detection and it is not unusual to discover a well-developed aneurism in the course of a routine gastro-intestinal examination.

The heart offers a field for more scientific roentgen study, but even with the methods in common use to-day, the experienced roentgenologist is in a position to offer the internist an infinite amount of assistance in the classification of his heart cases. The writer recalls from memory a most unusual instance in which the entire medical staff concurred in a diagnosis of mitral insufficiency and stenosis, despite entirely negative roentgen observations. At autopsy the heart was found absolutely negative.

In a large series of cases studied both roentgenologically and electrocardiographically in conjunction with other clinical methods of study, there has been a surprising coördination in diagnosis. As in many other spheres of roentgen endeavor, the chief factor of error is the normal variability according to individual type. In cardiac work it is most important to adhere strictly to certain recognized principles of interpretation, such as relative measurements of the right and left heart, contour of left ventricular borders and prominence of auricular and arterial convexities. In the short, stout individual, the long axis of whose heart shadow tends to the horizontal instead of the perpendicular, these factors lose their constancy, and it becomes increasingly difficult to draw accurate deductions.

Pulmonary Tuberculosis.—There is no doubt in the mind of your essayist that the roentgen method, properly applied, offers greater and more accurate values in the diagnosis of pulmonary tuberculosis than all other clinical methods combined. Nevertheless, there are many pitfalls for the unwary, and it is to these that your attention is directed. There is no standard normal lung roentgenogram. A group of healthy individuals without a history of known lung infection of any type will present a widely variant picture as to thickness and character of broncho-vascular tree, massiveness of hilus shadows and general density of the lung fields. Hence we must avoid general impressions and demand in the roentgenogram specific expressions of tuberculosis.

What are these specific expressions? One never attempts to describe them, much less to define them, without becoming involved either in incomprehensible verbiage or in the employment of established pathological terms to describe shadows, the true pathology of which is not yet established. In a paper before the A. R. R. Society in 1912 the writer advanced the theory that the shadows upon which roentgenologists were coming to rely for the early diagnosis were vascular in origin, probably due partly to lymphatic engorgement and partly to thromboses of tiny peripheral blood vessels. The theory was based purely upon the roentgen observations of a large number of cases, and evidence continues to accumulate to support it. Thus, one frequently observes the complete disappearance of all signs of tuberculosis in cases kept under observation over a period of years or months. This would not occur, were these signs due to tubercles or fibrosis, as was formerly held by many writers. Unquestionably, the conglomerate tubercle may be seen in the roentgenogram, but its presence is not proof of active tuberculosis. Fibrosis, too, produces gross changes in the lung field, but if one attempts to rely upon them for a diagnosis of tuberculosis, he will often be led astray. In fact, we must seek a part of the lung field which is relatively free from such changes, in which we may distinguish the wraith-like shadows which are so characteristic of active tuberculosis. The latter tend in the aggregate to assume a triangular shape. Miller and Dunham, in their excellent anatomical studies, have shown that this is because each lobule or lung unit is triangular in shape, and that each has its own vascular and lymphatic distribution. That active pulmonary tuberculosis may exist without producing characteristic roentgen signs is doubtful, but the following sources of error may be pointed out:

(1) Careless Technique.—In no branch of roentgenologic diagnosis is technical imperfection so dangerous. Stereoroentgenograms are absolutely essential and these must be made strictly according to standard technique. One must not rest content with poor roentgenograms, since the changes of greatest significance are the least outstanding and hence the first to be lost either through improper tube or dark-room technique. There is a tendency among certain clinicians, whose sole qualification as roentgenologists is the possession of a roentgen outfit, to rely too much upon the fluoroscope. This practice cannot be condemned too strongly, because it leads inevitably to self-deception and a false sense of security. Early and characteristic roentgen signs of tuberculosis cannot be seen on the fluoroscopic screen.

(2) Concomitance of Other Chronic Lung Infections.—The diagnosis of tuberculosis is always more difficult and questionable when there are changes in the lung due to other chronic infections. Bronchiectasis may exist with or without tuberculosis, but, fortunately, it usually involves only the lower lobes. It may occasionally happen, however, that changes due to the tubercle may be concealed by the bronchiectatic process. This applies also to pneumoconiosis, lung edema and chronic passive congestion.

Certain cases showing moderately advanced lesions may appear roentgenologically healed or latent, whereas physical signs or positive sputa prove them active. Here, again, the usual roentgen signs are covered up by the scars and fibrotic changes of the disease. This work demands close coöperation between the internist and the roentgenologist, if the best results are to be attained. If such coöperation cannot be had, it is probably less impossible for the roentgenologist to become proficient in the use of the stethoscope, than for the internist to learn to properly interpret the chest stereoroentgenogram.

ELECTROPHYSICAL AND CHEMICAL PROPERTIES OF ROENTGEN RAYS AND RADIUM*

BY ALBERT SOILAND, M.D.

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LOS ANGELES, CAL.

THE published reports on radium therapy by eminent observers during the past four or five years have stimulated many others to take up this work, and, now, this rare and potent element is undergoing exploitation in a manner neither desirable nor altogether altruistic.

Radium in the hands of the charlatan or unscrupulous physician offers perhaps the most prolific field in existence for humbugging the patient, both physically and financially. Numerous instances of this kind are undoubtedly fresh in your minds. On the other hand, radium exhibited by the careful and observant physician bids fair to rank as one of the evolutionary standards of medicine. Some of the radium therapists apparently derive much pleasure from making erroneous comparative statements concerning radium and x-rays. The writer has listened to papers where, among other remarks, the essayist stated that radium was five hundred times stronger than the roentgen ray. Then, in the very next sentence, the astonishing information was imparted that the x-rays produced burns and radium did not. In another instance, the writer remembers either reading or hearing the statement that x-rays could not be used in the treatment of skin lesions around the eye, but that radium alone was tenable. This and many other equally foolish remarks have prompted the present attempt to discuss briefly the physics and chemistry of both agents in order that we may understand their rôle in therapeutics.

Such remarks can emanate only from those who are either totally unfamiliar with modern roentgenotherapy or willfully misrepresent the facts. That the roentgen ray has been used and also abused unmercifully is self-evident, and that there have been a great many more failures than successes in its broad application is equally true. It is also a regrettable fact that we are all loath to report our failures and mistakes. At the same time, it is refreshing to observe that the gradual standardization of roentgenotherapy, on both a conservative and scientific basis, is fast winning the confidence and respect of progressive medical men.

Now comes radium therapy with its sponsors demanding the center of the stage, unmindful of the fact that it is in about the same predicament today that x-ray therapy was five or six years ago, but with the added advantage of knowledge obtained by these years of x-ray experience. While x-rays and radium are totally unlike in their physical aspect as to apparatus and mode of production, yet we must accept and bear in mind that like quantities or equal amounts of both agents have identically the same action and reaction upon all living structures in which they reside. This is a basic fact, easily borne out by microscopic findings, and already accepted by a vast majority of the workers in this field of medicine.

To reach a working basis for comparing radium with the roentgen ray, it is first necessary to know that the available therapeutic energy from all the radium so far collected by any individual or institution in the whole world is not equal in amount to the total output of energy from a single Coolidge x-ray tube working full capacity

In the second place, the working radius of the two agents is dissimilar. The area of gross therapeutic activity of radium rays from their source is from zero to two and one-half and three centimeters in extent. The area of therapeutic activity of the x-rays can be extended to a distance of twenty feet from the source.

By therapeutic rays in this dissertation are meant the actual rays which are absorbed by the particular tissues under discussion. Rays which pass entirely through the object aimed at are just as useless in the field as rays which fall short of the objective point. It is only those rays which are actually absorbed in the tissues, or whose rate of progress is stopped within the field, that are transformed into a working energy. Another difference is the length of time required for the radiations from radium to produce their effect upon responsive structures. In their present service qualities, the ratio varies between fifty and two hundred to one.

As a concrete example, suspend any given amount of radium say eight inches above the skin, the usual working distance where x-rays are employed, and without the interposition of any filter except the glass container of the radium salt; expose in this manner for ten minutes and note results. Not the slightest change occurs, either macroscopic or microscopic. Now make a similar exposure to an x-ray tube working at capacity without filter at the same distance. What occurs? Necrosis and death of the part exposed.

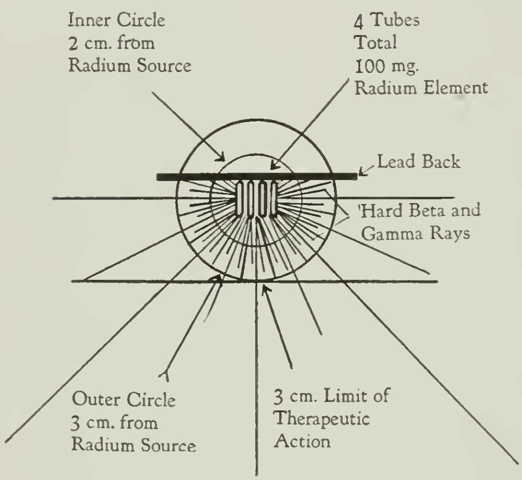
If we use radium in dosage approaching that of the roentgen rays, and give time enough for a sufficient amount of the energy of radiation to be transformed and liberated within the tissues, the same amount of irritation and destruction will be noted as occurs with the x-rays. If we call the effect of the different rays which strike the photographic plate actinic action, the same differential range of time between the two agents is again demonstrated. One may with impunity exhibit an unexposed photographic negative protected from daylight to within 48 inches of radium without danger of fogging the sensitive emulsion. Yet if this same negative comes within a distance of twenty feet of an active x-ray tube, it is instantly fogged.

Now, in order to understand clearly why these agents, apparently so dissimilar, exert the same influence on the living cell, it is necessary to consider their physical structure. This can best be shown by means of a table and charts which are appended. From a glance at these charts, it can be readily understood that radioactivity, whether from x-rays or radium, is identical as long as the ray energy from either source works at the same frequency and in equal amounts. These rays, whether

TABLE FOR COMPARISON

	Roentgen Rays	Radium
Source	High voltage current, 100,000 volts and over	From a mineral deposit of which uranium is the parent
Medium	Vacuum tubes exhausted to the highest degree possible	Chemical reduction and distillation, resulting in measured quantities of radio-active elements
Result	Cathode and x-rays soft, medium and hard	Emanation, radium, A B C to F, alpha particles, beta and gamma rays
Amount	Unlimited	Markedly limited
Penetration	Therapeutic rays up to ten or twelve inches	Therapeutic rays up to three centimeters
In Service	X-rays of all lengths and intensities	Hard beta and nearly all gamma rays
Out of Service	Cathode rays	Practically all alpha particles and a few very hard gamma rays that have no demonstrable therapeutic action

long or short, from both radium and the roentgen tube consist of vibrations of the ether, similar to light waves, and traveling with the same velocity. These vibrations



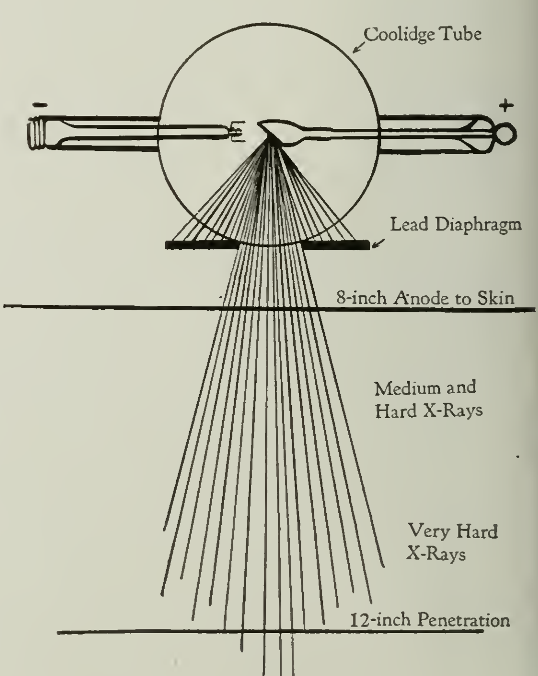
may have different wave lengths and frequencies, upon which their action depends qualitatively. Therefore, it can be equally well understood that a like amount of either form of radio-activity in sufficiently large amounts will in time produce stimulation, inhibition, or destruction of the living cells, according to length of exposure.

Some of you will perhaps recall the statement so positively made at the Delmonte meeting last month that radium and x-rays were entirely dissimilar. It is with the object of correcting this erroneous impression, which is prevalent among medical men, that these rather tiresome details are deemed necessary.

Physical measurements, carefully made by a great number of scientists, have now established beyond question that all of the phenomena occurring in a tube containing radium also occur in an x-ray tube.

If we desire to produce gamma x-rays of equal frequency and penetration with radium, it is only necessary to increase the generative voltage to 250,000. Then our x-rays would be of no more therapeutic value than the corresponding radium rays. The energy from radium is due to an inherent explosion of the radium molecule itself by disintegration, which causes the wave disturbances. These disturbances are always constant and of the same frequency, and they cannot be varied as long as the physical body of the radium remains intact. In the x-ray tube, the explosion results from the impact of the molecule on the tungsten plate by an electrical force which can be controlled at will.

As compared to radium rays, the x-rays are infinitely more numerical and complex as they emerge from the heated anticathode, and the great problem in their therapeutic employment is to utilize the particular bundle of rays that is destined to reach the part treated. The Coolidge tube has made great strides in this direction, and while we are still far from a homogeneous bundle of rays with variable voltage, we are approaching that standard in



a fairly satisfactory manner. With radium, the problem is much more simple. The apparatus itself is small and easily handled. The rays are comparatively less in number and of higher frequency, and most of the action takes place within a short distance of the source. If we recall that the available radium energy does its work at such short distances, it would be just as irrational to attack an intramural fibroid of the uterus by means of radium applied to the cervix as it is to use a filtered Coolidge x-ray tube with a ten-inch spark gap in a case of superficial acne. It is not intended to convey the impression that radium is of little service in medicine. On the contrary, this agent deserves the highest commendation and should be given every scientific opportunity to prove its worth. So far, however, radium has been shown to have a strictly limited field of usefulness, and like the roentgen rays, there is still great room for improvement in its universal application.

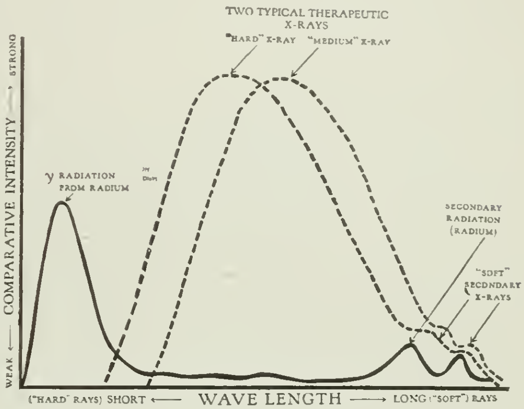
Summing up the foregoing and applying the deductions to the therapeutic utility of x-rays and radium radiation, we find the following to be true:

1. For therapeutic purposes, a range of different wave lengths, suitable for different purposes, is desirable.

2. Both the roentgen-ray tube and the radium capsule emit a number of different radiations, varying in wave length and intensity, but of identical structure.

3. The roentgen-ray tube may be controlled at will to produce almost any desired wave length of radiation, and to emit this radiation at any desired intensity.

4. The radium emits two main types of radiation, which can *not* be altered by any human agency. That is to say, such a capsule emits rays of two predominant frequencies or wave lengths.



5. The suitability of all these radiations is, in all fairness, still a matter of experiment. From the evidence at hand, it would seem that the "softer" of the two radiations from radium is too limited in its radius of action to have wide application, these rays having very little measurable influence beyond a few centimeters distance. The "harder" of the two main radiations from radium would seem, on the other hand, to have too high a penetration for great use. Such rays pass directly through the tissues, without exerting any appreciable effect.

6. The quantities of available radiation, as already stated, are far greater in the roentgen tube. From this, energy can be radiated in one second to exceed in amount the energy from an enormous quantity of radium delivered over several hours time.

INTRACRANIAL AEROCELE FOLLOWING FRACTURE OF THE FRONTAL BONE

WITH A REPORT OF A CASE

BY GEORGE W. HOLMES, M.D.

BOSTON, MASS.

FRACTURES of the skull and their complications are of especial interest at this time because of the frequency with which these injuries occur in our military camps, both at home and abroad. The type of injury discussed in this paper is of especial interest because of the ease with which it can be diagnosed when proper examinations are made and the radiographic findings are kept in mind, and because of the seriousness of the injury in untreated cases (all cases so far reported having been fatal). There is, also, a possibility that, if a correct diagnosis was made early and proper treatment instituted, some lives, at least, might be saved.

From a review of the literature it would appear that the condition is comparatively rare. The only similar case which I am able to find is one reported by Dr. E. H. Skinner at the September Meeting of the American Roentgen Ray Society in 1914. Dr. William H. Luckett has reported two cases of air in the ventricles of the brain which resulted from fractures of the skull similar to the one reported by Dr. Skinner and to the one which I wish to report. Dr. Walter J. Dodd also had one case of air in the ventricles which followed a fracture of the skull which has not been reported. In all of these cases there was a fracture involving the frontal bone and the frontal sinuses.

In those cases in which the collection of air was in the ventricles, the orbital plate was also fractured. In the cases of aerocele the fracture was through the inner as well as the outer table of the frontal sinus.

From a study of the cases it would seem, as Dr. Luckett has suggested, that the air was forced from the sinuses into the cranial cavity as a result of the increased pressure in the sinuses during sneezing or blowing of the nose and that bacteria were carried in along with the air. All of the cases developed a purulent meningitis except one in which Dr. Luckett operated early. This patient later developed a brain abscess. In all of the cases previously reported the air (as far as is known) was not present immediately after the injury.

The case which I wish to report was observed at the Massachusetts General Hospital on the service of Dr. C. A. Porter, to whom I am indebted for permission to report it. The patient was an instructor in the Aviation Department of the Signal Corps, U. S. Army. The injury was received while cranking a machine for a student. He was struck in the face and head by the propeller blade and was brought to the hospital immediately afterwards. At the time of admission he was suffering from shock and there was extensive laceration of the tissues of the face and head.

The roentgenographic examination consisted of two plates taken one from either side of the skull. The anteroposterior view was not attempted on account of the patient's condition.

The study of the plates showed a linear fracture through the outer table of the frontal bone and a suggestion of a continuation of the fracture through the inner table. The frontal sinus was involved.

In the plate taken from the right side there was a large oval area of markedly diminished density in the frontal region. The outline of the area was irregular and it was not seen in the plate taken from the other side. For this reason, it was thought at the time to be an artefact and, although it was mentioned in the report, special attention was not directed to it.

The patient did well under the usual treatment for about a week, at which time ie developed meningeal symptoms. A second series of plates taken under rather better conditions showed the area of diminished density in the frontal region still present, although somewhat diminished in size.

A definite diagnosis of intracranial aero-

wound was stitched to the dura and a rubber drainage tube was placed in the opening. The patient recovered from the operation but died two days later from meningitis. At the autopsy the surgical diagnosis and the roentgen ray findings were confirmed.

Fig. 1. Lateral View of Right Side of Anterior Portion of the Skull.

Fracture through the anterior table of the frontal bone can be distinctly seen and is indicated by a small arrow. The inner side of the frontal bone (indicated by the large arrow) is the irregular area of diminished density produced by the presence of air beneath the dura.

cele was made. An operation for drainage of the frontal region was performed by Dr. Porter. A small crack was found in the middle of the anterior wall of the frontal sinus. The anterior wall was removed and the sinus was found to be filled with blood clots. An opening was then made through the posterior wall of the sinus down to the dura. The dura was incised and there escaped through the opening about two ounces of turbid serum and air. The

In this case the evidence of air in the cranial cavity was demonstrated in the first series of plates which were taken within an hour after the accident. Possibly, if sufficient weight had been placed upon the finding of an area of diminished density in connection with a fracture through the sinuses, and an immediate operation had been performed, the meningitis which developed later might have been prevented.

Fig. 2. Lateral View of the Plate on the Left Side of the Skull Taken Immediately After Fig. 1.

It shows an irregularity in the appearance of the left side of the frontal bone and some diminished density, but the changes are not more marked than may be often seen in normal skulls.

It would seem that it is of especial importance to obtain careful roentgenographic examinations of all cases of fractures of the frontal bone immediately after the injury. These cases should also be followed and possibly roentgenographed again before discharge from the hospital. In the interpretation of the roentgenogram especial attention should be given any areas of diminished density in the frontal areas.

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A BALL AND SOCKET ELBOW

BY R. L. IVINS, M.D.

CRAWFORD, NEBRASKA

THE patient, J. S., had received a gunshot wound in his elbow. The bullet entered from behind, destroying the olecranon, pulverizing the inner condyle of the humerus and producing a T-shaped fracture, the transverse part of which was about three inches above the joint.

Three months later the case came under the care of Lt. Hugo Mella who, with the writer's assistance, cleaned out about a handful of necrotic fragments, and attempted to secure fixation at a more favorable angle. The transverse fracture was firmly united with considerable angulation. A narrow pencil of bone that seemed to be alive was left. It extended from the tranverse fracture line to the joint, articulating with the saucer-shaped head of the radius. C. D. technique was used, and complete healing had taken place about a month later.

Some time later the case came under the writer's care, when a very interesting state of affairs was discovered. The pencil-like fragment was now a relatively smooth cylinder, the upper end of which was firmly united, the lower end appearing as a smooth, round ball articulating with the head of the radius, which appears to have responded to the needs of the occasion by becoming wider and deeper.

Motion is now free for about ninety degrees, flexion being limited by the angulation of the humerus and the impacted remains of the coronoid process. The new joint is painless and useful. The man drives nails, combs his hair and uses this arm about as well as ever.

PREMIERES IMPRESSIONS D'UN ELEVE MANIPULATEUR

AIR: LA BOITEUSE DU REGIMENT — PAROLES DE REMONTIN

1E COUPLET

V'nant d'êtr' versé dans l'service de radio
J'suis arrivé à Neuilly, Port'Maillot
D'vant un' maison, tout c'qu'y a d'plus moderne
Ca m'a changé de mon ancienn' caserne
Ah! jamais j'aurais cru
Qu'on f'rait autant d'frais pour loger des poilus!
Y a un grand salon
Et un p'tit salon
Y a pas de fauteuils
Mais on peut à l'œil
S'asseoir sur des bancs
Y a aussi des tables
Qui sont demontables
Les murs sont garnise
D'un tas de fourbis
Y a d'sus des tableaux
Qui n'sont pas d'Corot
Mais qu'ont des boutons
Comm'mon pantalon
On accroche après
Des fils par paquets
Y en a par dessus
Y en a par dessous
Y en a qui sont durs
Y en a qui sont mous
Qui vont s'accrocher
De tous les cotés
A des tas d'machins
Que j'connais pas bien
Tels que des moteurs,
Des interrupteurs,
Ou des spintermètres
Et des ampèremètres
Ou bien des voltmètres
Y a même double mètre
Qui les fixe après
Les fils des trolleys
Y s'branchent à part ça
Sur des rhéostats
On bien sur des boules
Qu'on appelle ampoules,
Ou sur les soupapes
D'où les fils s'échappent
Pour aller tout droit
Dans une boite en bois
Plein' de paraffine
Qu'on appelle bobine
Comme je n'les ai pas vu r'ssortir
Je m'demand' c'qu'ils ont pu dev'nir ! ! !

2E COUPLET

Puis j'rai r'gardé c'que f'saient les troufions
Qui se trouvaient dans chacun des salons
Les uns traçaient des signes cabalistiques
Qu'ils app'laient, je crois, des schémas électriques
D'autres dans des bouquins
Potassaient la Radio, le soir comm' le matin.
Et pendant c'temps là
Cinq ou six soldats
De p'tits touche à tout
Se tenaient debout
Devant des fourbis
Bizarr'ment construits
Et garnis d'ficelles
Lorsqu'une étincelle
Jaillit violemment
D'un des instruments.
Un poilu furieux
Crie: Tonnerr' de Dieu!
Qui s'qu'a foutu l'jus
Moi . . . je n'marche plus!
Dans un autre endroit
Ils sont bien vingt-trois
A prendre un' leçon
Assis tous en rond
Si j'ai bien compris
L'professeur a dit:
Connectez l'moteur
Du condensateur
Sus l'carburateur
De la magnéto
Au moyen d'l'osmo
De la dynamo
Vous fermez l'circuit
Au moyen d'l'induit
Lors les électrons
S'mélangeant aux ions
Bombard'ront l'anode
De l'anticathode
Alors le courant
Percera l'écran . . . .
Bref le soir quand je suis parti
J'étais complet'ment abruti ! ! !

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CIVILIANS IN THE SERVICE

It has been decided to hold the next meeting of the Society at Fort Oglethorpe in coöperation with the military authorities engaged in medical instruction at Camp Greenleaf. Details of this meeting and program will be furnished in due course. There has been voiced some objection to holding the meeting at this place, largely because men not in uniform feel that they may be placed in an unfortunate light before those who do not understand their individual reasons for not entering the service. These men should certainly bear in mind the fact that the entire medical profession of the country can not engage in military work and that those who are carrying on, under trying circumstances in many cases, not only their usual work, but frequently that of their colleagues who have answered the call, may serve their country equally as well as those who wear the external evidence of patriotic endeavor. It may also very likely be true that those in the service may reap a considerable value by even temporary association with many of the more experienced men who could attend this meeting. The men under instruction at that time are likely to be largely those of limited experience, and the realization that men of established reputation and long experience are willing to bring to them counsel and assistance and to attend the meeting, even under the stress of war conditions, would certainly be an encouragement. Those who are in foreign service will surely feel gratified if their colleagues at home make the meeting that they are unable to attend an unqualified success.

J. S. SHEARER

COMMUNICATION FROM THE EXECUTIVE COMMITTEE CONCERNING THE PLATE EXHIBITS

Perhaps it is not needful—we believe it ought not to be needful—to stimulate your enthusiasm as to the coming Nineteenth Annual Meeting of the American Roentgen Ray Society at Hotel Patten, Chattanooga, Tenn., September 4, 5, 6, 1918.

None of the previous meetings have been

able to offer you a more vitally interesting program, a meeting place of greater historical interest or of greater natural beauty; nor have we had at any place better hotel facilities.

Added to this are two important things: first, none of us have felt that we could, with due regard to duty, allow for our usual recreation this summer—listen! here's the grand excuse; grasp it while the grasping is good. Second, we will all soon be—probably before the end of this year—either in the Service, going in, or else pledged to some specific service in civil life. If you are not sure which one of these classes you will get into, attend this meeting and find out. Please note that this is not a military meeting. Despite the time and the place, the larger part of the program will be taken by civilian members. The plate exhibit will depend almost wholly upon the civilians.

We wish to bespeak your interest especially in the plate exhibit. Your duty in this matter was never more important. Especially desired are plates of bone and joint diseases with confirmed diagnoses, which you are willing to present to the Military School. Such plates should be plainly marked with the donor's name and should be accompanied by all data used in making the diagnosis: also, they should give the manner of confirmation—operation, post-mortem or other. But whether or not you will donate plates, please do not fail to bring at least one plate for the Exhibit. Your failure to do so will be a loss to others in just the same way that the failure of the Plate Exhibit would be a loss to you. If you are not willing to bring the plates personally, they should be sent by express not later than August 20, addressed to the Plate Exhibit, American Roentgen Ray Society, Hotel Patten, Chattanooga, Tenn.

For general information about the meeting, address Dr. David R. Bowen, 235 So. 15th Street, Philadelphia, Pa.; about the program, Major Willis F. Manges, M. R. C., Camp Greenleaf, Fort Oglethorpe, Ga.; regarding the Commercial Exhibit, Mr. Paul B. Hoeber, 69 East 59th Street, New York City; for hotel reservation, Hotel Patten, Chattanooga, Tenn.

Executive Committee

Statement of the Forthcoming Loan

The United States will next month call upon the men and women of this country to support a great government loan to aid in winning the war. The issue of bonds for the Fourth Liberty Loan will equal or exceed $6,000,000,000. The tentative date for opening the sale of the new certificates is September 28. It will continue about three weeks.

It has been stated that the nation's war program will necessitate the expenditure of $24,000,000,000 during the fiscal year ending June 30, 1919. This money will be raised in two ways: by taxation and by the issue of bonds.

Taxes of all kinds added $4,000,000,000 to the nation's treasury during the past fiscal year, when total expenses were between twelve and thirteen billion dollars. We cannot contemplate doubling the national budget without increasing the tax income in the same ratio. Plans are now under way to make substantial additions to the amounts derived from war profits and personal incomes. Should these additions swell the tax returns to $8,000,000,000, there would still be left twice this amount to be raised by the sale of bonds.

Enormous as this sum appears on paper, it still barely scratches the surface of our national resources, which, as Thomas W. Lamont recently pointed out, were estimated at the beginning of the war at $250,000,000,000. The total amount derived from the sale of government securities to date is $9,978,785,800.

Without making any rash promises for the future or attempting to paint the chances of the Allies in too rosy colors, there is a possibility that this may be a "Victory

Loan." Nearly 1,500,000 United States soldiers are now in France. More are landing every day. The way the Yanks beat back the Germans during the July drive and their earlier victories at Cantigny and Belleau Wood, together with the successes of the French and British, are a sure sign, military experts say, that the fortunes of war have probably swung our way.

In the third Liberty Loan rivalry was stimulated by the awarding of Honor Flags to firms, sixty per cent of whose members and employees had bought bonds. Five thousand of these flags were awarded. More than fifteen hundred of the firms earned 100 per cent Honor Flags—that is, every worker in the concern subscribed to the loan. The Honor Flag system will undoubtedly be a part of the coming drive.

This advance notice is published at the suggestion of the Liberty Loan Committee. Every physician who has done his duty in the preceding loans, cannot fail in aiding "The Victory Loan."

THE NINETEENTH ANNUAL MEETING

THE Nineteenth Annual Meeting of the American Roentgen Ray Society will be held at Chattanooga, Tenn., and at Camp Greenleaf, Chickamauga Park, Ga., on September 4th, 5th, and 6th, 1918.

It is planned to have the evening sessions and one half-day session, for the transaction of the business of the society, as well as the scientific and commercial exhibits at the Patten Hotel, Chattanooga. The scientific sessions will be held at the Warden McLean Auditorium, Camp Greenleaf.

The program promises to be an excellent one, in spite of the fact that quite a number of our most active members are on duty overseas. Many others are in active service, and perhaps will be unable to attend; still others are serving on medical advisory boards and may perhaps on this account be kept from attending; but still we are assured of a good attendance.

The following men have promised papers: Lt. Col. A. C. Christie, Majors W. H. Stewart, H. E. Ashbury, A. W. George, A. L. Gray, L. T. LeWald, F. H. Baetjer, and F. H. Albee; Drs. G. W. Holmes, W. A. Evans, H. K. Pancoast, D. R. Bowen, A. W. Crane, H. E. Potter, H. M. Imboden, I. Gerber, B. C. Darling, S. Lange, R. D. Carman and J. H. Edmonson; Dr. W. D. Coolidge, Mr. Clyde H. Snook, Mr. Leo P. Larkin from Major Shearer's laboratory, and Mr. Millard B. Hodgson from the Eastman laboratory. Last year we had fifteen papers in addition to reports of cases and lantern slide demonstrations. The president hopes that any member who has material for a paper, or an interesting case to report, or lantern slides of unusual conditions to present, will promptly send to him papers, or, at least, abstracts with titles, so that he may arrange to have them included in the printed program. The matter of case reports and lantern slide demonstrations is always an important and interesting one. We should keep in mind the fact that the program will be given to an unusually large audience, and that presentations should be prepared carefully in order that they may be given promptly and accurately.

This scientific program will be given before a large body of medical officers who will be here at that time, getting the necessary military training and special instruction in the different medical specialties, prior to going to over-sea duty. We have never before had an opportunity to present our excellent work to more than a few hundred men at a time. This year we will have an audience of probably a thousand or more. In ordinary times we would be glad for such an opportunity. In this case we should be more than glad, for we will bestow the benefit of our work on those men who are going abroad to take care of our wounded American and allied soldiers. Think what this means. The vast majority of the student medical officers have been away from larger hospital clinics and laboratories for a matter of years and have not had opportunity to keep in touch with the progress in roentgenology, even if they have had a former knowledge of it. These men should be shown the extent to which they may rely on the roentgenologist to assist them in the care of the sick and wounded. They need this education now in an emergency, and we are fortunate to be able to give it.

Roentgenology is the only important subject in the entire field of medicine that is not taught seriously in all medical schools. War surgery and medicine cannot be successfully accomplished without the aid of it. Every surgeon and every other medical specialist needs this education now—not next year, not after the boards of trustees and faculties of our medical schools can be shown the value of it. It is not enough to say that our specialty should have been taught. We must do it. The faculties and trustees of our colleges will not be criticized if many of our soldiers go to autopsy with empyema, obstruction, bone sarcoma or the many other lesions, undiagnosed. No, but we, the members of the American Roentgen Ray Society, will be criticized. Every man in the society has had the experience of seeing patients for diagnosis when help could no longer be given. On the other hand, each one has been the source of information that has saved life or limb many times, both in surgical and medical cases. We all know the difference between the physician or surgeon who has a well-equipped roentgen-ray laboratory at his command, with a competent roentgenologist with whom to consult, and the one who is far removed from such facilities. The former appeals for help from the roentgenologist almost as a matter of routine, the latter only in the case of injury, advanced disease, or through the consulting surgeon or physician. The burden of education of the latter and larger group is on our hands. This is a golden opportunity to show what we can do, and this is the time of all times when we should accept the opportunity.

In addition to this large group of medical officers, we will have another very important group, who will serve their country more efficiently for having had the opportunity to attend our meetings. We refer to the officers who will be in attendance at the Camp Greenleaf School of Roentgenology. It is probably known by most of our members that the Camp Greenleaf school is now the only one at which military medical men are being trained as roentgenologists. Many of them have had but little practical experience, few of them have been afforded the inspirations and benefits that come with our meetings. They all need every bit of help, encouragement, and confidence that we can give them. They are going into the war zone to represent American Roentgenology and it is our serious duty to send them as well equipped as possible. Manifestly, it would be quite worth while having the meeting at Camp Greenleaf, if only this group could be reached. This

View from Inspiration Point, Appian Way.

very feature last year caused the meeting place to be changed from Pittsburgh to New York, and those of us who had schools at that time within reach of New York will remember how much benefit our students received from the meeting.

Your president has been on active duty at Camp Greenleaf as instructor in Military Roentgenology since January 10, 1918. He has seen the school through an interesting stage of development. During the time of the meeting, ample opportunity will be afforded you and your friends to see the excellent array of apparatus that has been selected and standardized by the Surgeon General through Lieutenant Colonel Christie. The teaching facilities will be not only a matter of interest to all, but a revelation to even the most experienced. The elementary and advanced physical laboratories, which have been moved here from New York, have been developed by our own Major Shearer; and certainly it is worth the trip to see these.

You will have read the description of the portable apparatus developed by Dr. Coolidge. Here you will be able to see this marvel of simplicity and efficiency. We hope, too, that we may have the latest development in our armamentarium, the mobile unit, and give you a demonstration of a real mobile x-ray unit.

Chimney Rock in the Heart of Blue Ridge.

Aside from these attractions, we have here many others to interest every one. Camp Greenleaf is situated in Chickamauga Park, where the soil has been made sacred by the blood of our fathers and grandfathers. It is one of the most important historical spots in our entire country, and it is also one of the most beautiful. At a height of twelve hundred feet above sea level it is surrounded by range after range of hills as far as the eye can see. Missionary Ridge, Lookout Mountain and Signal Mountain afford views as beautiful as one could wish to see. We would seriously advise all who can, to stay here over Sunday and see all of these attractions. The climate is delightful. The nights are always cool, and as a rule there is a breeze to relieve the moderate heat of the day. Chattanooga is only eight miles from the camp and special arrangements will be made for transportation to and fro. Lunch can be had at the camp so that only one return trip need be made.

The Surgeon General of the Army has expressed his approval of the plan. Colonel Munson, the Commandant of Camp Greenleaf, has expressed himself to the extent of saying that he not only favors the plan but wants it carried out.

You will find here a hearty welcome. Your efforts will be appreciated by those who have the responsibility of sending efficient medical officers to serve our troops and you will go away feeling that you have given something of real value to the great cause of freedom and humanity.

Let every man come regardless of the sacrifice—there can be nothing more important. Do not feel that the meeting will be a success without you, it will be more of a success with you here.

Willis F. Manges, *Major, M.R.C.*

Major Willis F. Manges, President, American Roentgen Ray Society, Camp Greenleaf, Chickamauga Park, Ga.

My Dear Major Manges:

I have read with much interest the editorial relative to the annual meeting of the American Roentgen Ray Society to be held here early in September, and desire to add a word in support of the plea and the program there outlined. I am sure that the opportunity for information which the meeting of your Society will bring here will be of great advantage to the student officers generally in the Camp. You may rest assured that anything that can be done by the administration of this camp to make your meeting a success will be done as fully as possible.

Very sincerely yours,

E. L. Munson,

Colonel, M.R., U.S.A., Commandant

July 10, 1918

Camp Greenleaf,

Fort Oglethorpe, Ga.

TRANSLATIONS & ABSTRACTS

Robertson, H. E. Influenzal Sinus Disease and Its Relation to Epidemic Influenza. (*J. Am. M. Ass.*, May 25, 1918, Vol. 70, No. 21, p. 1535.)

"It would, of course, be unreasonable to assert that all cases of influenza are accompanied by sinus complications. While it is true that in only one of our cases of influenzal purulent tracheobronchitis coming to postmortem did we fail to find sinus disease also present, it is unfortunate that both in this case as well as in the others of the series the antrum of Highmore was not also investigated. However, the number of cases is altogether too small to justify any sweeping conclusions. They do serve most emphatically to emphasize the importance of the sinuses in the respiratory type of influenza.

"This importance is interesting from two standpoints. First, from the standpoint of a local focus of infection, which not only constantly menaces the pulmonary system, only awaiting suitable conditions of exposure and lowered resistance for hostile invasion, but also furnishes continued sources of toxic absorption, not to mention the direct effect on the well being of the patient from the presence of these local conditions. Second, and more important, is the bearing that these local infections have on prophylaxis and treatment. When their attention had been called to the possible constant presence of sinus disease in patients suffering from influenzal bronchitis, the attending physicians adopted local measures of treatment for these conditions, even when their presence could not be diagnosed with any degree of certainty. Local applications to the nasal passages of cocain and epinephrin solutions often resulted in copious discharges of thick, mucopurulent exudate from the sinuses, with marked relief to the patient, such as amelioration of headache and pain in the eyes, as well as definite betterment of the conditions in the bronchi and trachea.

"While the general proposition that young, otherwise healthy adults do not die from uncomplicated primary bronchitis or bronchopneumonia is by no means without exceptions, nevertheless, it is always extremely desirable in such cases to search most carefully for foci of infection other than the respiratory tract per se. The middle ears, serous membranes and even the blood stream may harbor the offending organisms, but in cases of influenza and possibly other respiratory diseases,[1] the sinuses of the skull should always be investigated and their freedom from involvement assured before other than general therapeutic measures of relief are abandoned.

"Inevitably in these days, the question of carriers is linked up with that of actual cases, and perhaps too little consideration has been given to sinus disease as furnishing chronic foci for the spread of epidemics.

"The entire subject deserves further investigation, and whether or not my conclusions are found to be justified, in the study of larger groups of cases and by other workers, is a matter of minor importance. If more careful attention is directed toward what at times is an important feature of epidemic influenza, namely, sinus involvement, this communication will have fully accomplished its purpose.

SUMMARY

1. Epidemics of respiratory influenza (purulent tracheobronchitis) have been fairly severe in both the American and the British Expeditionary Forces.

2. In the investigation of cases, both clinically and at postmortem, little attention in the past has been given to the question of accompanying sinus disease.

3. Of eight fatal cases of purulent tracheobronchitis due to the influenza bacillus, all but one showed involvement of one or more of the sinuses at the base of the skull by inflammatory processes, probably, in all cases, directly due to the invasion of these sinuses by the influenza bacillus.

4. In six patients that died from some other apparently independent infection, the sinuses showed influenzal inflammations.

5. Of two patients dying from accidentally received injuries, both harbored in their sinuses lesions giving pure cultures of *B. influenzæ*.

[1] As, for example, whooping cough, which is very closely related to influenza both in the characters of the causative organisms, as well as many of the clinical features of the disease. The spasmodic cough of some influenza patients is often difficult to distinguish from the "whoop" caused by the Bordet-Gengou bacillus.

6. Appropriate treatment of the sinuses in patients suffering from influenza often served to relieve the symptoms and apparently to hasten convalescence.

7. Investigation of the sinuses during epidemics of influenza is strongly recommended and urged not only on therapeutic but also on prophylactic grounds."

Friedenwald, J., Cotton, A., and Harrison, A. C. Report of a Case of Huge Dilatation of the Esophagus. (*South. M. J.*, 1917, X, 717.) (Ref. *Internat. Abstr. of Surg.*, Jan., 1918, p. 28. Freilich.)

The author reports a case of very marked dilatation of the esophagus in a brakeman, 40 years old, who had been troubled for eighteen years with regurgitation of food shortly after eating, and more or less so-called indigestion. *X*-ray examination revealed enormous dilatation with marked retention for 24 hours and to a slight degree for 48 hours. Attempts at dilatation of the cardia with olive bougies were unsuccessful, as the swallowed silk thread would not pass through the stomach, due to pylorospasm. Gastrotomy was done but the patient died. Autopsy findings demonstrated a fusiform dilatation of the esophagus, which held 1,750 c. cm. of water.

The unusual features of the case were: (1) the extensive dilatation of the esophagus; (2) the inability of the silk thread to pass through the pylorus.

Meakins, J. C., and Gunson, E. B. Orthodiagraphic Observations on the Size of the Heart in So-called "Irritable Heart." (*Heart*, Vol. VII, No. 1, p. 16, April 22, 1918.)

We reprint here the conclusions of this article.

1. The heart in cases of so-called "irritable heart" is, on the average, somewhat smaller (0.7 cm.) than normal.

2. In cases with a diffuse apical impulse no enlargement is shown by the orthodiagraph. On the contrary, the average measurement is smaller than the normal, in the same proportion as in those who do not exhibit this sign.

3. When cases of so-called "irritable heart" rest in bed there is an average increase in the transverse diameter of the heart of 0.7 cm.

4. After strenuous Swedish exercise in cases having no material symptoms there is a decrease (1 cm.) in the size of the heart, while in cases showing conspicuous symptoms there is on the average, no appreciable change in the size of the heart.

Smith, E. H.: Arch Defects of the Human Foot. (*Calif. State J. M.*, San Fran., May, 1918, p. 256.)

Dr. Smith emphasizes the point that a roentgen examination should be made of every painful foot to determine the presence of a destructive bone lesion. In discussing the so-called weak foot in children, he states that formerly the ligaments and muscles were blamed for the deformity, but, since the advent of *x*-ray, we have learned that they are not at fault, that the weak foot is due to delay in ossification of the bones. He states that several articles have recently appeared, giving illustrations which show an alleged absence of some of the bones of the foot. He believes, however, that the bones are not absent, but are soft and pliable due to delayed ossification.

In discussing gonorrheal arthritis, he states that a most rapid destruction of the arch of the foot is found, which tends to rapid ankylosis and permanent disability.

Vaquez, H., and Yacoel, J. Benzene in Leukemia. (*Bull. Soc. méd. d. hôp. de Par.*, January 25, 1918, p. 68. Ref. *J. Am. M. Ass.*, May 18, 1918.)

Vaquez and Yacoel report three cases of leukemia which confirm anew the favorable action of benzene (benzol, C_6H_6) in this disease. They tabulate reports from eleven other clinicians, all showing improvement in the general health, and reduction in the size of the spleen and in the numbers of leukocytes, while the numbers of reds increased. The most striking change was in the patient of F. Deutsch, whose whites dropped from 836,000 to 7,000, but Frank Billings has reported a case not far behind this. Even with a pathologic increase in the reds, the benzene has likewise a regulating effect, but its leukolytic action is so pronounced that when given in the dose sufficient to reduce the reds from 8 to 6 millions, it reduced at the same time the whites down to 1,200. The leukocytes of normal persons are quite resistant to the benzene, comparatively speaking. Given parallel to a healthy person and to a patient with leukemia, the whites in the former dropped from 7,800 to 3,000 while in the leukemic it dropped from 800,000 to 16,000. They begin by giving 40 drops of benzene a day, increasing to 100 drops by the fifth day. This is continued during the first twelve days of each month, examining the blood every week and watching over the urine likewise. If the leukocytes are being destroyed too rapidly, the drug should be suspended for a fortnight. They give the benzol in capsules or in wine or milk. Given in this way it can be kept up for months. A supplementary course of radiotherapy may be useful. They alternate the courses of each. The patients in the cases reported were a man and a woman of 50 and 51 and a young soldier. The stimulating effect on the blood-producing organs is shown by the drop of whites from 525,000 to 15,000 in one case seven weeks after the benzene had been begun, while the hemoglobin has reached 75 per cent, and the reds gone up from 3,500,000 to 5,000,000. After this the whites ranged between 8,000 and 12,000, and the general condition has kept satisfactory.

HYMAN, A., Anatomic Results after Prostatectomy. (*Internat. J. Surg.*, May, 1918.)

The article treats of the mechanism of urination following suprapubic prostatectomy and the anatomic changes of the bladder resulting from the operation. The appearance of the normal bladder is discussed and also the appearance of the bladder associated with large prostates. The latter varies from the small contracted bladder to the large irregular flaccid bladder.

The changes characteristic in prostatic enlargement are to be found at the base of the bladder. Instead of the broad upper part narrowing at the outlet the opposite is usually seen. The inferior portion of the bladder is broad and flat with, at times, an upward bulging due to the gland projecting into the bladder. The flattening of the inferior portion of the organ is regarded as characteristic of prostatic enlargement. The bladder also is situated on a higher plane than the normal.

The most interesting and important changes after operation were noted at the outlet of the bladder.

"In a small proportion of the cases only a very slight funnel formation in the region of the internal sphincter was observed; in a very few instances no changes at the outlet were found. It is therefore evident that in this small group of cases the internal sphincter was not sufficiently injured by the operation to interfere with its proper function.

"In the great majority of cases the radiographs showed two distinct cavities—a larger, superior one corresponding to the bladder proper, and a smaller, inferior one extending from the lower margin of the bladder and continuous with it to the region of the compressor urethræ. The latter corresponds to the defect left by the removal of the enlarged gland. The contour of this cavity varies from a round or oval to a funnel-shaped formation. The latter is more frequent, the broad base being superior. There can be only one interpretation of these findings—the internal vesicle sphincter has either been destroyed by the operation, or its function so impaired that it could not have had any effect in retaining the fluid in the bladder; this has been accomplished by the compressor urethræ muscle. In other words, the true sphincter of the bladder following suprapubic prostatectomy is situated at the membranous portion of the urethræ. There can be no question that the compressor urethræ muscle acts as an efficient sphincter, for all of the cases in this series have excellent urinary control. That the collection of collargol found in the pouch formerly occupied by the prostate is not an overflow phenomenon caused by vesicle distension is demonstrated by radiographs showing the same formation in the bladder but slightly distended. A careful examination reveals the fact that in some cases the two cavities are separated by a narrow isthmus. This would lead one to believe that in these instances the sphincter has either partially regenerated after the operation or was incompletely destroyed by it. That the cavity left by the enucleation of the gland is not entirely obliterated, and that the internal sphincter is not completely regenerated, is shown by the very definite radiographs after an interval of three years.

"In conclusion it may be stated: 1, that the internal vesical sphincter is the true sphincter of the normal bladder, and of the bladder in prostatic enlargement. 2. The internal vesical sphincter, "compressor urethræ," is the functionating sphincter after suprapubic prostatectomy in the large majority of cases."

This paper is based almost entirely upon conclusions drawn from roentgen examinations.

MOUTIER, F. Appendicitis in the Gassed. (*Arch. d. mal. de l'appar. digest.* [etc.], Par., March, 1918, p. 493. Ref. *J. Am. M. Ass.*, May 18, 1918.)

Moutier says that in addition to the ulcerations that have been noted in esophagus, stomach and upper bowel from the toxic action of chlorin gas shells, he has witnessed a number of cases in which the appendix evidently shared in the lesions. He describes six cases in detail in which the appendix had been previously supposedly sound, and three in which there had been a previous suggestion of appendix mischief. The "incubation" was five to eight days in the first group, and twice this or more in those with old lesions. The symptoms did not indicate serious disturbances, and they subsided under local application. He does not attempt to decide whether the appendicitis is the result of swallowing some of the gas or of a general toxic action.

TIMBAL, L. Dilatation of Stomach from Atony. (*Arch. d. mal. de l'appar. digest.* [etc.], Par., March, 1918, p. 481. Ref. *J. Am. M. Ass.*, May 18, 1918.)

Timbal insists that hypersecretion in the fastening stomach is not necessarily a sign of ulceration. It may be a consequence merely of atonic dilatation. The resulting motor disturbances and stagnation of stomach contents irritate the walls, and secondary Reichmann's disease follows. As the motor functioning returns to normal, the secretion becomes more regular. Contrary to the hypersecretion with ulcer, with dilatation the hypersecretion is always pure at first, without admixture of lactic acid. The hypersecretion with dilatation from atony does not require direct treatment. What is needed is to overcome the atony. These patients are debilitated, thin and nervous, and should be treated on this basis. As they become better nourished and stronger, the atony subsides, and along with it the tendency to hypersecretion.

SKINNER, EDWARD H. Practical Radiography for the Orthodontist. (*Internat. J. Orthodontia*, May, 1918.)

The writer emphasizes the following points in identification of films.

Films of the upper teeth show:

1. Maxillary sinus.
2. Molars have three roots (excepting third).
3. Upper centrals show broad crowns and conical roots.
4. Median raphe distinctly visible.
5. No foramens or dental canals visible.

Films of the lower teeth show:

1. Molars have only two roots.
2. Mental foramen.
3. Inferior border of lower jaw.
4. No maxillary sinus shadow.
5. Lower centrals are straight and peg shaped.
6. No median raphe discernible.
7. Inferior dental canal.

LE FORT, R. Projectiles Left in the Mediastinum. (*Rev. de chir.*, Par., May-June, 1917, p. 495. Ref. *J. Am. M. Ass.*, June 15, 1918.)

This instalment of Le Fort's article fills 117 pages. It is based on thirty-seven cases of foreign bodies in the mediastinum, with healed point of entry, thirty cases of operations on regions contiguous to the mediastinum, and on a number of operations on the mediastinum for reasons other than the presence of a projectile. Most of the wounded with a projectile left in the tissues experience annoying symptoms from its presence, mostly dyspnea on effort, which debars them from work. By observing a number of minor points, which he describes, the foreign bodies can be sought and removed with ease and without harm. No operation on the mediastinum should be considered without roentgen study of the case with all the mechanical aids possible. The access to the mediastinum should be large and ample, and as direct as possible, with integral repair of the wound.

HOLDING, ARTHUR FENWICK, AND GREENWALD, MAX. Fluoroscopy in the Diagnosis of Chest Conditions. (*N. York M. J.*, June 8, 1918.)

The writers predict as gradual an adoption of the fluoroscope by the internist as of Laennec's stethoscope. They say the fluoroscope is of diagnostic and prognostic value in determining (a) the condition or pathology of heart and lung conditions; (b) stages of development; (c) observing the activity of a given process in lung condition; (d) the presence, amount, character and actual disturbances caused by fluid in the chest; (e) the condition of the lungs and the mediastinum, especially when the seat of metastasic disease.

"In differentiating chronic bronchitis and broncho-pneumonia respectively from tuberculosis and lobar pneumonia it is important to note that the adventitious shadows in bronchial affections are limited to the region of the "bronchial tree" and do not affect the distal parenchyma, whereas in tuberculosis and lobar pneumonia the adventitious shadows always extend well out into the parenchyma."

Weil, E. A. Roentgen Aspects of Rachitis. (*Nourisson*, Par., March, 1918, p. 65. Ref. *J. Am. M. Ass.*, May 18, 1918.)

Weil remarks that the lesions of rachitis are best studied, usually, on the wrist and hand or on the knee, as he describes in detail, with eighteen illustrations. He emphasizes in particular the opaque border of the end of the bone next the cartilage, *le signe de l'os bordé*, early in rachitis. This indicates that ossification is more intent here, while the rest of the bone shows decalcification. The ends of the shaft also spread out broad, or show a mushroom-like protuberance on the end, or they cast a cupule-shaped shadow. In advanced cases there may be two or four dark strips in the end of the shafts. When rachitis is acquired near puberty, the roentgen findings resemble those in young rachitic children. The roentgen findings with osteomuscular dystrophy and tendency to stunting of the growth differ from those of rachitis. In a case of tendency to dwarfism of this type, he applied moderate roentgen treatment to the ends of the long bones. The boy of 11 had shown no sign of growth of the bones for several years. The ossification in his knees was no farther advanced than in a normal child of 5, and the shadows closely resembled those of early rachitis. The growth was accelerated by the roentgen exposures.

Hurwitz, Samuel H., and Falconer, Ernest H. The Value of Roentgen Rays and Benzene in the Treatment of Polycythemia Vera. (*J. Am. M. Ass.*, April 20, 1918.)

Various earlier forms of treatment are mentioned, including drug therapy, diet, and venesection. None of these measures gave permanent results. Splenectomy has usually been fatal within a few days. The reasons why the roentgen ray and benzene are the logical treatment are discussed in the summary which we quote in full.

This patient was 38 years of age and was first observed in April, 1915, at which time she complained of headaches and an attack of blindness. Cyanosis of the face, gums, arms and hands was marked. On May 18, 1915, the blood count was hemoglobin 105, r. b. c. 12,400,000, w.b.c. 9000. Spleen was palpable. She was placed on a milk diet and given frequent intramuscular injections of an arsenical preparation, also venesection. She remained comparatively well with frequent venesections till August, 1916. She was admitted to the hospital in October, 1916, and during a week was given 33 grams of benzene. From November 8 to 18, she took 8½ grams of benzene. From November 23 to 28, 3 grams of benzene. She was given eight roentgen treatments over the spleen in the period from August 2 to October 22, 1916.

In January, 1917, the blood picture was normal, the red count being 5,200,000, hemoglobin 98, white count 9200. Subjective symptoms had completely disappeared.

The patient was last seen February, 1918, sixteen months after the beginning of the benzene and roentgen treatment. The blood picture was normal.

COMMENT

"Experimental and clinical observations concerning the effect of drugs and various radioactive substances on the blood and blood-forming organs have brought forth some interesting facts regarding the relative resistance to these agents offered by the white blood cells and the red blood corpuscles. In the first instance it has been shown that the various drugs and rays employed exert a selective action on the several tissues giving origin to the formed elements of the blood; and secondly, that the leukopoietic tissues are much less resistant to their destructive action than are the tissues concerned with the formation of erythrocytes. The latter elements, it would appear, show only moderate changes in number and structure at a time when the circulating leukocytes may have almost completely disappeared from the circulation.

"The observations of Heinecke and of Selling have established these facts, so far as the action of the roentgen rays or of benzene is concerned. This work shows that the roentgen rays exert a selective action on the lymphocytes, and that even prolonged irradiation will not bring about any noteworthy changes either in the number of red blood corpuscles or in the percentage of hemoglobin. Benzene, on the contrary, has a somewhat different action. This drug has been shown by Selling to act destructively first on the white cells and more especially on the nongranular elements, and later to cause a diminution in the number of erythrocytes. The experimental studies have shown, however, that in order to effect any striking anemia, the drug must be administered in large doses and over a long period of time.

"It is because of this essential lymphotoxic action that the roentgen rays alone have not been found of great value in the treatment of polycythemia. Whereas benzene, on the other hand, has yielded some brilliant results in the treatment of this disease, it must be kept in mind that these good effects have usually followed the prolonged ingestion of large doses of the drug—a procedure not entirely without danger. The danger lies, first, in the severe gastro-intestinal disturbance which may follow the administration of very large doses, and secondly, in the marked destructive action which these large amounts may have on the circulating leukocytes.

"It was with the hope of testing the value of smaller amounts of benzene, when combined with the roentgen rays, that the mode of treatment outlined in this paper was carried out. The patient, as will be noted from the clinical record and the table, received only 44 gm. of the drug within a period of a month, after which the benzene was stopped. The roentgen-ray treatments, however, were continued about two months longer. Although considerable reduction in the red count followed the use of benzene alone, the erythrocytes began to approach the normal level only after the seventh roentgen-ray treatment.

"The good effects of the combined treatment may be attributed either to the joint action of both measures, or to the delayed and cumulative action of the benzene itself. It does not appear likely that the latter measure can be the cause, since previous observers did not succeed in reducing the red count appreciably with the amount of benzene administered to our patient. We are, therefore, inclined to attribute this successful therapeutic result to the combined action of both agents. But the manner in which the roentgen rays may have served as an adjuvant to benzene therapy in this instance is not quite clear. We would venture the suggestion, however, that the roentgen rays may act in a more destructive manner on erythropoietic tissues, which have been rendered less resistant beforehand by the toxic action of benzene."

Zwaardemaker, H. Radioactive Balances. (*Nederl. Tijdschr. v. Geneesk.*, Amst., March 2, 1918, p. 602. Ref. *J. Am. M. Ass.*, May 18, 1918.)

Zwaardemaker reports here further research on the living isolated frog heart perfused with Ringer's solution made with some radioactive salt in the place of the potassium of the original Ringer solution. There seems to be antagonism between the action on the frog heart of the radioactive light metals and the radioactive heavy metals. Research in this line has elicited a number of new biologic facts as he describes in detail. Among them is that fluorescein seems to sensitize the heart so that a smaller amount of the radioactive salt has a greater effect than a large amount without it.

Maul, H. G. Bone Lesions in Yaws. (*The Medical Journal of Australia*, April 27, 1918.)

In an editorial on the above title we find that Dr. H. G. Maul has contributed to the clinical and roentgenological knowledge of bone lesions in yaws. He has studied one hundred patients in the Department Hospital at Manila, and has detected bone lesions in thirty-one of them. The involvements of the bones and joints were unsuspected, and the roentgenogram revealed the oval or elliptical rarefied areas. In twenty-six of the patients the bone lesions were multiple and in five they were numerous. The patients complained of pain when the articular surfaces of the joints were involved. The commonest site of these lesions was the shaft of the long bones. The tibia was most particularly involved. These osseous lesions were seen not earlier than six months after the appearance of the primary lesion, while the longest interval was nine years. The average interval was two years and nine months. Dr. Maul found salvarsan to be a specific. The changes appeared very rapidly and regeneration of the bone followed. The differentiation between syphilitic bone lesions and these lesions of yaws depends on the recognition of the primary involvement of the cortex of the bone and the absence of periosteal proliferation in the latter. The history and the skiagraphic appearances suffice to distinguish the two diseases from one another.

Condamin, R., and Nogier, L. Radium in Gynecology. (*Lyon méd.*, March, 1918, p. 97. Ref. *J. Am. M. Ass.*, May 18, 1918.)

Condamin and Nogier give the details of six cases which show the great advantages of radium treatment in its own special field, namely, for inoperable and recurring uterine cancer, for fibroma when an operation is inadvisable, and also preliminary to or following operative measures. They state that war conditions have evidently coöperated in allowing uterine cancers to get beyond the operable stage before they reach a physician. Since 1914 they have applied radium therapy in 500 cases of this kind. In one case an abdominal tumor reached two fingerbreadths above the umbilicus, in a girl of 12, with extreme cachexia and retention of urine. Under forty-eight hours of application, the radium in the center of the growth, the tumor disappeared completely and perfect health was restored. The total dose given was 24.03834 millicuries. No microscopic examination was made of the neoplasm tissue, as a complete necropsy in a short time was confidently expected. The tumor was undoubtedly malignant and originated in the ovary. It was as large as the child's head. The condition grew graver during the first two or three weeks after the exposure, evidently from absorption of toxins. This confirms the wisdom of removing all that can easily be removed of an inoperable tumor before applying the radium. In some of the cases reported this was done so effectually that there was n nausea, fever or other sign of toxic action aft the exposures. In a case of inoperable canc of the uterine cervix in a woman of 50, the cu has been complete for three years to dat The patient has complained at times of sligl pains in and around the uterus, but there no sign of recurrence, and the pains are probabl from compression of some nerve fibers in th scar tissue. In this and similar cases, the whol of the uterus has atrophied so completely th there is no need for the proposed hysterectom One disadvantage of preoperative radiu treatment is that the patients feel so muc improved, that they then withdraw the consent to an operation. A week after hyste ectomy, in another case, radium was applie to the sound tissue left, and a severe toxi febrile reaction followed, showing that th by-effects of radium occur with sound as we as with diseased tissue. In one woman of 3 the cancer returned three years after hyste ectomy, but the recurring tumor disappeare under radium treatment, and there has bee no further sign of malignant disease durin the nearly three years to date.

Gouldesbrough, Claude. *X*-Ray Appearanc of Trichiniasis. (*Lancet*, March 30, 1918 Ref. *N. York M. J.*, June 8, 1918, p 1099.)

Claude Gouldesbrough calls attention to th fact that after sufficient time had elapsed fron the initial stages of trichiniasis to permit o calcification of the trichinæ the use of the *x*-ra permits the making of a positive diagnosis witl ease. The calcified lesions show up in the plate as small ovoid discs of various sizes, locate in the muscles and definitely not attached t bone. In some of the areas the centres of th discs show clear. Such findings may occur a early as three months after the acute attack but usually a period nearer to six months i required for calcification.

Cameron, Donald F. Aqueous Solutions o Potassium and Sodium Iodids as Opaqu Mediums in Roentgenology. (*J. Am. M. Ass.*, March 16, 1918, p. 754.) Sodium and Potassium Iodids in Roentgenography. (*J. Am. M. Ass.*, May 25, 1918.)

The author discusses the theoretical and practical value of the salts mentioned for ystograms and pyelograms. For pyelography . 25 per cent solution is advised. For cystography a 15 per cent solution is advised. The esulting solutions are stable, neutral in reaction, and cause no precipitation in urine or bloody urine. On standing they become slightly yellow, but this causes no trouble. No special precautions are to be observed in preparing solutions. They are easily sterilized by boiling. The cost of these solutions is about half that of thorium. A 20 per cent solution of strontium iodide may also be used, but when mixed with urine a very slight but appreciable precipitate is formed.

KELLY, HOWARD A. Radium in Fibroid Tumors. (*Virginia M. Semi-Month.*, April, 1918. Ref. *N. York M. J.*, June 8, 1918, p. 1095.)

Howard A. Kelly states that, taking these cases as they run, handled by the skilled as well as the unskilled surgeon, the risk from operative treatment in them is still considerable. It has been his rule for many years to operate only where there is persistent hemorrhage or pain, where pressure symptoms are acute, or where there is good evidence of a complicating abdominal condition. Between March, 1912, and January, 1918, he has treated, with C. F. Burnam, 211 cases of fibroid by radium. The average age of these patients was forty-three years. Menorrhagia, metrorrhagia, or both were symptoms in 161 cases. Of the 148 cases in Group 1, viz., those forty years of age or over, sixty-two have been entirely cured by the treatment, the tumor having either disappeared or dwindled to negligible size; in forty-six the tumor has diminished, while in ten the patients are so well that they have never consented to a further examination. Setting aside cases where data are insufficient, those who have died from other causes, or who have had complications, one obtains 120 cases of simple fibroid, in 118 of which radium proved efficient. The sixty-three cases in Group 2—women under forty—were treated, as a rule, with temporary cessation of menstruation in view, or occasionally to reduce menstruation. In twenty-five the tumor nearly or quite disappeared, in sixteen it decreased, and four were well and not reexamined. The treatment consists of a preliminary curettage, the use of a polyp forceps to remove any peduncular growth, and the insertion of 300 to 50 millicuries of emanation of radium covered with a rubber cot on the end of a sound into the uterus, where it is allowed to remain about three hours. One treatment may suffice, or a second be required after several months. For this an external treatment may be substituted, consisting of radium, suitably filtered, applied over various areas of the abdomen for several hours. The intrauterine treatment is no more painful than the introduction of a sound. The immediate results are nausea for about twenty-four hours and abdominal tenderness for several days. Sometimes there is a leucorrheal discharge for a few weeks. In about half the cases no menopausal symptoms are complained of; in about one fourth they are moderate, and in the remaining fourth severe.

NORDENTOFT, S. Present Status of Roentgen Therapy, especially for Brain Tumors. (*Ugeskrift for Laeger*, Copenhagen, February 28, 1918, p. 331. Ref *J. Am. M. Ass.*, May 18, 1918.)

Nordentoft now has a record of twenty cases of brain tumors in which he has applied systematic courses of roentgen exposures. The results are quite encouraging, especially when compared with the 100 per cent. mortality of operative cases of cerebellar tumors in the Scandinavian countries. There is only one case known in Denmark in which a tumor elsewhere in the brain was successfully removed with long survival. He describes his technique and the findings and results in his twenty cases. The favorable experiences in his first series of eight cases have continued to date; there has been no recurrence of the growth or return of symptoms.

ELIOTT, ARTHUR R. Syphilis of the Aorta. (*The Medical Clinics of North America*, March, 1918.)

The importance of roentgen examinations in this disease is emphasized in this article. The author states that it is neglect if this modern method of study of the heart and aorta is not carried out, as it would enable the physician to detect the existence of a syphilitic aorta before it had advanced to a stage of degeneration.

He insists that the vascular change of syphilis constitutes the most important changes observed in this disease. The endarteritis of syphilis affects not only the circulatory organs but also the organs and tissues in general by interfering with nutrition.

The effect of this disease and its consequence are aneurysm, aortic regurgitation, and angina pectoris.

"The arterial disease of syphilis is a distinct type, differing from nonspecific arterial disease in several essentials, chiefly its mode of development, its usual focal distribution and the general absence of regressive metamorphosis, especially calcification. Microscopically, the endarteritis of syphilis is differentiated from the nonsyphilitic variety by the fact that the primary seat of the change is in the media and adventitia along the course of the vasa vasorum, any thickening of the intima that comes to pass being secondary in production. Conversely, in nonsyphilitic types of aortic disease the histologic change begins in the intima and predominates there. The true type of syphilitic involvement consequently occurs only in arteries that are supplied with vasa nutritia. This is why it is so often found in the brain because in the cerebral circuit even small arteries possess vasa vasora, whereas vessels of similar calibre in the extremities not being so provided escape these specific changes. For the same reason we find the ascending portion of the aorta to be usually the primary seat of change in syphilitic aortitis, in contrast to ordinary arteriosclerosis, wherein the changes are briefly situated in the descending aorta."

Other diseases, such as an acute rheumatic fever, streptococcus infections generally, and other acute infections, may produce aortitis, but rarely when compared with syphilis. When aortitis is due to acute infection, it undergoes spontaneous subsidence with the primary cause, but syphilitic aortitis, on the contrary, is stopped only by therapy.

He states that the aorta is one of the most frequent stations in which the infection may lurk obscurely. "From the practical clinic standpoint, accumulating evidence is forcing the conclusion that a persistently positive Wassermann in a patient without evidence of syphilis in the skin, mucous membrane or nervous system, points to the aorta as the next most probable seat of the disease."

"Larkin and Levy examined the aorta in 19 cases which showed positive Wassermann tests during the course. Seventeen of these 19 aortas gave evidence of aortitis. 60 per cent died from aortitis and its consequences. Citron used the Wassermann test in all chronic cases of aortic regurgitation finding it positive in 60 per cent. Warthin finds active lesions of the aorta in every case of latent syphilis examined." Thirty per cent. of all syphilitic patients with aortitis have aneurysm, and an equal percentage have sclerosis in retraction of the aortic valve. The suprasigmoid portion of the aortic arch is the point of election in the early stage of involvement. From this point it spreads in both directions. The early roentgen signs are dilatation or alteration of the curve of the aorta and abnormal pulsation. As these signs result only with a certain amount of corrosion the x-ray cannot be relied upon for the detection of aortic syphilis in the earliest stage.

Mantoux, C., and Maingot, G. *X*-Ray in Cavity Formation in Pulmonary Tuberculosis. (*Presse méd.*, Par., March 7, 1918. Ref. *N. York M. J.*, June 8, 1918, p. 1097.)

C. Mantoux and G. Maingot point out that the commonly recognized x-ray appearance of a lung cavity as a rounded light area in the lung parenchyma is not the only form which such a cavity may assume in x-ray examination. Often a cavity exists where a definite light area cannot be perceived. A special type of x-ray image, hitherto not described yet very characteristic when one once learns to recognize it, is one presenting, on a rather dark background, an appearance as of a cross section through a loose meshed piece of bread, with its agglomeration of incomplete circular spaces of different sizes, running into one another. During the act of coughing the breadlike area may become displaced and distorted. In some other cases the spaces are all approximately equal in size, regularly disposed, and in part polygonal in outline, presenting what the authors term the honeycomb condition. This appearance, which is met with especially in the upper half of the pulmonary fields, is often overlooked in radioscopy, becoming manifest only on the x-ray plate. If the spaces are large, however—usually in the tissues between the hilum and the clavicle—the condition is readily visible in radioscopy. During the act of coughing the honeycomb appearance changes less than either the ordinary large rounded vity or the breadlike cavity picture. Neither ust be confounded either with the reticular ppearance sometimes presented by fine bronhial ramifications, the socalled marbled apearance with less definite and regularly ounded outline, or misleading shadows at the ilum, which can be differentiated by comarison with the hilum of the opposite side. utopsies always showed losses of lung tissue t the points corresponding to the honeycomb r breadlike areas. Usually there were multiple avities in different planes of the lung, but in ne case with a very definite honeycomb condition there was found a single cavity crossed by a number of bands of fibrous tissue. Whereas the ordinary rounded space appearance is met with in over half the cases of open tuberculosis, the special appearances described were noted in one seventh of 350 such cases. The bread appearance was met with more frequently than the honeycomb. Not a single case among 250 patients with closed or suspected tuberculosis, showed either of these conditions. The auscultatory signs confirmed in four fifths of the cases the existence of cavities, where one of these conditions was noted.

BOOK REVIEWS

Electro-Therapy in Gynæcology. By Samuel Sloan, M.D., F.R.F.P.S.G. Consulting Physician to the Glasgow Royal Maternity and Women's Hospital, and to the Glasgow Hospital for Diseases of Women; Examiner in Midwifery and Gynæcology to the University of Glasgow, and for the Fellowship of the Royal Faculty of Physicians and Surgeons, Glasgow; President of the Section of Electro-therapeutics and Radiology, British Medical Association, Aberdeen, 1914, and of the Electro-therapeutic Section, Royal Society of Medicine, London, 1909–10; Hon. Fellow Gynæcological Society, Chicago; Formerly Consulting Physician Glasgow Samaritan Hospital for Diseases of Women; President of the Glasgow Obstetrical and Gynæcological Society; Examiner in Gynæcology for the Triple Qualification Edinburgh and Glasgow, etc. With thirty-nine illustrations. Price, cloth, $3.50. Paul B. Hoeber, New York. 1918.

The review of "Electro-Therapy in Gynæcology" by Dr. Sloan has been both a pleasant and a profitable task. The reviewer's interest becomes manifest in the introductory chapter of the book, where the author affirms that the presentation of his work is based wholly upon personal experience in the use of various electrical modalities in the treatment of pelvic and allied affections.

It is indeed a pleasure to be able to grasp in so small a volume the lifelong experience of an earnest and able worker. Most of the literature offered to the profession at the present time consists of voluminous compilations, chaotic and confusing in character. This is not true, however, of Dr. Sloan's book.

The author adheres to his promise in offering to the reader only the results of his varied experience, with the one exception of his interpretation of electrophysics. However, most readers will gladly pardon this exception, as Dr. Sloan's presentation of his hypothesis is most interesting and alluring, and, should the reader not be willing to accept the author's viewpoint, he will, at least, be fascinated with Dr. Sloan's ingenious deductions, and be given much food for thought and reflection.

The presentation of electromedical apparatus is concise and practical. American readers will be somewhat disappointed that more space is not allotted to sinusoidal or various static modalities, especially the static wave current. It must be remembered, however, that the author is presenting his own experiences and that he has achieved most brilliant results with the armamentarium that he utilizes.

The author's treatment of neurasthenia is somewhat contrary to our standard technique. Dr. Sloan, in the treatment of this affection, utilizes the secondary induced current applied to the head by large, well-fitting electrodes. The satisfactory results reported by this method of treatment by the author would seem to justify its employment. Care should be taken, however, that the technique as described by Dr. Sloan should be strictly adhered to.

The chapter on Sepsis of the Genital Tract is perhaps the most valuable contribution of Dr. Sloan's book. The author minutely describes the technique of the use of a special hydrovaginal electrode and its therapeutic application.

The chapter on the treatment of fibroid tumor of the uterus may prove of less interest to most American readers. In the treatment of this affection Dr. Sloan utilizes the constant current, and makes no claim for its use except the control of hemorrhage. As this result may be achieved by deep roentgenotherapy with less discomfort to the patient, electrolysis is likely to be employed with diminishing frequency in the future.

One of the most valuable features of Dr. Sloan's book is the appendix, wherein the author tabulates his results from the treatment of two hundred and twelve cases of pelvic affections by means of the various electrical modalities.

Dr. Sloan's book is most attractive and well arranged, and should be read not alone by those especially interested in electrotherapy but by gynecologists, who, as a class, are inclined to be ultraconservative in regard to all methods of treatment other than surgical.

John H. Burch

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CLINICAL OBSERVATIONS IN MILITARY ROENTGENOLOGY*

WITH ESPECIAL REFERENCE TO THE BISMUTH-IODOFORM-PARAFFIN PASTE OF MORISON AND TO A METHOD FOR THE DETERMINATION OF THE PRESENCE OF FOREIGN BODIES BY SECONDARY EMANATIONS

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THE following communication is offered as a meagre exposition of some impressions created and noted in actual field practice in military roentgenology under the present-day technique of the care of the wounded as pursued by certain of the Allied Forces. Its purpose is to describe conditions not unusual which have been met with by the writers, and which may be met with by any roentgen worker who enters the European war area. As in every form of scientific endeavor, it may be found that in clinical situations of the greatest expediency practice is far removed from theory, and many thoughtfully evolved technical plans must, of necessity, be abandoned under the pressure of active field service.

The military roentgenologist, desirous of contributing to the scientific literature, and stimulated to that end by a prospect of the relative quietude of routine, or even of research, at a so-called base hospital, often finds himself detailed to what may be in reality an evacuation hospital of large dimensions, where convoys of wounded are succeeded by proportionate evacuations in rapid rotation. The keynote at such posts, therefore, with relation to the wounded and consistent with their proper care is *speed*, and this is always a desideratum, even at the base, in time of "push." Under such circumstances, the simpler cases must, and can, be quickly handled to make way for those of a more complicated nature in which localizing methods of greater precision are necessary. At such periods of pressure, the load of disproportion between volume of work and available time weighs most heavily upon the *x*-ray department, because many cases pass through the hands of the roentgenologist only to be returned to a convalescent camp without operative treatment, although presenting a definite surgical complexion. Also, many cases are sent down from the casualty clearing stations (evacuation hospitals) a

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few kilometers behind the Line, bearing x-ray diagnoses, which must needs be again examined at the base on account of their nature, and this fact in no way detracts from the wonderfully accurate roentgen diagnoses made under pressure in forward areas; on the other hand, this accuracy is usually proven by the subsequent diagnostic procedure at the base.

Fig. 1. Case A. Gunner G. 29th Yorkshire Regiment.

Here the intermuscular dissemination of "bipp" does not occlude the foreign body.

While the activity of a military x-ray department is naturally directly proportionate to the existing degree and nature of military operations, the capacity for speed must always be maintained in order that any unusual pressure may be withstood. Since so great a part of the surgical roentgenology of a military station deals with the localization of foreign bodies the writers have found that, on occasions when vast numbers of such localizations must be made, the most simple methods consistent with accuracy must be employed. This statement by no means implies the lack of appreciation of the many localization methods which the war has produced, but their many excellent points do not always coincide with the necessity for rapidity, which in our experiences has been almost constant. We have found that a simple parallax method, or an equally simple "displacement" method, suffices admirably for all purposes except where especially accurate transference of extraneous "known points" is to be made to the surgeon, as the use of the compass method would insure. Such accuracy is demanded nearly always in cases where it is important to take the necessary time for the purpose. Our simpler problems were always set aside for cases such as wounds of the head and thorax, where the greatest possible degree of exactitude is required. In the simple cases we found that we could work best and quickest with one of the two methods first mentioned (to wit, a simply managed parallax method and a method of displacement such as might be exemplified in the Strohl method). Our record of one hundred and forty-three localizations in the twenty-four hours tends to bear out this general statement.

It is essential to localize as near to the foreign body as possible. In other words, to so manipulate the patient, if possible, that the shortest distance will be obtained between screen surface and foreign body. Our method of doing this implied two steps. First, a preliminary step of "gross localization" by which, upon rapid tube-displacement from side to side and in the direction of head to feet, the speed of shadow movement will indicate clearly *in gross* the distance-relation to the plane of the screen. If it is thus found that the horizontal plane of the foreign body be deeper than the medium horizontal plane of the part under examination, the patient is turned or manipulated, whenever possible, so that the short distance is uppermost. The second step is then undertaken—that of finding the central ray and proceeding with the localization method

Fig. 2. Case B. Private K. Sherwood Foresters. Multiple foreign bodies, with much "bipp" simulating others.

of election. The question of the manipulation or movement of the patient is always influenced by the severity and extent of the wounds. The eminent likelihood of secondary hemorrhage, the question of intense pain on motion, the presence of gas infection or gas gangrene, the presence of Carrel tubes, will all make at times the acquisition of desirable postures difficult if not impossible. It is unfortunate that there is no such thing as standardized positions in military roentgenology.

Perfect *liaison* with the surgeon is possible only when he is informed of the position the patient was in when the second localization step was undertaken, and such *liaison* is maintained only when he bears in mind that the skin mark of the vertical ray should be the highest point of the vertical axis of that part. If there be no skin to mark at this point, there are numerous ways of marking tissue other than skin.

It is unfortunately the case that there are other impedances to obtaining gross localization beside the nature and distribution of the wound or the multiplicity of the wounds. Such handicaps may often result from the presence of material injected into the wound in forward areas

Fig. 3. Case C. Captain A. 11th Hants Regiment. Wide dissemination of "bipp," not grossly obliterating foreign bodies (projectiles).

for the purpose of producing antiseptic action. The presence of these substances, although not distinctly deterrent factors to ultimate diagnosis should be constantly

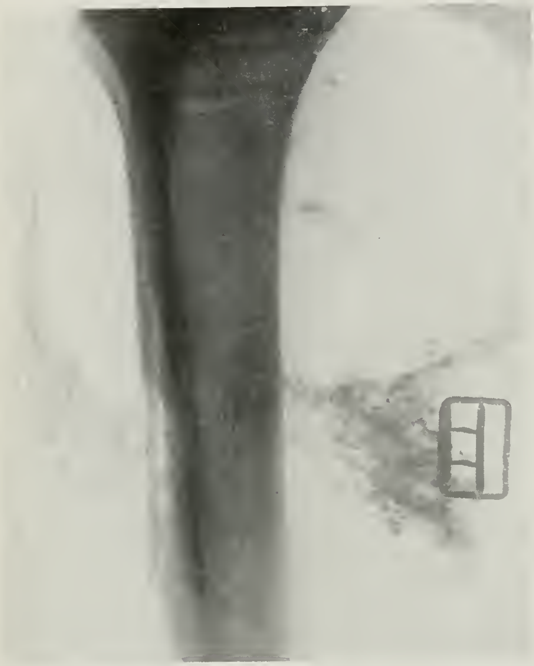

Fig. 4. Case D. Private H. Black Watch. Fine spread of "bipp" which does not occlude projectile material.

borne in mind as to their existence in any given case. Out of the various antiseptic methods employed by the British perhaps that which was most constantly encountered by us was the presence in or about the wound of the so-called bismuth-iodoform-paraffin paste of Rutherford Morison, first described by him in 1916. This combination, as the basis of an injected dressing for infected wounds, presents varying manifestations as recorded upon the *x*-ray plate, and it is with these manifestations that the military roentgenologist should acquaint himself. In general, the disposition of this "bipp," as it is called in abbreviation, with relationship to the foreign body, may be: (1) an engorgement of the track with embracement of the body itself, or (2) a wandering from the track into the surrounding tissue without any special or characteristic relationship to the foreign body. The latter manifestation varies, naturally, with the degree of septic tissue-disorganization. The roentgen graphic evidence of the presence of "bipp" often transcends that of foreign material acquired in combat. It becomes, therefore, a matter of some moment promptly to recognize by screen the extent and form of "bipp" distribution, in differential comparison with the size and position of the foreign body or collection of bodies. With but short practice, this differential diagnosis becomes easy by but a glance at the screen, and it is rarely that a plate is required to settle the point. Where they do occur, however, instances of unusual difficulty are seen in cases where either a single very small foreign body or a multiplicity of foreign bodies may be present. Here a somewhat sporadic or finely disseminated distribution of "bipp" may lead to a perplexing shadow-complex by screen which, it may be, a plate only can elucidate. It is injudicious to pin one's diagnostic faith on the as-

Fig. 5. Case E. Sapper M. Gordon Highlanders. Large projectile almost completely occluded by "bipp."

mption that shrapnel or other forms of ojectile will produce stronger shadows an bismuth-iodoform-paraffin emulsion,

FIG. 6. CASE F. PRIVATE G. SCOTS GUARDS. Carrel tube draining an extensively "bipped" wound.

for, as a matter of fact, this is not so; especially when in a given shadow-complex, the two substances vary widely as to screen-plane or plate-plane relationship.

The screen-diagnosis of the presence of a relatively small foreign body in close juxtaposition to larger and often denser "bipp" masses is a problem of a different nature, although often of equal degree. It is usually possible to disassociate the respective shadows by either movement of the subject or of the tube, although cases may arise wherein even this produces but little added information. Even the plate at times effects a differentiation only with difficulty.

Inter- or intramuscular "bipp" distribution presents diagnostic difficulty only rarely, as the "bipp" shadow in such cases usually forms a thin tracery which in no wise occludes the shadow of even a minute foreign body.

The bismuth-iodoform-paraffin paste of Morison is but one of several extraneous substances, as has been mentioned, employed in the surgical treatment of infected wounds, which may offer slight problems of differential diagnosis by x-ray. For instance, the shadows of cross-sections of Carrel tubes have also been known to stimulate foreign bodies of meagre density; the relative surgical value of bismuth-iodoform-paraffin, however, makes it a necessary therapeutic factor which the military roentgenologist must educate himself to meet in diagnosis.

The inclusion and exclusion of secondary rays and the well-known screen appearances in such performances may be

FIG. 7. CASE G. SERGEANT P. 3RD GLOUCESTERS. Large mass of "bipp," occluding projectile.

utilized to lay a diagnostic foundation in rapid way as to the presence or absence of foreign body in any given field. This

Fig. 8. Case H. Private R. M. G. C.
Large projectile, with others complicated by "bipp."

method has been found especially useful by one of us (Brown) as applied to the region of large joints, where dense bony masses are normally found. In thin subjects, especially, it will often be found that anatomic structures, as, for instance, the coracoid process, will, when vagrant rays are excluded by diaphragm, appea of such localized density as closely t simulate a foreign body of correspondin size. When close fluoroscopic search i being made for a foreign body within th joint, this fact may for the moment b confusing until the diaphragm is widene sufficiently to allow a brilliant vagrant il lumination of the visualized screen-field This illumination will immediately pro duce an obliteration of the shadow-promi nence in question, if it be anatomical an normal; if it be a foreign body, it will, o course, absorb the vagrant as well as th normal rays and its shadow will persist This "short cut" method enables one, i field service, at once to exclude from th region about the important joints espe cially, the possibility of error in recogni tion as between foreign body or promi nent anatomic process of great density. I foreign body is thus determined it may b localized by any of the accepted or gen erally used methods.

In conclusion, we desire to acknowledg the support and coöperation we have re ceived in our work from our respectiv Commanding Officers, Lieutenant-Colone Robert U. Patterson, M.C.U.S.A. an Colonel C. C. Collins, M.C.U.S.A.

CAUSE OF LEUKEMIA

The *Nederlandsch Tijdschrift* summarizes an article by Wiczkowski in the *Przeglad Lekarski* relating that he succeeded in inducing a disease in a hen, resembling in some respects human leukemia, by intravenous injection of pleural effusion from a young man who had developed acute leukemia after a trauma. The leukocytes numbered 590,000 and there was pleuris on one side. In the hen the hemoglobi dropped from 55 to 9 per cent. and th bone marrow showed infiltrates, etc. Th clinical picture differed completely fron that with so-called fowl leukemia. (Ref *Journal Amer. Med. Assoc.*, Vol. 71 No. 10.)

INFLUENCE OF RADIUM ON CANCER TISSUES *

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WHAT I have to say concerns not so much the therapeutic accomplishments of radium, as the effect the advent of radium has had on the general progress of cancer research.

Since 1904, it has been my lot to make periodic visits to cancer research institutions in Europe, and I recall two observations of special interest in connection with the treatment of cancer. I found that these institutions were always in the habit of employing some constitutional agent in the treatment of inoperable cancer. The list of the agents used was quite large, and included thyroid extract, antisera made against tumor proteins, injections of tumor proteins, vaccination by living cancer cells, and a number of toxic substances, among which were enzetol, colloidal copper, and other metallic colloids. The Huntington Fund in New York has spent a good deal of time investigating many of these agents, and vaccination, especially, has been used on an enormous scale all over the world.

The second fact of importance is that there were definite and well-attested therapeutic results obtained by many of these agents. These results, however, were so uncertain and capricious that one could never be sure that they were not due to some spontaneous change in the natural history of the disease, so much so that a distinguished French surgeon, Tuffier, characterized them as paradoxical. Now in the case of radium, the conditions are entirely different. It has been evident from the very first that when one applies the same amount of radium through the same filter to the same type of cancer, the result is invariably the same.

We must welcome the discovery of an agent which will affect cancer in a manner not open to argument. Radium can be relied upon to do the same thing under the same circumstances. Under many circumstances the result involves the disappearance of cancer tissue and the complete healing of the lesion. It is highly important, also, to recognize that the action of radium is specific, in the sense that it produces results which have not been duplicated by any other method, and produces histological changes in tumor tissue which one does not see under any other circumstances. What these changes consist in will be shown later in the evening, and I will not attempt to analyze them in detail, but they are controlled by two general principles.

Radium exerts its chief effect upon the cell nucleus, especially upon the dividing nucleus, by means of which the growth of the cells is inhibited and they undergo a peculiar form of liquefaction necrosis and atrophy. Another important principle of its action is the effect upon the underlying tissue in which the tumor is growing. It stimulates the growth of granulation tissue, which excavates the cells of the tumor and causes a remarkable exudation of various round cells, the result being a natural and complete healing process.

In estimating the effects of radium upon tumor tissue, it is highly important to recognize that different tumor cells react in a very different manner to radium, some tumors being extremely susceptible and others very resistant. Among the susceptible growths are the very cellular and rapidly growing tumors, as lymphomas, embryonal carcinomas, and basal cell carcinomas. On the other hand, squamous cell carcinoma is comparatively resistant. The benign tumors and those which contain a considerable amount of dense fibrous tissue are quite resistant.

* Discussion at the Meeting of the County Medical Society, May 27, 1918, at the New York Academy of Medicine.

The pursuit of radium therapy has required a study of the whole list of tumors with regard to their physical and chemical constitution which determines their response to radium. The numerous conflicting reports which one hears regarding the results of radium therapy are very largely due to the failure to recognize those essential differences in tumor structure.

Any prophecy as to the future position of radium is perhaps ill-timed. In one respect, this agent is far from being an ideal cancer cure. As employed at present, it has no constitutional influence at all. It may be possible that, by injecting radium in the form of deposit in salt solution, a constitutional effect can be produced, but this is a matter for future study. This and many other details in the proper application of radium form a complex field of investigation which requires the services of a well-equipped physical laboratory. At the Memorial Hospital we are conducting such experiments on a considerable scale, with the idea of making the application of radium more accurate and of employing it for different diseases in more appropriate ways. The local application of radium produces its effect over a limited territory. For that reason I firmly believe that its proper field is one in which the specific effects of this agent can be made to include the whole field of the tumor, and this means, as a rule, the comparatively early stages of cancer. As a remedial agent in advanced or inoperable cancer its results, while extremely important in many circumstances, will never, I believe, represent its greatest usefulness.

TREATMENT BY RADIUM OF CANCEROUS MUCOUS MEMBRANES *

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ANY ONE who has had an opportunity to observe the effects of the treatment of malignant disease by the use of radium cannot fail to recognize that an important field of usefulness must be assigned to this agent in the management of cancer.

It is a matter of much importance to accurately know the indications for this use of radium. At the present time, there is a wide difference of opinion upon the place in cancer therapy which radium should occupy. This difference is perhaps most strikingly expressed in one of the first questions, in this connection, to suggest itself. Should some of the more important forms of cancer be treated by radium in their early stages, in an attempt to cure the disease by this agent, instead of by operative removal, or should radium be used solely as a palliative or supplementary means to the usual methods of dealing with the disease?

Approximately a year ago, at a symposium on radium in this room, it was stated by one of the most important users of radium in this country, that those seeking to find in radium a cure for cancer would be disappointed, that in all forms of cancer, except possibly some of the benign circumscribed varieties of skin epithelioma, the most that can be expected from the use of radium is temporary improvement in the patient's condition.

* Read at the Meeting of the Medical Society of the County of New York, May 27, 1918, at the New York Academy of Medicine.

Improvements of a very considerable degree are obtained in many varieties of tumor. They are especially notable in the leucemias, in the lymphosarcomas, and in the very cellular carcinomata, such as the teratoid carcinomas of the testes, even after these have produced metastasis in the abdominal cavity. They may always be obtained after surface application to the carcinomas of the mucous membranes, even when of large size. Few, however, of any of the more advanced inoperable growths in which these improvements have been obtained, have failed to recur; and the fear that the same result would follow the treatment of the more favorable and smaller operable lesions by radium in a larger proportion of cases than it would follow the treatment of these patients by operation, has led to the belief that it would be unjust to treat these patients by radium.

At the Memorial Hospital, we have been encouraged to treat a rather large number of operable cancers of the mucous membranes. The remarkable improvement in some of the cases treated palliatively has not alone stimulated this attempt, but more especially the favorable result obtained on many early cancers in patients refusing operation, or in whom operation was contraindicated for other reasons. Two facts have been demonstrated by this experience: first, within the time limits in which we have been working, single applications were often sufficient to cause apparent complete retrogressions; and second, in the larger lesions, where this favorable result was not obtained, the lesion had become much more of an operable one than it was before treatment. There have been obtained, for instance, complete retrogressions within the time limits in which we have been working

In twenty-one cases of cancer of the lip.

In eight cases of cancer of the superior maxilla, including two originating within the antral cavity.

In nine cases of cancer of the tongue.

In one additional case in which a large growth was greatly reduced in size, and has since been removed under local anesthesia, without recurrence to date, an interval of five months.

In three cases of cancer of the tonsil, and probably in two others, which have not been traced to date.

In one patient with cancer of the soft palate.

A number of patients with cancer of the larynx have been greatly improved, but none have been cured by radium alone, although in several cases there was a complete disappearance of the disease for a time. In one patient, with advanced cancer of the larynx, an incomplete but marked retrogression of the disease was caused by radium.

At this stage, I removed the larynx, and the patient has been free from recurrence now for one year, and is able to speak loud enough to be heard across a small room.

In cancer of the esophagus, definite temporary improvements have been obtained from single treatments. These improvements have meant relief of the dysphagia, sometimes for one year, to a much greater degree than can be obtained by bouginage. One patient, whom I treated two years ago, and upon whom I made a diagnosis of cancer of the esophagus, at the time, by esophagoscopic examination, is still well. I believe, however, that it is not absolutely certain that this man had cancer of the esophagus. We did not secure, in his case, a confirmation of the diagnosis by microscopical diagnosis, and the cure of his condition by the application of the radium has not been duplicated in any other case.

Cancer of the rectum offers a most important and fruitful field for radium therapy. The operative cure of cancer of the rectum has been disappointing. Moreover, the necessity of establishing an artificial anus in the majority of the cases is a most serious drawback to the operative treatment of cancer of the rectum. While we cannot, at the present time, claim with the same certainty the favorable results in the treatment of cancer of the rectum that we can in the more accessible cancers of the mucous membranes of the mouth, yet the results thus far obtained fully warrant the management of early cancer of the rectum by radium. If the entire management should not be by radium, at least the preliminary treatment should be by radium.

Among the patients whom we have treated, clinically complete retrogressions have been obtained in eight patients. At the present time we are unable to speak of absolute cures. Of these patients, one was treated first in August, 1914. When last heard from, a few months ago, he was well and working.

Life was prolonged in two other cases in comparative comfort for two years.

Three other cases are, at present, clinically free from disease at an interval of one year from the time of their treatment.

The majority of our patients had very advanced lesions, and the end results in these patients must be wholly discounted. The technique of the treatment of cancer of the rectum is constantly improving.

Unquestionably, the most promising field of radium therapy among the mucous membrane cancers is cancer of the uterus. It is possible to safely give these cancers very large doses, and it is doubtless due to this fact that, in my own experience at least, practically uniformly good results have been obtained. Among my own patients, I have two who had primary growths of the cervix, involving most of the vaginal surface of the cervix, from which positive microscopical sections were obtained. These two have remained well after one treatment for a period of two years up to the present time. At least five other patients promise equally good results to date.

The mixed tumors of the parotid, many of them being fairly cellular with the carcinomatous elements pronounced, have given almost specific response to radium treatment. We have five striking results among these tumors.

We have wholly omitted reference to epithelioma of the skin, not because the benefit conferred upon these patients is not a life-saving one, but because the problem is relatively simple. The real problem in the treatment of cancer today is the successful management of cancer of the mucous membranes. It is a problem unsatisfactorily solved by surgery alone. The delay in the treatment of these cases is not wholly responsible for this unsatisfactory solution by surgical means. In cases of cancer, in equal stages of growth, the character of the end result among cases cured by radium, coupled with the ease to the patient by which this result can be obtained, far surpasses the results of surgical ablation.

We offer these results, as demonstrating the possibilities of the radium treatment of early cancer of the mucous membranes. It is true that some of these results have been obtained in a manner which is far from ideal, nor have they been obtained uniformly in the same class of case. Nevertheless, the possibilities of the radium treatment of cancer are by no means exhausted. When we began our work at the Memorial Hospital, we little dreamed of the step to step improvement in technique, which we have already accomplished. This improvement promises satisfactory and fairly uniform results for the future.

RADIOTHERAPEUTIC METHODS IN THE TREATMENT OF UTERINE HEMORRHAGE*

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THE treatment of uterine hemorrhage with or without uterine fibromyoma is now so well established that we must assume that, given a sufficient dose, one can at will produce a permanent amenorrhea in women over thirty or thirty-five; and that in women under thirty a temporary amenorrhea can be brought about by careful dosage, while in women over thirty the latter result will be less certain. Secondly, the increasing number of cases reported with almost no specific denials indicate that a fibromyoma of the uterus will shrink to insignificant proportions after proper dosage with x-ray or radium.

Granted, then, that the above results may be assured, several problems remain to be solved. The first of these involves the selection of proper cases for such radiotherapy, and the second concerns the general method of application and dosage of these two agents for the bringing about of one of the three results above mentioned.

The conditions which are increasingly referred for this method of treatment are, first, those of excessive or prolonged hemorrhage from a uterus showing no gross pathological lesions, which occurs at puberty, at the menopause, and, to a less extent, during the whole child-bearing period, and, secondly, fibromyoma of the uterus in all its phases. The cause of the bleeding in the grossly normal uterus was up to about ten years ago believed to lie in anatomical lesions which represent various stages of inflammation, either in the endometrium or the uterine muscle and vessels. Chronic endometritis was a name applied to the conditions of the endometrium so frequently associated with uterine hemorrhage. This so-called chronic endometritis (endometritis hyperplastica, endometritis villosa, endometritis polyposa, etc.), as a primary cause of uterine hemorrhage, however, was effectually discredited by Hitschmann and Adler in 1908, and by many others since. Their researches have clearly shown that the swollen, congested edematous membrane is merely the counterpart or an exaggerated form of the normal premenstrual endometrium, and that although it, like the normal membrane, without doubt is concerned in the actual pouring out of uterine blood, nevertheless shows every evidence of being stimulated or otherwise affected by the same influences or substances which bring about normal menstruation.

Researches on clinical material and by direct experiment with substances injected into animals have clearly demonstrated that such a substance does exist in the corpus luteum in large amounts and also in the placenta. Other researches show that in individuals suffering from uterine hemorrhage there is, with striking frequency, found a ripe corpus luteum. In normal menstruation, at any rate, it has been shown that the cycle of hyperplasia and depletion through which the endometrium passes is coincident with the cycle of development and recession of the corpus luteum, and it is now universally believed that the dependence of the bleeding on the corpus luteum is absolute. It seems almost certain, then, that in the pathological, as well as in the normal, uterine bleeding some disturbance of the graafian follicle in some stage of its development—probably the corpus luteum—is the essential factor, whether this be in turn affected by other glandular substances, emotion, etc., or not. The pathological bleeding is merely a variation in amount,

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duration, character or periodicity from the normal menstrual flow.

The other lesion in the grossly normal uterus associated with hemorrhage is fibrosis in the muscles and vessels, so-called chronic metritis (myopathic hemorrhage). The presence of large amounts of connective tissue in the uterine walls and vessels in cases of uterine hemorrhage was pointed out by Theilhaber. That, in a large majority of such bleeding uteri, there is an increase of connective tissue is demonstrated by an examination of even a small series of uteri. Pankow and a large following, on the other hand, present irrefutable statistical evidence to show that fibrosis of the uterus is just as frequent in the non-bleeding as it is in the bleeding uterus, and that this condition is a more constant sequela of multiple child-bearing than it is an associated lesion of the abnormally bleeding uterus. The previous error lay in the fact that practically all such uteri come from older women. In the majority of bleeding uteri which I have examined (all in multiparous women) both hyperplasia of the endometrium and fibrosis of the muscle have been present together. The presence of both weakens the importance of either as an essential cause of the abnormal bleeding.

If, then, abnormal uterine hemorrhage be nothing but a variation of the normal and we wish to bring about its cessation, the logical procedure is to destroy the one essential element in the menstrual cycle, namely the graafian follicle. It has been shown that next to the lymphocyte and spermatozoa, the ripe graafian follicle is the most susceptible to the action of the x-ray and radium. It needs but a step then to apply these agents to the graafian follicle to bring about the cessation of the normal or pathological uterine flow. The ripe follicle is very much more susceptible than is the primordial follicle, and if the dose may be possibly regulated to destroy only the follicles of an advanced degree of development, then a fairly definite period of amenorrhea could be brought about, depending upon the number of primordial or immature follicles remaining after the exposure.

Uterine hemorrhage is often accompanied by gross anatomical changes in the uterus, and an incomplete analysis concerning such cases, which I am now making, shows that in only four groups of conditions does there seem to be any peculiar association between the hemorrhage and the pathological change. There is a rather low percentage of hemorrhage with acute pelvic inflammation. There is a somewhat greater percentage of cases of hemorrhage with retroversion of the uterus, although in this type of case the retroversion is associated with other conditions such as cystic ovary, infantile uterus, etc. However, the reduction of the retroversion has relieved the bleeding in a fair percentage of cases, although in the majority of the cases this procedure has had a negative or only a temporary effect. The cause of the bleeding in these two conditions is still doubtful. It may be that active or passive congestion exerts a mechanical influence in the causation of excessive bleeding, but cases presenting a much more severe congestion of the uterus and cases of hypertension, unassociated with excessive bleeding, cast some doubt upon this factor and make us lean more on the theory of a disturbed function possibly brought about by the disturbed anatomical relationships —nervous irritation, ovarian circulatory disturbance. The third group includes the ulcerative conditions—carcinoma, polyps, pedunculated submucous fibroids, erosions. These, when operable, are so clearly without the realm of radiotherapy that they will only be mentioned.

The fourth anatomical condition associated with excessive uterine bleeding is fibromyoma of the uterus. There is no doubt as to the definite coincidence of these two conditions. The causal relationship, however, is still obscure. That menorrhagia may be coincident with a fibroid without any causal relationship, and may recur after the fibroid has disappeared without recurrence of the fibroid is illustrated by the following case.

Case I.—A woman forty-six years of age was admitted with severe menorrhagia of several months' duration. On examination she was found to have a fibroid measuring about 8 cm. in diameter. She was given 625 milligram-hours of radium intrauterine, filtered with one millimeter of brass, after a curettage. Amenorrhea ensued after four periods, persisted for eight months and was followed by a recurrence of the bleeding. On admission about a year after her first radium treatment, examination showed a grossly normal uterus. She was again treated with one thousand milligram-hours of radium not filtered.

The interesting question that arises from this case, aside from the effect of the dosage, is what relation the fibroid had to the uterine hemorrhage when the latter reappeared in the absence of the former. I cannot help but feel that there was a mere coincidence in the presence of a fibroid with a typical functional menorrhagia. Furthermore we had one case of menorrhagia unrelieved by myomectomy; and two cases in which the onset of the excessive bleeding followed myomectomy.

On the other hand, a long series of cases of excessive uterine hemorrhage relieved by myomectomy shows that there is some causal relationship between some fibroids and the bleeding. Be that as it may, it would seem that the fibroid would exercise a contributory rather than an essential rôle in the uterine hemorrhage, because in no case of fibromyoma treated by radiotherapy has there been any more difficulty experienced than has been encountered in the treatment of grossly normal uteri.

As to the mechanism by which the fibroid is diminished in size, three theories are offered. The first, and probably the most important, is that the fibroid shrinks in the same manner as do those fibroids which are present in women who have passed the menopause. The second theory is that there is a direct action upon the smooth muscle cells by the rays, causing them to degenerate and become replaced by connective tissue. The third theory is that the endarteritis caused by the x-ray is severe enough to starve the myomatous growth.

That amenorrhea may have more to do with the shrinking of the fibroid than direct action on the mass or starvation by obliterated vessels may be perhaps demonstrated by the following cases.

Case II.—A fibromyoma of about ten centimeters in diameter was found in a woman thirty years of age who was suffering from severe menorrhagia. Operation although preferred was counterindicated. Therefore roentgenotherapy was instituted. There was a total dosage of three thousand milliampere minutes (given as indicated below) in two sessions a year apart. The first fifteen hundred units stopped the menorrhagia so that the patient had seven scant periods during the course of the year before the hemorrhage recurred, but the fibroid remained unchanged in size. The second dosage produced a permanent amenorrhea for a few months. The size of the mass has not since been noted.

Case III.—A woman of thirty-six was given four hundred milligram-hours of radium, filtered through one millimeter of brass. This caused a great diminution in the amount of the uterine bleeding for about four months. The bleeding then became more profuse, and the patient chose hysterectomy rather than repeat the radiotherapy because she was afraid she had a cancer, although this had been excluded by curettage. The uterus showed a very constant endarteritis. The muscle tissue in part was replaced by connective tissue.

The interesting point to be noted in these two cases is that, even with a large x-ray dose, the fibroid remained unchanged while menstruation persisted. The dosage is sufficient, in a woman of forty or more, to produce a permanent amenorrhea and to cause a pronounced or complete shrinkage of the fibroid. In the second case, while no myoma was present it was clear that the profuse blood outpouring from the endometrium was not hindered by the sclerosis in the vessels.

Further evidence against the theory of tumor starvation by occluded vessels is presented in the so-called myopathic hemorrhages mentioned above, where excessive bleeding occurs in a uterus more sclerosed than those affected by the rays. Direct observation on the chick's heart indicates that smooth muscle is particularly unsusceptible to radiant energy. Fibroids treated by roentgenotherapy in young women usually resume their growth when menstruation becomes reëstablished. On the other hand, fibroids shrink more rapidly after the artificial menopause than in the normal. Moreover, certain fibroids which have continued to grow after the normal menopause have been reduced by x-ray. What influences the constitutional changes, such as lymphocyte destruction, stimulation, or the elaboration of substances caused by the breaking down of susceptible cells, may have is still a matter for study. Whatever importance these processes have, there is one effect necessary for the satisfactory reduction of a fibromyoma, and that is some degree of amenorrhea.

Before taking up the matter of the application of the rays to the conditions mentioned above, it is best to try to illustrate as well as possible what is meant by dosage. With the roentgen ray, which in this form of treatment is now given almost entirely through the abdominal wall, the erythematous dose is of course the standard. A dose just short of this is given through as many portals of entry as seems practical, the number differing according to the ideas of the particular therapeutist. The number of openings through which I have directed the cross fire is determined by that size of opening through which I feel reasonably certain of directly attacking an ovary with the rays. This is a square measuring six centimeters. About seven of these areas fit below the umbilicus. Through each buttock and through the sacrum three more areas are provided, making ten in all. Ten erythematous doses through ten such areas, each dose directed at an ovary, constitutes a series. Each area of skin is given a rest of about three weeks, is exposed again, rested again three weeks and again exposed. Such a dose is practically sure to produce a permanent amenorrhea in a woman in the neighborhood of forty.

What a partial dose may be is more difficult to ascertain. Two women of over forty have been made permanently amenorrheic with two-thirds the above dosage. On the other hand several others who have interrupted the treatment at the same stage have had their periods return. In young girls the partial dosing is almost as difficult to determine because of the apparent variability in susceptibility in different individuals. This may be illustrated by the two following cases.

Case IV.—A girl of sixteen suffered from metrorrhagia for two years. Various operations were unsuccessful. Hysterectomy was the last resort, with the exception of roentgenotherapy. The complete three series as indicated above had no effect upon the bleeding until acetone was applied to the endometrium. The patient was regular for six months, when severe metrorrhagia recurred. Six hundred twenty-five milligram-hours of radium in the uterus caused a partial amenorrhea (six periods in a year), when metrorrhagia again appeared. Six hundred twenty-five more milligram-hours were applied and the patient is still amenorrheic after a short period.

Case V.—A girl of fifteen suffered from severe metrorrhagia for a year, the duration of her menstrual life. She was given one-fifth the x-ray dose given to the previous case, her periods became regular and stayed so for four months when she had another hemorrhage. The dosage was repeated, her periods were regular for three months, then skipped for four months and have been fairly regular but scant for eighteen months.

In neither case were there any menopause symptoms. The dosage in the first case was nearly ten times as great as in the second and the result, if anything, not quite so complete.

With radium a permanent amenorrhea may be promised in women over thirty after applying in utero fifty milligrams unfiltered for twenty-four hours. When twenty-five milligrams are inserted for twenty-four hours, there is likely to be a return of menstruation after a time in older women and almost certainly in women under thirty, especially if it is filtered with a millimeter of brass. See Case I.

The problem of applying the above dosage to the conditions mentioned is one whose difficulties fall rather more upon the gynecologist than upon the radiotherapeutist, and in the majority of cases the two should work with mutual knowledge and sympathy. The ideal arrangement is to have the gynecologist properly equipped to carry out any procedure necessary, whether operative or roentgenotherapeutic. If it be admitted that it is possible and feasible to produce with a reasonable certainty a permanent or partial amenorrhea in the conditions mentioned above, and that, further, the rays will cause a fibroid to shrink to a satisfactory degree, or even to disappear, so as to evade the examining finger, the problem becomes one of selection in the first place and of dosage in the second.

Excessive hemorrhage in the grossly normal uterus is due to a disturbance in the proper balance between the various elements controlling menstruation. The ideal treatment is to restore that balance. In the bleeding of young women the disturbance is one of development, and every effort should be made to restore this balance by general treatment, by endocrinological study and treatment, trying to replace the deficient factor, or even by simple curettage, although improvement follows the latter in only about ten per cent of the cases so treated. Radiotherapy acts by destroying the graafian follicles and is not the ideal treatment, because it must be assumed that the ability to reproduce must be undisturbed wherever possible. When, however, the bleeding becomes so severe that hysterectomy is threatened, radiotherapy is by far the method of choice. In women under thirty partial amenorrhea can be promised, and in women between thirty and forty, it can be accomplished with somewhat greater difficulty but, in most instances, certainly. In this latter group, however, the promise of a return of menstruation must be given with caution, because even after small dosage a permanent amenorrhea may be produced, due no doubt more to the occurrence of a premature menopause than to radiotherapeusis. Such a case is the following.

Case VI.—A woman of thirty-four suffered with menorrhagia and metrorrhagia for two years, being incapacitated for one year. She was given two-thirds the dose mentioned above as necessary to produce a permanent amenorrhea at the menopause age. She had two periods thereafter and has been amenorrheic since—two and one-half years. While her health is perfect and she has been able to resume her activities as superintendent of a metropolitan hospital she, nevertheless, had a few hot flushes during the first year and is distressed with the idea of being unable to have children, although there is no actual desire for them.

With *x*-ray a single series as described above is given after each period. If the next one be excessive the dose is repeated. With radium six hundred twenty-five milligram-hours intra-uterine, without filter, is safe in women under thirty. Over that the dosage is best cut down by a millimeter of brass.

In women near the menopause age—thirty-eight or over—radiotherapy becomes a method of choice because the menstrual balance is disturbed by the approach of old age and the cessation of the child-bearing period, probably as a consequence of the decadence of the ovarian function. Since the natural menopause is imminent it seems logical to precipitate it and to save the woman months and even years of partial or complete incapacity because of her uterine hemorrhage. In such cases a massive dose is indicated from the start.

The treatment of bleeding associated with retroversion is very much like the above. The deformity should be replaced in all cases, if possible, without operation, and the effect upon the bleeding noted. In younger women, moreover, operation should be performed if reduction fails. In older women, however, if there are no other symptoms from the retroversion, it seems fairer to leave the displacement alone, because the reduction of such displacements in older women has not, in my experiences, relieved the bleeding. In these women radiotherapy should be instituted at the outset.

The excessive bleeding associated with fibromyoma of the uterus cannot be treated alone, but must be considered along with the whole question of the proper treatment of fibromyoma. Before the use of roentgenotherapy there were certain principles governing the treatment of fibroids. The first of these was that the fibroid itself was not a menace and caused no damage except by its size, that it did not change from a benign tumor into a sarcoma. Secondly, such a fibroid should not be treated except when it gave symptoms, because sarcoma is so rare that operating on it on mere suspicion would harm more individuals than it would help. The symptoms for which operation was advised were, in the first place, excessive hemorrhage, secondly, various symptoms due to pressure on nerves or organs and, thirdly, rapid growth or large size of the tumor mass.

With the advent of radiotherapy the problem remains very much the same. The new problem is again concerned with the selection, out of those needing treatment, of the fibromyomata which are suitable for radiotherapy, and of those cases which should be operated upon. As above stated, the results to be expected from radiotherapy are, first, cessation of the bleeding, and, second, the shrinking of the growth. This shrinkage requires varying lengths of time in different cases and, in my opinion, should receive scant consideration from the radiotherapeutist. If a mass is pressing upon any organs or if it is of extremely large size, say over fifteen centimeters in diameter, and if the patient be an excellent operative risk, the mechanical removal of the mass seems the better treatment at the present stage of our knowledge.

Hemorrhage is the symptom *par excellence* that should be treated by radiotherapy in those women in whom a permanent menopause is acceptable. In younger women, say up to the age of thirty-eight, radiotherapy becomes less satisfactory because, in them, the menopause symptoms must be considered unsatisfactory even if they do not in any way incapacitate. Radiotherapy should in this class of patients be reserved for those in whom an operation is counterindicated, being particular, however, to raise the standard of operability and to pay stricter attention to counterindications which would, in the days before radiotherapy, have been considered negligible. While the menopause symptoms are not desirable, they are to be preferred to any real operative risk, and can be fairly well controlled by organotherapy. If radiotherapy is applied to a case with fibroids the dosage should be complete because, while the mass and bleeding may be controlled by frequent and continued small doses, nevertheless the prolonged attendance necessary produces a worse mental state than does the menopause. Moreover, a carcinoma, although excluded before the beginning of the treatment, may creep in to destroy the patient.

In the discussion pro and con concerning the merits of radiotherapy in the treatment of fibromyoma several objections have been raised.

Doubt has been expressed of the results as reported. Unfortunately, such doubts are vague, and only in exceptional instances accompanied by specific examples. In the cases so far treated in this clinic, the only failures have been those following insufficient doses. One of them was operated upon, the second received insufficient x-ray dosage and was cured in another institution by radium, the third received insufficient radium dosage and was cured by further x-ray treatment. All of these cases received their treatment about a year and a half ago when too confident attempts at partial dosage were being made.

The second objection is that the results are obtained only after long periods of treatment. With radium the treatment does not prolong the time necessary for the diagnostic curettage, a matter of a few days. X-ray treatment can be completed in six weeks. Unless the patient be incapacitated by her bleeding she will lose practically no time during the course of the treatment. The improvement in the blood picture is immediate after the radium treatment and comes only a few weeks later after x-ray treatment. Comparing these results with those following hysterectomy I think that any one who has consistently worked in a follow-up clinic will not question, in these respects, the superiority of the lesser over the major procedure.

The most important objection to the use of radiotherapy is that a malignant tumor may be overlooked. Unfortunately, the word malignant tumor is promiscuously used in such criticisms. It is true that a sarcoma may be overlooked, but it is agreed that the occurrence of sarcoma is very rare—less than one-half of one per cent—and that it may, except in the case of a rapidly growing tumor, be neglected in determining the proper treatment. Greater stress is laid on the coincidence of carcinoma or epithelioma with fibromyoma—about five per cent of the fibroids. The claim is made that the neglected cancer in radiotherapy goes on to its fatal termination, whereas the cancer discovered in the specimen after hysterectomy has been performed will have no harmful consequences.

I cannot strongly enough repudiate this attitude. A malignant epithelial tumor of the uterus is readily accessible. No matter what the form of treatment outlined for the fibroid, it must be altered when the cancer is discovered. In this clinic an examination under the anesthetic with curettage precedes the further treatment, whether it be hysterectomy or radiotherapy. If the curettings are suspicious, a frozen section is made and the exact diagnosis established. In two cases in our series an unsuspected carcinoma has been disclosed, and the proper complete operation performed. I wish to repeat that a carcinoma discovered after either radiotherapy or any operation demonstrates a faulty diagnostic procedure.

The next objection is that the fibroid may "become malignant." Again unfortunately the word malignant is promiscuously used. Theoretically a myoma may become a sarcoma, but evidence is very scant that such has occurred. That a fibromyoma could become carcinoma is of course not to be thought of. Whatever mesoblastic tumors may become hypoblastic, the uterine tumors are not amongst them. If the fibroid had a chronic irritative activity, there should be a greater incidence of carcinoma among fibroids, where, as a matter of fact, it is about the same as that given for women in general.

Summarizing the above discussion, it may be said that:

1. Menstruation is directly dependent on the graafian follicle.
2. Variation in duration, amount, frequency and periodicity, when they tend to excess, give menorrhagia and metrorrhagia.
3. The destruction of the graafian follicles

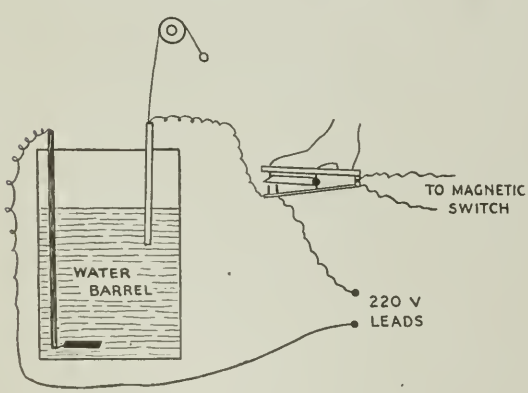
causes a cessation of either the normal or pathological bleeding.

4. The x-ray, or radium, depending on the dosage, destroys the graafian follicles, affecting the fully developed more than the primordial, and thereby causes the uterine flow to cease.
5. The uterine flow is made to cease in the same manner even if it is associated with gross changes, such as retroversion and fibromyoma.
6. In functional menorrhagia and metrorrhagia, in women near the menopause age, radiotherapy is the method of choice, while in younger women it should be used with caution.
7. Fibromyomata shrink, and the uterus ceases to bleed after proper radiotherapy. They should be treated only when giving symptoms. Those tumors occurring in women in whom a menopause is acceptable are proper subjects for radiotherapy, if pressure symptoms are not severe; if the mass is not rapidly growing; or if it is not of excessive size. The menopause should be permanent.
8. The presence of carcinoma of the uterus should be excluded before treatment of any kind is given for uterine bleeding in women over thirty, whether a fibroid be present or not.

A WATER-BARREL RHEOSTAT

That those engaged in Overseas Service are frequently "put to it" to make their machines work is illustrated by the following, which is quoted from a letter recently received by the United States Army School of Roentgenology from one of its recent students.

"We have a gasolene motor running at high speed controlled by a governor. Running synchronous with it is another large motor—our rectifying motor. When a heavy current is drawn, a sudden load is put on the generator with consequent



slowing up of the gasolene engine. Even if the governor works very quickly there is bound to be a slight temporary slowing of the engine. The rectifying motor revolving at a high speed cannot answer to this slight slowing on account of centrifugal action—the motor with the disc acting as a flywheel—and the motor is consequently thrown out of synchronism. Acting on this supposition, I tried to think out a remedy and am now using the following:

"I made a large water-barrel rheostat, in which I can control the load from five to thirty amperes. This load is always on the generator. In the circuit is a heavy duty foot switch, on the other side of which is a button switch, controlling the magnetic x-ray switch. These are so arranged that one is always on. The one contact is made just as the other is broken. The water-barrel load is adjusted to the amperage that my x-ray will take by lowering the iron rod in the water. The generator has always the same load—either the water-barrel load of say 20 amperes or the x-ray load of 20 amperes. The change is practically instantaneous, and the gasolene motor runs at the same rate. Even the ammeter does not show any fluctuation. Working with this arrangement, we have been able to get 60–70 milliamperes with excellent results."

TUBERCULOUS ADENITIS AND ITS TREATMENT BY ROENTGENOTHERAPY *

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IN THE treatment of tuberculous adenitis the first and most important consideration is that it is a local manifestation of a constitutional disease. Therefore, any method which treats only the local lesions is efficient only when it or nature or both conjunctively are able to combat the constitutional disease. End results in the treatment of tuberculous adenitis by roentgenotherapy are superior to those produced by any other method, because radiation is a local as well as a constitutional treatment. Twenty-five to fifty per cent more cases are permanently cured by this than by surgery alone, and a few surgeons have stopped operating entirely.

Roentgenotherapy is a method which never spreads the tuberculous process, leaves no deformity, and, during the treatment, the patient always gains in weight and general health. These statements cannot be made too emphatic, because a number of therapeutists have treated over 500 cases of tuberculous adenitis with over ninety per cent of cures.

To-day a surgeon is not justified in operating on tuberculous glands before roentgenotherapy has been employed and then in only a small percentage of cases. The reason some surgeons have been slow in referring these patients for roentgenotherapy is that no surgeon sees or operates on many cases in a year and his experience is rather limited. In fact tuberculous adenitis is a side issue with most surgeons and many of them are following the old methods without realizing the results which are being obtained with roentgenotherapy. It is not ignorance, prejudice or commercialism, as many claim, because lately many prominent surgeons, who in the past had been doing extremely radical operations, are referring tuberculous adenitis for roentgenotherapy.

Lack of wider knowledge is really our fault in being slow to report our cases, and the surgeons have seen only a few of the cases treated, in most of which the treatment was unfinished and incomplete. There is a small per cent of cases, five or ten per cent, where it is advisable to remove the fibrous nodules after radiation. Frequently, when the surgeon is consulted, he may declare the treatment a failure without realizing that the patient is practically cured. If such nodules are removed and examined when the treatment has been efficient and complete, they are found to contain little or no tuberculous material, the fibrous stroma of the glands remaining. Many of the laryngologists are referring tuberculous adenitis from roentgenotherapy as a routine procedure. It will be only a question of time until roentgenotherapy will be universally adopted as a method of choice.

In the past the treatment accorded tuberculous adenitis depended largely upon the physician first consulted. There have been the hygienic, medical, roentgen ray, radium, light-therapy, vaccine, laryngological and the surgical treatments. Light-therapy is too superficial to affect the deep-seated glands, and any results obtained are by the effect on the general health of the patient. Tuberculin, as a whole, has been rather unsatisfactory and since by roentgenotherapy we are able to produce an effect almost identical to that produced by a supposedly successful tuberculin treatment (the rays apparently producing an autogenous vaccine as well as

* Read before the Roentgen Society of Central Pennsylvania, and Clearfield, Elk and Jefferson Co. Medical Societies, DuBois, Pa., June 11, 1918.

destroying the adenoid tissue) it would seem that vaccines are seldom ever indicated in the treatment of tuberculous adenitis, nor will be until we have a more accurate method of prescribing them. The local applications of iodine, belladonna, mercury or ichthyol are useless.

Prophylactic treatment is important, and has not received proper attention. Persons having unhealthy tonsils, adenoids, nasopharyngeal catarrh, bad teeth, etc., are predisposed to tuberculous adenitis. Until recently very little attention was paid to the source of infection. An effort should always be made to locate the channels of infection, although a great many cases are cured without finding the primary focus. Many are not removing the tonsils, adenoids or bad teeth until the disease is well localized on account of the danger of spreading the infection.

Surgical treatment in the past did not comprise any one single method. One surgeon would drain abscesses, another would inject antiseptics, another would excise glands unless there was an abscess, and another would excise both the glands and the abscess. Some hesitate to operate until a sinus is healed while others disregard that entirely. Some difference has prevailed as to the extent of the operation, whether to remove the entire chain or to remove only the main glandular mass. As a rule, in general practice the physicians have waited until suppuration takes place. So in a large majority of cases, the surgeons do not see the patient before the formation of an abscess. A lung tuberculosis should always influence the treatment. I am sure a certain number of patients have lung involvement following operations, particularly if performed before the process is well localized. Lately, surgeons are beginning to consider this very important fact.

In reviewing the literature one is rather forcibly confronted by the fact that there are only about four or five surgeons who have contributed much to the surgical form of treatment of tuberculous adenitis and that the number of patients they have reported are small compared to those who have been treated in the various roentgen laboratories. Also there are very few papers published on roentgenotherapy. This is a criticism which is attracting the attention of the roentgenotherapeutists. Injudicious surgery in the past has accounted for the notion that the surgical treatment is inefficient and that glands recur at the site of a previous operation, so that when operation is advised it is looked upon as but the beginning of a series of operations.

Mathews' remarks in regard to the treatment of tuberculous adenitis are worthy of careful consideration, and he gives his objections to surgery as follows: "first, children, at least, get well without it; second, we have no certain method of diagnosis in the early cases; third, we cannot remove all the affected glands; fourth, scars; fifth, recurrence." Mathews continues: "I wish to advocate the earliest possible removal of an isolated glandular focus both in children and adults, for the following reasons: it is local at first and can be removed with slight scarring and without sacrificing important structures. Hygienic treatment is always important but will be more successful after the removal than when the tuberculous glands are present."

You will undoubtedly agree with Mathews that we are not absolutely sure when the tuberculous foci, even in the early stage, are localized. Since this is true and since the disease can just as successfully be removed by the roentgen rays with no danger of spreading the disease, without scarring and without sacrificing any important structures, complete extirpation of tuberculous glands should never be performed until the disease is well localized. Past experience and present results with roentgenotherapy should at least make every one advise this method, at least for its localizing effect.

In some clinics more than one thousand cases of tuberculous adenitis have been eated by roentgenotherapy, and operaon was required in less than ten per cent : the cases even for the removal of the orous nodules, over ninety per cent being ured by radiation alone. All agree that ie rays cause a disappearance of the denoid tissue, leaving only the stroma. t is generally agreed that after roentgenoierapy, in most cases the nodules disppear entirely, while, in a small perentage of cases they remain small and ard. If these nodules are removed and xamined there will be seen a central heesy mass surrounded by connective issue in which there is no tuberculous naterial. A total disappearance of adenoid issue is noted.

I have observed the cervical glands undergo a calcareous degeneration followng radiation that left the glands so dense hat a roentgenogram disclosed the shadows plainly like those seen in the chest following nature's cure of a tuberculous process. One or two glands may be seen above the clavicle in old tuberculous cases, but never the number seen in this roentgenogram. Really radiation cures the glands in the same manner as nature, except that it does it so much more quickly. A sclerosis of all the glands with an entire obliteration of all adenoid tissue can be produced in every case if the treatment is properly given, just as certainly as fire will boil water. Any degree of local destruction of the lymphatics can be produced if the operator knows how.

Different authorities call attention to the fact that when the older methods are employed a certain per cent of the patients ultimately acquire pulmonary tuberculosis. This possibly never occurs when radiation is given before any lung involvement takes place. For this reason the medical treatment should not be persisted in too long without roentgenotherapy.

Large glands due to an inflammatory process are frequently secondary to a septic condition elsewhere and a search should be made for the primary lesion. When this is found and treated, if the glands remain large, and particularly if they show a tendency to suppurate, roentgenotherapy should be employed at once. If they are given treatment promptly and properly, suppuration can nearly always be avoided.

I do not favor opening a tuberculous mass as soon as it begins to soften, as many advocate. A few roentgen treatments given first greatly facilitate repair of the parts, and the sinus which frequently follows will not be so deep and will heal more readily. Certainly nothing is slower to heal than a sinus leading into a gland which has been opened just as suppuration was beginning.

It is a well-known fact that we have no better treatment than roentgenotherapy for carbuncles, boils or any other of the localized pus infections. Then why be in such haste to open a tuberculous abscess before it begins to bulge? Under roentgen treatment they are never painful. This brings up the question, do the rays produce an immunity both to tuberculous and mixed infections? I am sure that susceptibility to the development of tuberculosis is always greatly lessened after a few radiations and that the patient in some cases at least is rendered immune.

Recent investigations regarding tuberculosis and the various processes of tubercular infection lead to the conclusion that tuberculosis has three stages. The first stage is the infection of the glands, usually coming in childhood; the second is the infection of the bones and joints; the third, infection of the lungs.

There is no longer any doubt that the lymphatic glands form the first line of defense against tuberculosis. Nowhere is this so well demonstrated as where the glands of the neck are invaded, because almost invariably the virulence of the bacillus is greatly lessened after its entrance into the glands. In many instances the disease does not become general, so that many patients recover in a way that shows truly this infection is arrested. These tumors may spontaneously subside without suppuration, while in other patients the disease progresses until fluctuation shows that suppuration has taken place in the glands. Constitutional infection is not uncommon, when tuberculous glands are neglected. Therefore, a patient with chronic enlarged glands in the neck should have treatment before the constitutional symptoms develop. In the past this has not received sufficient attention. We see too many cases coming late where the glands have been enlarging for a year or more. Such neglect often necessitates longer treatment and may even endanger the life of the patient.

We frequently see a case of tuberculosis of the glands followed later by tuberculosis of the bones and, finally, there is an extension into the lungs. In some individuals the process is checked in the bones or joints. The process then becomes very chronic, the resistance of the patient being sufficient to end the infection. Therefore, it should be our aim to destroy the disease while it is a primary infection in the glands.

By radiation the local disease can be removed and the removal of the hypersusceptibility prevents an extension of the disease. The healing of the process or local lesion is by far less important than preventing a spreading of a general tuberculosis. Tuberculin has been given for this purpose, but experience has shown that, unless we are able to give the proper dosage with the proper intervals, more harm than good is done. In the future, tuberculin may be used with greater success. We must remember the great responsibility of checking the disease in the primary stage and treat the glands by roentgenotherapy as soon as discovered. It should be apparent to every one that the removal by radical surgical operation is contra-indicated, and when a recurrence takes place, not on account of the lack of surgical skill, but because of the presence of tubercle bacilli which are beyond reach of the knife, the organism is rendered more susceptible, giving the disease a greater chance to spread than before the operation. The hypersusceptibility is greatly increased by anything which tends to lower the vitality of the patient.

Tuberculous glands have been classified with regard to the pathological involvement. Closed glands are found in two varieties, the hyperplastic and the fibrous. In the hyperplastic type the glandular substance increases together with the stroma. In this variety, if left untreated, the glands soon liquefy and form an abscess known as soft glands. It may remain a long time, but, if left untreated, a tryptic ferment will digest the capsule, finally reaching the surface and producing an unsightly scar. Fibrous glands occur in individuals who have a greater resistance; the tuberculous process is slower, and the glandular material is not increased in the same ratio as the fibrous tissue. In the fibrous variety, nature is almost curing the patient. If the fibrous tissue does not entirely absorb, it will frequently leave a hard nodule the size of which depends upon the number of glands.

Cicatrized glands are enlarged glands where the tuberculous process has been healed by the formation of scar tissue. If the glands have attained great size before roentgenotherapy is given, a small palpable nodule will usually be left. The patient may even think there is still a tuberculous process, and even the physician may not realize that a fibrous healing takes place in the cervical glands as it does in the lungs. Particular attention should be directed to this, and the rays cannot be expected to absorb all the scar tissue which has been formed by the tuberculous process, when the glands have attained great size, or where large amounts of fibrous tissue have been formed by nature's cure before roentgenotherapy has been employed. This is always less when treated by radiation than by any other method, because the rays always absorb a large amount of scar tissue. As before stated, it has been proved that when radiation is properly given less than ten per cent of the cases will require operation for even the enlarged nodules. Then, when perations are performed for such cica-ized glands, radical procedures are never ecessary and large unsightly scars are voided, because the operation is per-rmed for a different purpose. The healed odules can be removed through a small icision and closed by sutures so no de-rmity is left.

Open glands are those that have sup-urated and opened to the surface. There re two varieties, those that break down as result of a tryptic ferment, the discharge f which is sterile, and those which have roken down due to a mixed infection.

Recurrent glands, after a radical opera-ion consisting mainly of mixed infections, re those recurrent immediately after the peration. These are usually of a purely ubercular character. The increased hyper-susceptibility of a patient after operation s often a factor in the recurrence. Glandu-ar enlargement on the opposite side of the neck, or anywhere else in the body, shows the increase of susceptibility after a radical operation. In these cases it is very important to begin roentgenotherapy at once and not attempt a second opera-tion, as has been the custom in the past.

It has been known for a long time that contagious diseases increase the hyper-susceptibility to a marked degree. This condition does not seem to bear a relation to the severity of the infectious diseases, as we have a much larger increase of hyper-susceptibility after an attack of grippe than after the contagious diseases which one would naturally expect would emaciate the patient considerably more. We have different grades of susceptibility in tuber-culous adenitis. The small closed glands naturally represent the lowest grade of susceptibility, which is explained by the fact that the glands act as filters and contain the tubercle bacilli on their route to other organs. As long as the glands do not suppurate they are successfully check-ing the tubercle bacilli, although they are undergoing pathological changes. When the glands have broken down they are not performing their full functions as filters and the extension of tuberculous adenitis is more likely. The results obtained by the treatment of tuberculous adenitis with roentgenotherapy leave no doubt that this method is the treatment *par excellence* for this condition.

Bonime says: "That surgical treatment is contra-indicated in every case of tuber-culous glands is beyond dispute. Those who still resort to radical operation will find the responsibility harder to shoulder with the ever increasing recognition of the fact that the glands can be cured without it." While Bonime's statement may seem to some to be too strong, yet the facts produced and the results obtained by those experienced in this method of treatment of tuberculous adenitis fully justify his assertion; and what is most essential now is a wider knowledge among physicians of the positive curative results of roentgenotherapy.

In conclusion, permit me to state that the technique or method of employing the roentgen rays is very important if results are to be obtained in the treatment of tuberculous adenitis. This is not gen-erally recognized, even by many roent-genologists, to say nothing of the general medical profession. This paper deals with the clinical side of the subject and it would be entirely too lengthy if the technical side were discussed. However, I will say that two or three full skin doses, covering the entire area, is inefficient treatment. The neck should be divided in a number of small areas and as much cross-firing as possible employed. Suitable and adequate technique for each case has produced over ninety per cent of cures without deformity.

MODIFIED TECHNIQUE FOR THE X-RAY TREATMENT OF HYPERTRICHOSIS

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IN *The New York Medical Journal*, January 6, 1912, I published an article on the x-ray treatment of hypertrichosis. This was based upon the results achieved in 100 cases treated up to that date.

The results accomplished, while quite satisfactory as regards the permanent alopecia, were rather disappointing as far as the ultimate cosmetic effect of the treatment may be considered. In practically all the cases treated, there developed a certain amount of atrophy of the skin, interspersed with more or less telangiectasis, leading in some cases to considerable disfigurement. While by various methods this condition could be partly avoided and somewhat improved, still on the whole the results accomplished were rather discouraging. So much so, that for a number of years I discontinued the roentgenotherapeutic treatment of all these cases, and depended entirely upon electrolysis for their relief. Unfortunately, in a very large number of cases, electrolysis offers very little hope. It offers practically no relief in a case where a large area is involved, especially when we have the long, fine, delicate lanugo-like hairs to deal with. Even when the hairs are coarse, where we have a very extended involvement, as in many cases—often amounting to a complete beard—to achieve results with electrolysis is practically a life job and, if accomplished, will be followed by more or less scarring—especially if the hairs are in very close proximity. Many patients cannot stand the pain accompanying the treatment; so while electrolysis may be used with good results in cases with a limited number of hairs, there are a large number of cases where it cannot even be considered. The mental suffering of these patients cannot be overestimated. I know of no dermatological condition that can be compared with it. I have seen them on the verge of melancholia and insanity, brooding over their condition, threatening suicide, shunning the light, and avoiding their friends, leading a very morbid and miserable existence indeed. To such an extent, that in many cases something must absolutely be done to save them from themselves and to turn them into useful members of the community.

So about three years ago, unable to withstand the pressure of persisting, family physicians and imploring patients, who were willing to exchange their ailment for almost any other kind of disfigurement, and who were willing to accept all responsibility, I decided to try a modification in x-ray treatment, which I hoped would prove more satisfactory. This modification consisted in producing epilation by the use of x-rays of very deep penetration, filtered through 4 mm. of aluminum and other filters, thereby filtering out all the soft rays—those that are absorbed by the skin, and which most probably play the important part in the production of skin atrophy and telangiectasis. In hospital and private practice, up to date, I have treated 74 cases with this method and the object of this paper is to describe the technique and the results achieved.

Choice of Cases.—This is limited entirely to cases in which something must be done, and where electrolysis for one reason or another cannot be utilized. Before treatment is begun we must explain to the patient the period of time over which the treatment must be persisted in, the possibility of the development of telangiectasis and pigmentation. The patient must assume the responsibility of these developments, and only when we feel convinced that nothing that may develop from the treatment will cause more mental suffering than the condition for which they seek relief are we justified in advising the treatment.

Technique.—We can most conveniently divide the face, for the purpose of treatment, into five areas: left side of face, right side of face, chin, left upper lip and right upper lip.

In applying our protection we must be extremely careful to avoid overlapping. It is always preferable to treat these patients in a lying-down position, with the entire body protected, and only the part to be treated exposed to the rays. In protecting the adjacent areas with lead rubber, it is advisable to place a thick piece of gauze under the sharp edge of the rubber. The object of this is to prevent a very sharp line of demarcation in patients where the exposure is followed by more or less hyperpigmentation. By doing this we find that the pigmentation merges with the skin more gradually and is not as marked as it would be otherwise.

The tube used is a Coolidge tube with a penetration backing up a 9-inch spark gap—about 10 Bauer.

The filters used are 4 mm. aluminum attached to the tube stand and a number of layers of thick photographic paper and a loofah sponge, placed over the area to be treated. The object of this is to filter out the secondary rays generated in the aluminum filter.

The tube stand is carefully grounded and is tilted at a suitable angle to permit the rays to enter the follicles as directly as possible.

The Dosage.—The success of the treatment depends entirely upon the administration of the proper dosage. In working with unfiltered or lightly filtered rays the epilating and the erythema dose are practically synonymous. With highly penetrating and heavily filtered rays the epilating dose is a little below that of the erythema dose. To expect satisfactory results in the treatment of these cases, we must never go beyond the epilating dose. We must avoid producing even the slightest blush. We must very carefully standardize our apparatus, find out what our epilating dose is and use that as our standard. This will differ considerably with the apparatus used. It is impossible to give the epilating dose in figures of X, as this seems to differ with the different types of machines. A certain number of X with a machine worked with an interruptor seems to produce a more intense effect than the same number of X from a transformer—at least this has been my experience. Besides, our different methods of measurement are still rather inaccurate and give very varying results. It is useless to attempt to measure highly penetrating and filtered rays with Kienboeck stripes. This method was only intended to measure medium, unfiltered rays; with any other kind of rays the measurement will be most inaccurate. In using the other measurements in vogue, we find that the same exposure will give a different reading, depending upon the method used. For instance I found on repeated experimentation that where a test exposure gave me 50 X on a Sabouraud & Noire pastille, it registered 32 X on a Holzknecht radiometer and also 32 X on a Hampson.

The only satisfactory method is to work out a set rule for your apparatus, never vary this, and work with a unit of fraction of time. With the apparatus I use under certain set rules, I get an epilating dose in 10 minutes; so I use this as my unit, and have no difficulty in administering fractional doses by simply using a fraction of the 10 minutes.

In cases where the entire face is involved, where we have five areas to treat, I find it most satisfactory to treat at the rate of one area each week. This enables one to treat each area once in five weeks, which is about the frequency with which they should be treated.

The first dose administered is an epilating dose. If five weeks later there has not been a complete epilation and no untoward results have developed, another full epilating dose may be administered. After a complete epilation, if treatments were discontinued, the hairs would return in about two or three months, but this can generally be postponed by giving them an exposure at regular intervals for a period of about one year. At the end of this time, the hairs as a rule do not return, or if they do, they generally return as small white hairs, not very noticeable and so lightly attached that merely touching them will sometimes make them fall out. If the patient finds this condition still objectionable, an occasional treatment at long intervals—about once in three months—may be persisted with.

The dosage given is gradually diminished as time goes on. The first dose after epilation is complete—if there is no reason to the contrary—is about three-fourths of an epilating dose, and the balance of the exposures will be between that and half of an epilating dose—that is, providing there is no sign of recurrence. If there is, we must promptly return to a full epilating dose again. The important thing is to get along with using as little x-ray as possible, and never to go beyond the amount necessary to produce epilation.

Complications Arising During Treatment.—There are a number of symptoms that occasionally arise during the course of treatment, the significance of which we should be familiar with. In treating the side of the face, patients sometimes complain of slight neuralgic pain developing in the region of the maxillary bone. This usually lasts but a short time—probably one or two days—is generally not very annoying and promptly disappears without any treatment. Sometimes a slight blushing appears over the area treated, shortly following exposure. This is due to the effect of the secondary rays produced in the aluminum filter. It lasts probably a few days and can be very much shortened by the application of the alkaline lotion suggested by the late Dr. Dodd. This lotion, the formula of which is

Zinci Oxidi	℥ ss
Acidum Carbolicum	ʒ ss
Glycerinum	ʒ i
Aqua Calcis	℥ viii

may be used methodically throughout the entire treatment to great advantage, as a safeguard against the development of dermatitis. It should be well shaken and mopped every night, or oftener, over the treated area. It drys on the skin in the form of a white powder, and is not at all objectionable to the patient. If at any time during the course of treatment an x-ray dermatitis develops, no matter how slight, treatments must be promptly discontinued and the lotion above mentioned used as frequently as possible. Even after the dermatitis has disappeared, it is best to stop treatments altogether over the area affected; other areas may be treated, depending entirely upon the judgment of the operator.

Hyperpigmentation develops quite frequently, especially in patients with a dark olive complexion, sometimes after the first epilating dose. When this occurs, it is best to wait until it fades out before the next dose is administered. This generally takes a month or two. In other cases it does not appear until towards the end of the treatment. The latter type is much more persistent, but I have found that even this has a tendency to get lighter in course of time. We might use desquamating lotions to hasten its disappearance, but one should not use the ultra violet light to remove the pigmentation, as this light generally aggravates the condition.

In treating the chin and lower jaw, we frequently get swelling of the salivary glands. This may be very slight, lasting but a day or two, or it may be rather severe, bringing about almost a complete cessation of the salivary secretion. These cases are often accompanied by annoying constitutional disturbances, which persist over a considerable period of time. In the light cases there is no objection to resuming treatment at the regular time, with a diminished dosage. In the more severe cases treatment had best be discontinued for a long time; if resumed at all, it should be done very carefully and with as small dosage as possible. In the very severe cases, treatment should be discontinued entirely. In many cases the swelling of the glands is due not so much to the action of the *x*-ray as to the absorption of the electrical discharges surrounding the tube. In these we might alleviate the condition by following Pfahler's excellent suggestion of covering the part treated with very thin tin foil and grounding this.

Occasionally we have to treat other parts of the body than the face for hypertrichosis, in patients who are very anxious to get rid of excessive growth of hair in different parts of the body. I treated a number of patients for this condition affecting the lower limbs over an area extending from knee to ankle. Here we might treat each entire limb at one time, dividing it into four or six areas and giving each area a full epilating dose. The after treatments are carried out as those described for the face. These cases generally do very well, but in one instance a marked lymphedema developed after a number of treatments. This disappeared after a few months and left no permanent bad effect. It was very annoying while it lasted, however, and in treating these cases we must always warn the patient about the possibility of its development. If it does develop, it is best to discontinue treatment entirely and advise rest as much as possible, with the limbs in an elevated position. Upward gentle massage and firm bandaging seem to be of decided value.

I treated several patients for the removal of hairs from the axilla. Here, occasionally, we get a swelling of the sweat glands followed by furunculosis. This is treated in the usual way, and generally gives very little trouble. The treatment of the axilla is rather difficult on account of the irregular surface it presents to the ray; the results are not very satisfactory and it should be very much discouraged.

Conclusions.—The results accomplished in the 74 cases so far treated by this modified technique have been fairly satisfactory. The great majority of cases have shown no sign of any permanent injury to the skin. Several have shown signs of telangiectasis and in some there is still a certain amount of hyperpigmentation persisting. I have not as yet seen any symptoms of skin atrophy developing in any of the cases treated. I realize that the time which has elapsed has not been sufficiently long to show all the damage that the *x*-ray may have produced, and that in course of time I may have reason to change my opinion about the ultimate results achieved in the cases treated.

To the best of my knowledge at the present time, there is not a single dermatologist or roentgenotherapeutist who does not condemn the *x*-ray treatment of hypertrichosis. I have no doubt with very good cause, for up to the time that I tried this modified technique I have not seen a single satisfactory termination to any of the cases treated. There is something about this condition that plays havoc with the mental state of many of these patients; probably, as they see the hairs grow, they look upon it as a sort of masculine sex reversion and as something that should be carefully kept a dark secret from the rest of the world. To observe the improvement in their mental state, as they see the hairs disappear, is very gratifying indeed.

Even now I realize that the treatment is far from ideal and should be reserved only for cases where something must be done, and where there is no other possible method of treatment. In such cases, in my opinion, the results not only justify the treatment, but it is our duty to employ it, to give the only possible relief to a class of patients to whom this affliction is a great burden.

A CASE OF CONGENITAL DEFORMITY OF THE HANDS, SUPERNUMERARY TOES, AND ABSENCE OF TIBIÆ

BY ARTHUR J. DAVIDSON, M.D.

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PHILADELPHIA, PA.

THE following interesting and unusual case illustrates, in the same individual, three distinct types of congenital deformity of perverted development; viz.: malformation of parts, absence of parts, and supernumerary parts.

FIG. 1. SHOWING FIVE FINGERS ON EACH HAND—NO THUMBS.

The child, R. F., a boy, was born on December 24, 1913. Was a full term baby, normal birth. He is the sixth of seven children, having four sisters and two brothers all of normal development and good health.

There is no history of any deformity in any member of the family on either the maternal or paternal side as far back as can be traced. The father and mother are normal, healthy country people, the father being thirty-seven years and the mother thirty-six years old when the baby was born.

The child was brought to the Orthopedic Department of Jefferson Medical College Hospital in April, 1916, at which time he was slightly over two years of age. He is a bright well-nourished child; has never had any illness except chicken-

FIG. 2. RIGHT HAND.
Roentgenogram by Dr. W. F. Manges.

FIG. 3. LEFT HAND.
Roentgenogram by Dr. W. F. Manges.

ox. His head and neck are well formed, hest and abdomen of excellent developnent and the heart and lungs are normal.

HANDS.—On each hand the thumbs are bsent. There are five well-formed fingers, each about of equal length. There is a metacarpal bone for each finger. The carpal bones have not yet appeared by x-ray examination. The child uses each hand very well and apparently does not miss the absent thumb action.

FEET.—On each foot there are eight fairly well-formed toes. In the right foot there are six metatarsals which are of about equal development. The innermost is a little larger and the outermost is second in size. The innermost toe and the fourth, counting from the inside, have very imperfect bone development and do not articulate with a metatarsal. Practically the same condition exists on the left side except that between the second and third metatarsals, counting from the inside, there is a rudimentary one, there being present just the distal portion of the bone. The x-ray interpretation of the tarsus is difficult. There is a fairly well developed os calcis and astragalus and three other centers of ossification, one of which is apparently a normal cuboid. The tarsal development of the right and left foot is alike.

LEGS.—The upper leg, hip, thigh, and so forth, are normal. The lower legs are

FIG. 4. SHOWING EIGHT TOES ON EACH FOOT.

FIG. 5. SHOWING ABSENCE OF BOTH TIBIÆ, SUPERNUMERARY TOES, PERVERTED DEVELOPMENT OF TARSUS.

Roentgenogram by Dr. W. F. Manges.

FIG 6. SHOWING FIVE FINGERS, NO THUMBS, EIGHT TOES ON EACH FOOT, ABSENCE OF TIBIÆ.

very short. There is complete absence of each tibia. The fibula is present but its articulation is faulty at both ends. It articulates neither with the femur nor the astragalus. On both sides there is a distal epiphysis. There is no stability to th lower legs. The child walks with difficult by inverting the feet and bearing th weight on the outer side of the lowe leg.

COMMUNICATION FROM THE COUNCIL OF NATIONAL DEFENSE

ENROLLMENT OF PHYSICIANS

1. On August 8 the following statement was authorized by the War Department, signed by Newton D. Baker, Secretary of War:

"The War Department today has suspended further volunteering and the receipt of candidates for officers' training camps from civil life. This suspension will remain in force until the legislation now pending before the Congress with regard to draft ages is disposed of and suitable regulations drawn up to cover the operation of the selective system under the new law. * * *"

Fearing that this order might be misinterpreted by doctors who would not distinguish between enlistment as a private soldier and enrollment as an officer in the Medical Reserve Corps, on August 9 I asked the Secretary of War to issue a statement making clear this point.

2. In response to this request on August 10 the following statement was authorized by the War and Navy Departments:

"Orders issued by the War and Navy Departments on August 8 suspending further volunteering and the receipt of candidates for officers' training camp from civil life do not apply to the enrol ment of physicians in the Medical Reserv Corps of the Army and the Reserve Forc of the Navy. It is the desire of both depar ments that the enrollment of physiciar should continue as actively as before s that the needs of both services may b effectively met.

(Signed) Josephus Daniels,
Secretary of the Navy.
(Signed) Newton D. Baker,
Secretary of War."

3. It is desirable that the definit attention of the medical profession b called to this interpretation in order tha enrollment for the Medical Reserve Corp of the Army and the Reserve Force of th Navy which is going on so rapidly at th present time, shall not be interrupted.

I trust that you will give this prominer space in the next issue of your Journal an such editorial comment as you may deer desirable.

Franklin Martin,
Chairman, General Medical Boar

HOLDER FOR DIRECT SETTING OF HIRTZ COMPASS

BY J. S. SHEARER, M.S.

Major, Sanitary Corps, U.S.N.A.

ITHACA, N. Y.

SINCE the article on standard methods of localization recently published in this JOURNAL was written, there has been perfected a holder for direct setting of the compass while the patient is in the position in which fluoroscopic examination was made. Detail of the holder is shown in Fig. 1. It consists of a tube fitting the screen carrier, with a square sliding rod which permits of longitudinal motion but not of rotation. The tube is held in position by a V-shaped projection on a fixed ring at *A*, and the sliding arc may be clamped where desired by the thumb nut, *D*. The compass is held in position by thumb nut, *B*, and the indicating rod of the compass inserted through the hub and holder is locked in position by nut *C*. Fig. 2 shows the mode of operation and may be briefly described as follows:

After the localization and depth determination has been made, the screen holder is removed from its socket and the compass holder inserted in position. On account of the construction the axis of the compass and its pointer will be parallel to the line of sight by means of which localization has been made. In other words, it will be vertical and parallel to the post of the screen carrier. The brass holder in which the compass is mounted is so designed that the upper portion compensates for the thickness of the slider on the arc of the compass. The arc is removed and the compass placed in position. The pointer is inserted and clamped so that the distance of the ring mark at the end of sliding clamp on the pointer rod is as far above the top of the brass holder as the projectile is below the skin mark. The end of the pointer so raised is brought in contact with the skin mark previously made, and the holder is locked so that the compass is rigidly held in position. The arms and legs of the compass are then adjusted to any desired positions on the patient's body, and all parts of the compass are locked. By means of the vertical movement of the carrier the compass may be raised an eighth of an inch or so and the marks placed directly under the feet of the compass, which is much more convenient than to make the marks first and adjust the compass afterwards.

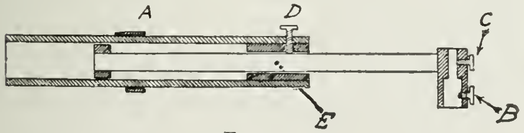

FIG. 1.

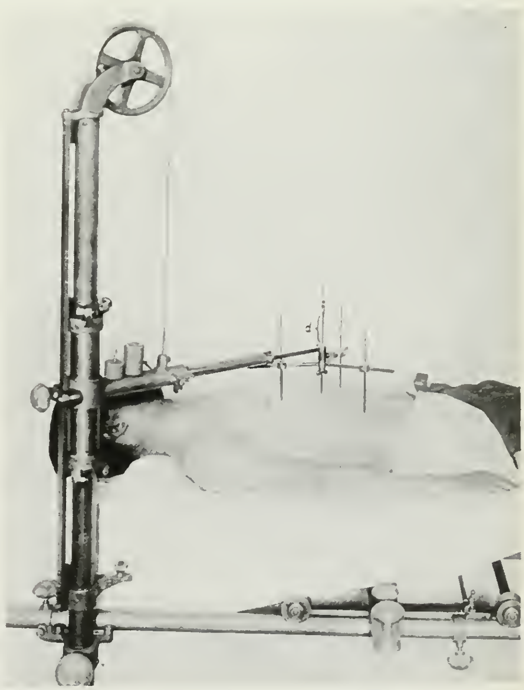

FIG. 2.

This method possesses two distinct advantages: (1) it may be done quite expeditiously, (2) it indicates clearly to the operator how the compass is going to stand on the patient when in use. Its disadvantages are: (1) the necessity of considerable illumination in the dark room when placing the compass, (2) danger of movement of the patient between localization and final adjustment, (3) need for the compass in the fluoroscopic room as well as in the operating room. It will remain for the individual operator to decide which of the various methods is most desirable for the case at hand as no general instructions can be given.

THE LONG COMPRESSION TUBE IN ROENTGENOGRAPHY

BY CAMP C. THOMAS, B.S.

ANN ARBOR, MICH.

FOR a long time roentgenologists have recognized the value of long target-plate distances for roentgenography of the chest and objects which do not lie close to the plate. In addition to the long target-plate distances, many are using the long compression tube of small diameter. But as manufacturers are slow in placing suitable tubes in the requisite varieties on the market, we have made our own compression tubes from drawn lead pipe ferrules, twenty inches long. A cast-iron ferrule at one end of the lead pipe is used as the nozzle-end of the compression tube, stiffening it and insuring a perfect circular shadow upon the plate. The other end of the tube is soldered to a lead collar to form the attachment to the tube stand. In the case of the six-inch-diameter tube it is only necessary to bend over the edge of the tube forming a flange to fit the groove of the tube stand. With the large-diameter tubes it is necessary to use a diaphragm, Fig. 1.

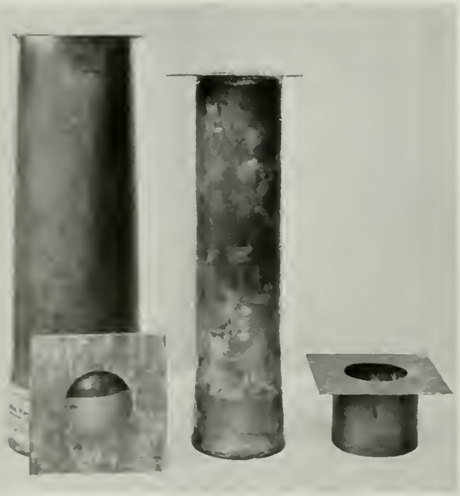

FIG. 1.

We use a diaphragm having a three-inch opening with the six-inch tube. For immobilizing the patient an aluminum semisphere or an inflated rubber bag may be interposed, instead of using sand bags. This tube weighs twenty-five pounds and by its mere weight makes some compression.

The short tube is useful when confusing details of overlying structures are to be avoided as in roentgenography of the antra, frontal sinuses and mastoid cells.

The six-inch diameter tube, with compression, is convenient and efficient for examination of the shoulder, knee and hip joints, spine and chest. It makes the average target-plate distance thirty-six inches.

The greater distance of the target from the patient acts as a protection, especially where repeated examinations are made.

It is possible that in the future the chest will be examined by exposing small areas in preference to covering the whole field with the large plate. With the six-inch-diameter tube and three-inch diaphragm, roentgenograms of the lungs and mediastinum possess shadows of exquisite detail and definition, Fig. 2.

Secondary radiation is to a large extent iminated by the use of the long compression tube. In tubes exceeding four ches in diameter it is necessary to use diaphragm.

The technician is sometimes careless bout having the central ray strike the late perpendicularly. With the long ıbes, especially those of small diameter, his mistake is not likely to be made. s the operator does not have much hadow-space to waste, he is, as a matter f necessity, more careful about centering he tube. Thus, distortion of shadows re prevented and a more constant techique is insured.

For subjects of average size the targetlate distances are automatically fixed, hich serves to facilitate the examination. s the target-plate distance is increased, he time of exposure is greater, but this s well compensated for by the greater ealth of detail and the comparative abence of distortion it ensures. For nearly ll bone work we use an exposure of ten econds with the tube passing 20 ma., arying only the spark gap by changing he rheostat or the heat of the filament of he Coolidge tube.

In conclusion we claim that the long compression tube offers the following advantages:

FIG. 2.

1. Less distortion of shadows;
2. Richer details and better definition;
3. Greater safety for the patient;
4. Easier to center;
5. Simple immobilization.
6. Stability of target-plate distances.

PROFESSIONAL ETHICS IN CUBA

The *Revista de Medicina y Cirugia* of Havana relates that the Medical Press Association of Cuba has decided to underake a tenacious campaign against quackery, quack advertising and quack pracices, and against acts committed by physicians that do not conform to professional ethics. It says: "Notwithstanding the resoutions voted in recent national represenative gatherings, the evils in the medical corps are increasing instead of diminishing. It is actually scandalous that, in the very capital of the nation, individuals with university degrees are serving as protectors for animal-magnetism healers, and that in some laboratory and other institutes—perhaps behind the back of their medical directors—efforts are made to get the clients away from physicians who send their patients there exclusively for some laboratory examination." Drs. Aragon, Jr., Montoro and Arteaga brought up the matter at the meeting of the Medical Press Association. Our exchange adds: "It is hoped that something can be done, backed by the authority of the Public Health Service and the ministry for Public Instruction, to fight these elements which show such contempt for professional ethics and their university degree. Now that the first steps have been taken, let the work be continued by the Academia de Medicina, the Colegio Medico and other professional organizations." (Ref. *Journal American Medical Association*, Volume 71, No. 10.)

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THE NEW INTERNATIONALISM

The close contact among scientists of the allied nations which has been engendered and stimulated by the war, is resulting, it is gratifying to note, in a *liaison scientifique* which bids fair to develop into a new type of internationalism. To us this is especially noticeable in connection with the field of military roentgenology. Even now, our equipment of men and material for our x-ray service abroad is one of the most important of our national activities and its extent and thoroughness has already made a deep impression on those o our Allies engaged in similar work. Particularly remarkable to them is our ability by means of the system we have worke out, to install and operate x-ray mechanism of large calibre *in forward areas.*

The common efforts of the allied x-ra services upon common soil are bound t react as a stimulation for closer scientifi relationship, both during the remainder o the war and after it. A more generous exchange of communications and record should, and will, appear in allied literatur dealing with matters roentgenologic. Already, in fact, have contributions to ou pages reached us from military roentgenologists of other nations. Members of ou Society who have been operating with th British forces have contributed in no sma measure to the British literature of th subject. The British have been prompt t appreciate the efforts of American co workers in the field of roentgenology, as i those of surgery and medicine, and especially have the French shown intense in terest in the development of America military apparatus for the production an application of x-rays. But a short tim ago, a society of French military expert was delighted by a description of the lat Major Caldwell's stereofluoroscopic apparatus, presented to them, in French, b Lieutenant Colonel Case, Chief Consultant in Roentgenology of the America Expeditionary Forces.

Such events as these point, we believ to a new and exceedingly interesting typ of internationalism which will be we come indeed.

PERCY BROWN.

TRANSLATIONS & ABSTRACTS

DEAVER, JOHN B. Peptic Ulcer. (*Surg., Gynec. & Obst.*, May, 1918.)

"I have on so many occasions emphasized my conviction that the basic factor in the development of peptic ulcer is infection that it seems almost superfluous to further insist upon it. The toxemic origin of peptic ulcer is generally recognized and there seems little doubt that infection is the primary cause of the toxemia in the vast majority of cases. Furthermore, clinical experience in recent years is indicating more and more clearly that the original site of the infection lies in the vermiform appendix, and Rosenow's demonstration of the elective localization of micro-organisms, especially streptococci, is additional confirmation of the infectious origin of these ulcers and similar lesions. Indeed, Rosenow's studies show that the cells of the tissues for which a given strain of bacteria shows an elective affinity may "take bacteria out of the circulation as if by a magnet-absorption." From Bolton's careful histological studies, we learn that the initial lesions which give rise to ulcer of the stomach are localized necrosis of the mucous membrane, localized hemorrhage and inflammation of the lymphatic follicles. The common cause of necrosis is bacterial infection or its toxins circulating in the blood stream and, as pointed out by Bolton, the cells of the gastric mucosa being primarily attacked by the poisons in the circulation, necrosis is readily produced by the local action of the gastric juice. Necrosis may arise in this way without any preceding hemorrhage or lymphatic inflammation, but hemorrhage is an actual and frequent cause of ulcer and is likewise due to bacterial toxins circulating in the blood stream, which, destroying the endothelial cells of the capillaries, pave the way for the local destructive action of the gastric juice. Finally, inflammation of one or more of the lymphatic follicles, so thickly studded along the lesser curvature of the stomach especially toward the pylorus, may give rise to a submucous abscess which by rupture into the gastric cavity allows the juice to act on the base of the ulceration thus exposed.

"Ulcers developing in one or the other of the processes mentioned would heal in a normal stomach, but being constantly exposed to the action of the frequently hyperacid gastric juice they show a tendency to spread rather than to heal and sudden perforation or hemorrhage is often the first indication of gastric ulcer. Or in cases of simple ulcer the tendency is to become callous with chronic peptic ulcer as the result. There is little doubt that every chronic peptic ulcer was at one time acute and began in one of the aforementioned processes."

With the aid of the *x*-ray and various clinical tests and a careful history, correct operative diagnosis of ulcer was made of 88 per cent. of the cases operated on in the last year. Deaver regards every case operated on as a medical failure, and says that the increasing number of medical failures is seen from the increasing number of cases operated on.

NORDENTOFT, J. Pseudoleukemia. (*Hosp.-Tid.* Kobenh., February 20, 1918, p. 225. Ref. *J. Am. M. Ass.*, Vol. LXX, No. 18, p. 1344.)

Nordentoft reports fourteen cases of Hodgkin's disease or other forms of pseudoleukemia. The tumors were rapidly progressive, as a rule, but under roentgen treatment they melted away. After failure of all other measures, this vanishing of the symptoms and return of apparent health within a few days are most amazing. The disease is not conquered, however; constant recurrence is the rule, but there may be long intermissions and the recurrences generally subside equally promptly under renewed roentgen treatment. The greater the susceptibility to the roentgen rays, the graver the outlook; the more frequent, the more rapid and the more malignant the recurrences. There are a few complete cures to the credit of the roentgen rays, but they are extremely rare, and Nordentoft thinks that in many of them there was a mistake in the diagnosis. In his experience, two of his fourteen patients seem to be cured, but the diagnosis of a mediastinal tumor may have been erroneous in one case; the hemorrhagic pleuritis and adhesions may have been of tuberculous origin. In the other case the diagnosis of Mikulicz' disease seems more probable than pseudoleukemia. No other proliferation of lymphoid tissue was to be discovered except in the parotid glands, and the tumors in them had developed very slowly and were apparently benign. In none of the other cases was a cure realized or even to be anticipated. But the long intermissions between recurrences are equivalent to a cure in many cases. Only one of the total fourteen patients seemed to be refractory to the roentgenotherapy. Necropsy in this case showed necrotic processes for which the roentgen rays may have been responsible. In one young man a tumor in the neck, as large as a man's fist, subsided within a day. The exposure had been made at noon and by evening the subjective and objective improvement was pronounced. One girl of 11 with a large tumor masking the shadow of one lung entirely, gave normal roentgen findings with roentgenoscopy two weeks later. But the toxic action from the subsidence of this tumor was so great that the child died, and the conclusion seems inevitable that the roentgen exposure of the tumor was responsible for the fatality. An interesting feature of the roentgen treatment in some of these cases was that unexposed tumors, at a distance from the one being given the roentgen treatment, subsided along with it. This suggests that possibly the blood may acquire a weak radioactivity, sufficient to act on extremely susceptible tissue. But Nordentoft's experimental research on dogs failed to show any such action even when the negative plate was exposed to the blood for days at a time.

Kretschmer, Herman L. True Prostatic Calculi. (*Surg., Gynec. & Obst.*, Vol. XXVI, No. 1.)

The author emphasized the importance of roentgen diagnosis, both in making the diagnosis and as a postoperative procedure, in the following quotation:

"The diagnosis of prostatic calculi can be definitely established in every case by the aid of the roentgen ray. It is surprising, in view of the fact that the roentgen ray is perhaps the one agent that gives us the most information in the diagnosis of this condition, that its routine employment is so often neglected. Its routine use after the operative removal of stones should always be carried out, so that one may be sure that all of the calculi have been removed. That this is often neglected is very plainly demonstrated by a review of the recent case reports in the literature, a large number of which do not mention the roentgen ray findings. This certainly is unfortunate, as doubtless many of these sufferers seek relief without finding it and are often subjected to many needless examinations and to prolonged courses of treatment without obtaining relief."

He also states that large stones may be found on both sides and on the midline, though usually the calculi are apparently located in one of the lateral lobes, and small calculi may be located in the midline, to one side of it or on both sides.

Whipple, Allen O. A Study of Postoperative Pneumonitis. (*Surg., Gynec. & Obst.*, Vol. XXVI, No. 1.)

The author calls special attention to the importance of the roentgenographic method of studying these cases by stating that in a certain percentage shadows in the lungs were demonstrable before physical signs of consolidation were elicited. The site of election is one of the lower lobes.

It is interesting, though not important, to take serial roentgenograms from the incipient rise until the plate shows the lung again clear;

Out of a total of 72 cases roentgenographed, 11 showed a shadow before physical signs appeared.

In 6 cases there were *x*-ray shadows with no signs of consolidation.

In 48 cases the shadow and the signs appeared simultaneously.

In 11 cases there were no shadows but physical signs of consolidation were present.

Medicolegal. Roentgenographic Pictures in Book as Evidence—Damages for "Blues." (Chicago, R. I. & G. Ry. Co. vs. Smith (Tex.), 197 S. W. R. 614). (Ref. *J. Am. M. Ass.*, Vol. LXX, No. 12, p. 879.)

The Court of Civil Appeals of Texas, in affirming a judgment for $10,000 damages for personal injuries, in favor of plaintiff Smith, holds that there was no error in permitting the plaintiff to introduce in evidence, in connection with the testimony of a physician, certain roentgenographic pictures of the bones of the normal foot found in the medical work known as "Treatment of Fractures," by Scudder. The court says that on the cross-examination of the physician he stated that the plates or photographs introduced were to his knowledge correct pictures of normal arches of the feet. He further testified that the book containing the plates was a standard work, accepted by the medical profession generally. It further appeared from the record that the condition of the plaintiff's feet, both before and after the injury, was shown by the evidence. In this state of the record, the plates were certainly not immaterial or irrevelant. Their correctness was established by the evidence of the physician, and, while the predicate for their introduction in evidence was not laid prior to their introduction, this objection was removed by proper subsequent proof.

de Abreu, M. D. Radiology in France during the War. (*Rev. med.-cirurg. do Brazil*, January, 1918, p. 4. Ref. *J. Am. M. Ass.*, Vol. LXX, No. 25.)

De Abreu is chief of the radiologic cabinet connected with the Franco-Brazilian ambulance stationed at Paris, and he descants on the revolution that has taken place in France since the war began in the general estimation of the roentgen rays. Before that, there were a few very eminent radiologists in France but the rank and file of the profession paid little attention to the roentgen rays, "and nothing," he remarks, "opposes such unconquerable resistance to the onward march of ideas as silence." The professional roentgenologists were misled by the Austrians into viewing radiology almost exclusively from the therapeutic standpoint.

The rays were experimented with in every disease and although the results were found excellent in some, this was restricted to certain parasitic skin diseases, tumors and certain forms of bone or skin tuberculosis, and leukemia. The rays were also used in diagnosis by a few French writers, especially the internists. But the majority of the physicians knew little and cared less about this method of examination, and even some of the first class medical services in the hospitals only rarely called for a roentgen examination of a patient, and then only for cancer of the stomach or kidney stones, and the chief of the service never followed the patient to the roentgen room. De Abreu had charge of the roentgen service in the largest hospital, and in his long months there only Chauffard, and he only once, followed the patient to the roentgen room. All apparently were content with the auscultation and percussion, the pathologic anatomy and bacteriology and chemistry findings.

But with the war and the necessity for locating projectiles in the tissues, radiology sprang at once into the first rank, and its importance for diagnosis in wide fields was soon recognized—a revelation for all. At the same time, roentgenology did not detract one iota from the value of clinical examination but enhanced its value. The war precipitated the use of the roentgen rays and de Abreu pleads for a similar diffusion in Brazil of knowledge concerning them and their wide and systematic utilization, without waiting for a war to force it on the country. He urges the creation of a chair for radiology in the University of Rio de Janeiro. Both in civilian and in military circles the young physicians of Brazil should get this training in roentgen work, and perhaps take a leading part in radiology, as some have done already in bacteriology.

Mayo, W. J. Cancer of the Stomach. (*Surg., Gynec. & Obst.*, Vol. XXVI, No. 4.)

"More than 30 per cent. of cancer in civilized man is in the stomach."

He emphasizes the chronic irritation theory and says that perhaps the reason why 85 per cent. of all cancers and ulcers of the stomach involve the lesser curvature is because the *x*-ray shows that food passing into the stomach is not carried directly into the cavity, but by muscular contraction a canal is formed on the lesser curvatures along which it passes.

"The early diagnosis of cancer of the stomach depends upon the roentgen examination and Carman has shown that it may be demonstrated in 95 per cent. of the cases in this way by the time they give sufficient evidence of their presence to call the patient's attention to the fact that something is wrong. Every person in whom there is a suspicion of cancer of the stomach should be promptly subjected to an examination by the roentgen ray. All persons with anemia which cannot be otherwise explained, should be subjected to such an examination."

Roberts, P. W. The Etiology of Perthes' Disease. (*J. Am. M. Ass.*, 1917, lxix, 19, 1598. Ref. *Surg., Gynec. & Obst.*, February, 1918, p. 137.)

The author states that the etiology of osteochondritis of the hip, generally known as Perthes' disease, has been the subject of much speculation ever since the condition was recognized as a clinical entity several years ago. "Traumatism, obscure infection and perverted metabolism have each had their advocates. Tuberculosis has been eliminated because the joints recover with good function, and syphilis has been excluded because Wassermann reactions have been negative."

Notwithstanding the results of laboratory tests Roberts advances the opinion that this affection which occurs with considerable frequency in children is the result of inherited syphilis. In support of this view he states that:

1. A negative Wassermann is not reliable as infallible evidence of the absence of bone syphilis.

2. The pathologic findings described by Perthes coincide with one of the most common expressions of bone syphilis in children, namely, osteochondritis.

3. There are subjects with Perthes' disease who show dental evidence of inherited syphilis.

4. The course of osteochondritis of the hip is similar to that of many other syphilitic joint conditions in that the destructive process is self-limited and that there is a tendency to more or less complete restoration of function.

Roberts believes that the treatment of this condition on the hypothesis that it is of syphilitic origin is worthy of further investigation. In his experience all syphilitic bone and joint conditions improve more rapidly when the dose of potassium iodide is carried to the point of tolerance than when dependence is placed on a routine dose of moderate size.

Philip Lewin.

Bugbee, H. G. The Management of Renal Tuberculosis. (*Surg., Gynec. & Obst.*, May, 1918, Vol. XXVI, No. 5.)

The author discusses the difficulties of arriving at a diagnosis and says that most unfortunate results follow from hasty diagnosis.

He emphasizes the importance of repeated urethral catheterization and pyelogram in cases showing long remission.

Roberts, Dudley. The Recognition and Treatment of Intestinal Diverticula. (*Surg., Gynec. & Obst.*, February, 1918, Vol. XXVI, No. 2.)

In the roentgenographic study many of these cases are overlooked, due to their position either directly in front of or behind the lumen of the bowel. Dependence should be placed on daily study of the colon from twenty-four hours p. c. until the meal is entirely discharged from the bowel.

The value of stereoscopic plates is emphasized. The author advises the use of numerous small plates in corpulent patients. Attention is called to the jagged appearance of the sigmoid when seen filled by opaque enema.

Sohmer, A. E. Fracture Sprains. (*Internat. J. Surg.*, 1917, xxx, 292. Ref. *Surg., Gynec. & Obst.*, February, 1918, p. 146.)

So-called sprains are often associated with fracture of bone near a joint, usually a small fragment of bone being torn off by trauma. If overlooked, these leave the joint in a weak, painful or deformed condition, with limited or abnormal joint motion. It is more important to recognize a fracture in injuries which appear to be simple sprains than one which is frankly a fracture away from a joint, because of the bearing on subsequent treatment.

Fracture sprains disable by aiding the process of callus formation, offering subsequent interference with joint motion, the possible loss of proper attachment of ligaments and tendons, interference with fulcrum action of joints, and more or less dislocation with greater permanent deformity, to the factors of ordinary sprain without fracture.

The prompt recognition of fracture sprains is important in railway surgery because of its bearing on liability claims in cases of prolonged disability and permanent deformity.

To verify a diagnosis, the roentgenogram is

.e best appliance, either by stereoroentgeno-am or plates in different planes. The fluoro-ope is not reliable because of the small size : bone fragments and the relative density : tissues near joints.

A knowledge of the development of epiphyses t different ages is important in diagnosis, ecause of subsequent interference with growth f bones if the true condition is overlooked.

The prognosis of fracture sprains depends n its early recognition and subsequent treat-nent. They bear an important relationship o constitutional infection elsewhere in the body, specially tuberculosis. Lessened lower resis-ance by injury may lead to local hematoge-ous infection. Treatment should provide for ufficient immobilization, careful massage and passive motion.

Fracture sprains which occur most frequently are the following: fracture of the ulnar styloid, accompanying Colles' fracture; avulsion of trochanters of the femur; condyles of the humerus; fracture of the tip of the olecranon or head of radius, the phalanges of foot or hand, the intrinsic cartilages of the knee, the malleoli of the ankle, and the os calcis.

In all injuries near a joint, every apparent sprain should be considered as complicated by a possible fracture, until the latter has been excluded by every means of diagnosis, especially by *x*-ray plates.

Mixsell, H. R. Osteogenesis Imperfecta. (*Arch. Pediat.*, 1917, xxxiv, 756. Ref. *Surg., Gynec. & Obst.*, February, 1918, p. 147.)

The condition known as osteogenesis imperfecta is described as synonymous with fragilitas ossium and osteopsathyrosis. Attention is called to the influence of heredity in its occurrence. The multiple spontaneous fractures which occur are the result of a distinct deficiency in bone development, the haversian systems of stress-resisting bony rods being absent and the cortex extremely thin. The skull may feel like a rubber bag with mosaic inlays of small pieces of bone around the centers of ossification with the fontanelles wide open.

Metabolism studies of the patients show that the calcium retention is decidedly below normal. The general appearance is that of chronic illness; the skin is soft and delicate, the child is under weight, mentality poor, neck short, chest asymmetrical, extremities short and curved with any sort of deformity due to the fractures. The fractures are usually intraperiosteal and the callus formation is excessive. Structural markings in the spongy bone are absent and the medullary cavity is large showing irregular mottled shadows in the roentgenogram.

Two cases are reported; one, a child of eight months, had fracture of both femurs at birth, and three more painless spontaneous fractures in the first seven months. The skull was tabetic and the back kyphotic. The child improved on cod-liver oil and phosphorus. The other case, a year old, showed many lumps of callus on clavicle, forearms, thighs and legs, an evidence of multiple fractures. The child improved under the same treatment.

W. A. Clark.

Pirie, A. H. Shrapnel Balls; Their *X*-Ray Characteristics Compared with Bullets and Other Foreign Bodies. (*Canad. M. Ass. J.*, 1917, vii, 778. Ref. *Surg., Gynec. & Obst.*, February, 1918, p. 163).

Pirie's analysis is based on a study of 10,000 *x*-ray plates made during one year at a hospital in France. Shrapnel balls were shown on 241 plates and bullets on 242. Pieces of shell casing, bombs, hand grenades, etc., were shown on 3,846 plates. In no case did a shrapnel ball pass entirely through the body as a bullet frequently does; they were in several instances stopped by the skin on the opposite side from the entrance. There was no instance of the fracture of the femur shaft or the penetration of the brain by a shrapnel ball. In one instance both tables of the skull were fractured and the ball remained in the bone.

Shrapnel balls are usually of lead, but balls of iron have been found. Differentiation is important if the projectile is to be removed by aid of the vibrator. The shrapnel fragments generally have smooth or rounded edges. If a bone is hit, dust-like particles are seen at the contact.

Pirie believes that the shattering of bone by bullets occurs at the point of exit rather than at the entrance. In soft tissue the wound of exit is larger and more ragged than the wound of entrance.

David R. Bowen.

Downes, W. A. A Case of Giant Duodenum. (*Ann. Surg.*, Phila., 1917, lxvi, 436. Ref. *Surg., Gynec. & Obst.*, February, 1918, p. 129.)

Downes reports a case of giant duodenum in a child of four and one-half years. The child weighed 6 pounds at birth and 29 pounds on admission to the hospital. He had had frequent fits of vomiting since birth, with periods of one to two months' freedom.

At operation the stomach appeared normal with possibly a slight thickening of the wall; the pylorus was normal, and the duodenum was dilated to the size of the stomach. The wall was smooth and three or four times thicker than normal. No diverticula, adhesions, or peritoneal bands were present. Distention involved the entire length of the duodenum, ending abruptly at the point where the gut passed under the superior mesenteric artery. No effort was made to determine the nature or cause of stenosis. The usual posterior gastro-enterostomy was performed.

Japiot, P. The Nutrient Canal of the Ilium—its Radiographic Aspect and its Importance in the Diagnosis of Fractures of the Wing of the Ilium. (*Arch. d'électric. méd.*, May, 1918.)

In *The British Journal of Surgery* there have been reported cases of error in the diagnosis of fissured fractures through the wing of the ilium, confusing them with the nutrient canal. These fractures usually are Y-shaped, and often run in the same direction as the nutrient canal, which is formed as a V with the point downwards and the branches rather irregular and different in size. It is only infrequently that the canal can be seen in the *x*-ray, and one must have good plates to be able to see it clearly. The fractures are easy to recognize when they are complete and when there is displacement, but when the fissures are incomplete, one must take great care to always compare with the opposite side. The aspect of the fissured fracture is different from that of the canal; one always gets a uniform shadow without double clear contour.

To make a diagnosis of a suspected fissured fracture of the ilium, it is necessary to have as good plates as possible. Do not try to make a diagnosis from prints, and always roentgenograph the uninjured side for comparison.

Scully, Francis J. Perforated Gastric and Duodenal Ulcer: a Statistical Report of Fifty-nine Cases. (*Am. J. M. Sc.*, June, 1918, p. 874.)

In this article Dr. Scully gives us his very valuable experience with perforated gastric and duodenal ulcer from six years' work at the Cook County Hospital. Out of 578 ulcer cases, he has collected 59 cases of perforated ulcers, 48 of them being ulcers of the stomach, and 11 cases of perforated duodenal ulcers. Only the cases where the ulcers were actually seen at the operation are counted in, excluding all doubtful cases.

Of the 48 perforated gastric ulcers, 44 occurred in males, and only 4 in females, showing the most marked predilection for the male cases. The majority of the cases were between 30 and 40 years of age. The duodenal ulcer occurred entirely in men, and at a slightly earlier age.

Some of the cases were found to have had previous gastric disturbances, but very often the history obtained was uncertain. The only and most constant prodromal symptom was pain, often associated with eating; but many cases did not give any prodromes at all, and practically in every case the onset was very sudden, with an agonizing pain in the epigastrium. Vomiting occurred in 35 of the perforated gastric ulcers, shortly after perforation, and in 6 cases of the duodenal ulcer.

Following the sudden onset of pain there was a period of reaction. At this time the seriousness of the condition was difficult to recognize, and a dangerous delay was thus often caused. Later on the recurrence of pain indicated the onset of peritonitis.

In the examination, the point of natural tenderness corresponded to the point of maximal pain. In cases seen later, the tenderness was more generalized. Rigidity was always present. Fluid was diagnosed in some of the cases. In the early stages the pulse was not much increased in rate, although the leukocyte count was increased; while in later stages the pulse was rapid. When seen early and when a good history was obtainable, the diagnosis was not difficult. Acute appendicitis, acute cholecystitis, acute pancreatitis, ruptured appendix and general peritonitis are the conditions from which to differentiate the perforated ulcer, but in many of the cases the diagnosis was first made on the operating table.

The most common site of perforation in gastric ulcers was on the anterior wall of the stomach near the pylorus along the lesser curvature. Only in 4 cases was the perforation posterior. In all the cases of duodenal ulcer the perforation was anterior, near the pylorus.

The prognosis was never very good, only 16 cases recovering out of 40 cases of perforated gastric ulcers and 5 cases of perforated duodenal ulcers. Several of the cases died of shock.

The mortality was found to be proportionate to the length of time elapsing after the perforation, and it is evident after a study of Dr. Scully's cases that an early recognition of the condition followed by an immediate operation is necessary for the best results. Considerable confusion in the diagnosis of the perforation arises from the fact that the patient presents a markedly different clinical picture in the various stages. The symptoms are not progressive, and the physical signs not well developed until comparatively late.

Nogier, Th. Procédés de protection. (*Arch. d'electric. méd.*, No. 426, March, 1918.)

In this article about protective measures for roentgenologists, especially in war work, Dr. Nogier first points out the very important reasons for adequate protection, as well in fluoroscopic as in roentgenographic work; he compares the protective measures against the x-rays to the gas masks against the asphyxiating gases. The protection can be made in two places, either stopping the rays on their point of emission or where they first meet the body of the roentgenologist. In the first category is the lead glass shield. The writer does not consider that sufficient, as the glass must be enormously heavy for the rays not to penetrate it, and there are always so many openings through which the secondary rays especially can escape. In the estimation of the author the measures which render protection against the rays when they meet the body of the roentgenologist are much superior.

For protection of the hands the five-fingered glove of soft pliable lead rubber is the only good measure; the old stiff glove, used in the first part of the war, was perfectly useless for quick work and was always residing in a corner, while the work was done with unprotected hands.

For protection of the head, eyes and the face one must be certain of the perfect opacity of the lead glass in front of the fluoroscopic screen and of the sufficiently large size and opacity of the lead glass spectacles. Better than these Dr. Nogier found the metal helmet with the movable visor of lead glass. This consists of a helmet, similar to the trench helmets, with a front piece of lead glass reaching down to the chin, protecting the whole face, the eyes, and the hair, and with two side pieces of metal for the protection of the ears. The front part of lead glass may be closed and opened between the examinations by means of a hinge. This apparatus has been very much employed by Dr. Nogier and his assistants.

For the protection of the chest and abdomen the lead rubber aprons seem sufficient, but one must always be certain to get them large enough to reach all the way around the back.

For the protection of the legs, leggings made of lead rubber have been employed, but it is much better and easier to construct side walls on the four sides of the operating table from the table top to the floor.

Besides all these protective measures the roentgenologist must always employ the most rigorous discipline in this work to avoid all direct radiation of even the shortest duration; one must constantly think of avoiding the rays just as a surgeon must avoid microbes.

A few cardinal regulations for this discipline follow:

1. The roentgenologist must never make any examination without an apron, gloves, and spectacles; or better still, he should wear the protective helmet.
2. The roentgenologist ought always to work with the smallest possible opening of the diaphragm.
3. The roentgenologist ought never to palpate by hand for a foreign body under the screen, even when employing an opaque glove.
4. The palpation must always be done with a metallic instrument placed on the end of a wooden handle.
5. In every examination the current must not be turned on except at the exact moment of use. For this purpose the foot switch of Hirtz ought to be employed.

6. The roentgenologist ought never to hold in his hand the fluoroscopic screen, but he should always hold it by a handle fixed anteriorly to the frame of the screen.
7. When it is necessary to take off the gloves for more delicate localization, the roentgenologist must never hold the pencil for marking on the glass or the patient directly in his hand, but must employ a pencil holder with a protective cuff.
8. In the case of the employment of the Coolidge tube, one must always remember that in this tube the rays are emitted posteriorly to the anticathode, and that it therefore exposes the roentgenologist much more than the other tube.
9. If there are numerous fluoroscopic examinations in the vertical position, the roentgenologist ought to employ a small Spanish wall, lined with lead, to protect the knees and the legs.

Résumé.—When combining all these procedures and using them in a systematic way, one may not avoid all the dangers, but one may reduce them to an infinitesimal proportion.

Peer Lund.

White, Franklin W. Improvements in the Diagnosis of Chronic Ulcer of the Stomach and Duodenum. (Medical Clinics of North America, Boston Number, January, 1918.)

Dr. White lays emphasis on the value of following the progress of ulcers by means of the *x*-ray. While recognizing the great value of the roentgen studies, he regrets the increasing tendency to accept the roentgenologist's diagnosis without studying the case from the clinical and laboratory side. He reports five operated cases to illustrate the general points cited below.

The "six-hour residue" is a minor sign in ulcer, but valuable as a test of function and guide to treatment.

In deciding whether delay in emptying is due to spasm of the pylorus or actual tissue narrowing, he emphasizes the use of atropin. If the stomach relaxes and empties after the use of atropin, it can be concluded that the obstruction was due to spasm. If, however, the obstruction does not relax after atropin, spasm as a cause of delay cannot be absolutely ruled out. Muscular spasm is a very variable and intermittent affair and such a patient does not always behave alike at different times, entirely apart from the use of drugs.

As regards the effect of ulcer deformity on the emptying of the stomach, he finds that the oldest ulcers, as a rule, produce the most deformity but do not necessarily show the most obstruction. Deformity means old scar tissue or adhesions, as well as active ulcer which may cause deformity from spasm.

The greatest stress is laid on the demonstration of the ulcer itself by finding a defect in the stomach or duodenal wall. The indirect signs, such as changes in peristalsis, spasm and six-hour residue are valuable as indications of something wrong. They occur in ulcer and also in other conditions, such as chronic appendix or gall-bladder or general nervous irritability.

Under medical treatment, the deformity of gastric ulcer disappeared in a number of cases. In cases showing marked deformity of the duodenum, he found that while the deformity might be greatly lessened, it did not entirely disappear.

The late diagnosis of the condition of ulcer after treatment is considered as of great importance. Some of the functional tests are repeated after two or three weeks of treatment. In all cases it is recommended that the patient be examined at least once in three months during the first year, whether symptoms are present or not.

Herman A. Osgood.

Millet, John A. P., and Mueller, Theodore. Some Phases of Radium Action with Special Reference to the Hematopoietic System. (*J. Cancer Research*, April, 1918).

In the large amount of work done in the study of the effects upon the hematopoietic system of exposure to radioactive substances most conclusions have been based upon lower animal experimentation. The chief results have been those of roentgen ray effects, such as the destruction of lymphoid cells, explosive in character and preceding effects upon other body cells; destruction of bone marrow cells *in situ;* primary rise in the polymorphonuclear count, followed by a subnormal drop; a steady decline in the lymphocyte count; and resistance of red cells to radiation. Aside from a vague knowledge of blood changes in roentgenologists, there is very little definite knowledge of the effects of radiation upon man. Schweitzer, who studied the effects upon the blood following heavy mesothorium exposures in cases of carcinoma of the cervix uteri and vagina, observed a primary leucocytosis, followed by a drop below the original count within twenty-four hours and maintained for eight weeks; a primary drop in lymphocytes followed by lymphocytosis; a similar change in the eosinophile count; and absence of any effects upon red cells. He attributed these changes to the production of toxic substances of unknown origin, and regarded the leucopenia as an unfavorable effect.

For their investigations, the authors selected ten cases of squamous cell carcinoma of the cervix uteri and vagina for the purpose of studying the immediate and remote effects of the therapeutic radium exposures upon the activity of the blood-forming organs. Some of the patients received roentgen ray exposures in addition. The technique consists of a comparatively small amount of 50 mg. radium element placed in a brass applicator, surrounded by a finger cot, and applied for thirty hours in each instance in which immediate effects were studied, with two exceptions. The applicators were packed in place by cotton, or the healthy portions of vaginal walls were protected by placing the applicator in half cylinders of 2 mm. lead, using adhesive plaster and rubber to cut off secondary radiation from the latter. Blood studies were made immediately before the application and at intervals of one-half, one, two, four, six, nine and twelve hours after the application started, and then daily. The patients received no breakfast, had a light luncheon after the six-hour count, and supper after the twelve-hour count. The subsequent daily counts were made three or four hours after breakfast. Observations were made by the same individual throughout any given series.

It is difficult to render a concise summary of the results, but the more important conclusions drawn may be briefly summarized as follows: The remote effects of radium alone were similar to those of combined radium and roentgen ray applications. The *immediate* effects of radium were an immediate drop in the total leucocyte count, reaching its minimum in from one-half to six hours, with a return to the original level within twenty-four hours and usually within twelve hours, and an occasional rise to a higher point than the original in from twelve to seventy-two hours after the application. The total polymorphonuclear count closely paralleled this. The total lymphocyte and large mononuclear counts showed no characteristic changes. The relative lymphocyte count showed a tendency to drop and the polymorphonuclears to rise during the application, but this tendency was reversed during the period immediately following. The *remote* effects were a fall in the lymphocyte count from two to four weeks after treatment, lasting until the end of the second month; a fall in polymorphonuclears, sometimes simultaneously with the lymphocytes, but usually coming on later and being less striking; an attempt of the lymphocytes to recuperate and rise to the original level at some later date. The *late* effects were a relative increase in polymorphonuclears and decrease in lymphocytes without leucocytosis, as the patient's resistance weakened; and a terminal leucocytosis, due mainly to an increase in the absolute polymorphonuclear count, although usually accompanied by an absolute decrease in lymphocytes.

Theoretical conclusions: In the terminal stages of death from cancer there is a relative and often absolute lymphopenia, although this may not appear until a few days before death, and there may be an increase up to such a time. The lymphocyte count is, therefore, not an infallible index to the patient's resistance at any given time. As all the patients were hopeless ones the above changes cannot be used as a guide to the proper intervals and dosage of the applications, but it does not seem unreasonable to suggest that no second application should be made until the lymphocyte count has recovered from the preliminary drop following the first application. Information is desirable as to the behavior of the blood in patients treated under more favorable circumstances. The exact mode of action of radium upon the blood is uncertain. There is ample clinical and histological evidence that radium has a definite local action on malignant growths, detrimental to their development, but there is a more general effect we do not understand. Further blood studies may explain some of the miraculous cures on the one hand and the unexpected failures on the other.

It seems not impossible that the early blood changes noted were due to the sudden introduction of protein substances from cell destruction into the blood, with the same effects upon the blood-forming organs as are caused by intravenous injections of foreign protein. Even if this be true, however, it does not justify the assumption that the therapeutic effect of radium is dependent upon the formation of these products of abnormal cell destruction.

H. K. Pancoast

Holmes, George W. The Examination of the Heart and Great Vessels by Means of the *X*-Ray. (Medical Clinics of North America, Boston Number, January, 1918.)

The writer presents a method for the roentgenographic examination of the heart which combines the advantages of fluoroscopy, orthodiagraphy and teleroentgenography; and provides a fairly accurate knowledge of the size, shape and pulsations of the various chambers.

The fluoroscopic observations are made with the tube at a distance of 2½ feet and the patient upright in the anteroposterior and right oblique positions. The rapidity, force and time of pulsations in the various chambers are noted. Tracings are made on glass of the outline of the heart and great vessels; the excursion of the diaphragm and the changes in outline and position of the heart with respiration are recorded. This tracing is then transferred to a chart which is used in conjunction with a plate taken at a six-foot target-film distance during normal breathing. Measurements are made on the plate of the length and breadth of the heart, distance of the right and left borders from the midline, and the distance across the great vessels.

The various lesions of the heart and great vessels are briefly discussed and their roentgenographic appearance described. A table of normal heart measurements is offered by Claytor and Merrill.

Herman A. Osgood

George, Arial W., Leonard, R. D., and O'Brien, F. W. The Roentgen Diagnosis of Diseases of the Upper Right Abdominal Quadrant. (Medical Clinics of North America, Boston Number, January, 1918.)

The authors find that a normal first portion of the duodenum in serial plate rules out surgical ulcer. A second portion of the duodenum which, instead of passing directly downward, passes outwards towards the liver border and then curves to its normal position, they consider almost pathognomonic of gall-bladder disease. From the study of a series of cases they find that the gall-bladder shadow seen in the *x*-ray plate is always indicative of a pathologic change. This shadow may vary in size, is usually characteristically pear-shaped, and may be found almost anywhere on the right side below the diaphragm. Gall-stones, they claim, can be demonstrated by proper *x*-ray technique whenever present. They take a series of plates of the right upper quadrant on the fasting patient. They then pay particular attention to the examination of the barium-filled duodenum in relation to the densities seen in the right upper quadrant. They also find that considerably more gas will be found in plates of the right upper quadrant in gall-bladder disease than in the normal. A gas-filled hepatic flexure and transverse colon in the six and twenty-four hour plates following the bismuth meal is considered quite characteristic in gall-bladder disease.

Herman A. Osgood

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ON THE INSTRUCTION OF WAR ROENTGENOLOGISTS

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AMONGST many other new developments due to war conditions, the capital importance of roentgenology as a primordial factor in diagnosis, surgical treatment, and medico-legal decisions must rank first in our interest. It has given rise to a quantity of problems involving physical technique, medical and surgical technique, as well as general organization—problems which it is our duty as specialists to examine carefully and to help in solving.

In regard to physical technique it can safely be asserted that considerable progress has been made and that owing to the fruitful collaboration of such physicists as Coolidge, Hull, and Shearer we are in possession of equipments that will meet all requirements for the work to be done on the front as well as in the interior.

In surgical technique, where the localization of foreign bodies with all its consequences has a long time been the main center of interest, we can also consider that the problem, which had of course been solved theoretically long ago, is now very adequately solved from a practical view also—a few very simple fluoroscopic methods being sufficient to give a rapid and accurate answer to every possible question that may arise (with the single exception of intra-ocular foreign bodies). The surgical extraction with the aid of the "bonnette" is their complement. Many other points—diagnosis of gas, gangrene, et cetera —have received due attention and lead up to important results. But it seems as if the questions regarding the general organization of war roentgenology have elicited less interest amongst members of our specialty though they undoubtedly are of a very vital importance at the present moment.

The first question to be solved is how to supply the armies with roentgenologists. I am not at liberty to state any positive figures but I can well say that with the actual war conditions, and the ever increasing quantities of men on the front, a very considerable number indeed of roentgenologists is required if we want—as we undoubtedly do—to afford every possible facility for the proper care of the wounded. And this number of roentgenologists outstands by far the number of men already in the specialty even if every roentgenologist was actually available for service.

We have, then, no other alternative than to form new roentgenologists in quantities sufficient to meet the ever growing requirements of the army; and this is no mean task. It demands care and reflection and should command the greatest interest and personal collaboration of all engaged in the specialty, as it requires a considerable and persistent effort, the difficulties of which can only be realized by those who have already had a hand in this instruction.

Two conditions are to be fulfilled, in my opinion, by any man enlisting as a military roentgenologist: (1) He must be a fully qualified medical man. (2) He must take real interest in this specialty and in this kind of work; for only those who "take to it" are able to do it well and it must be done well or not at all.

If several hundreds of roentgenologists (satisfying the above two conditions) are wanted for the armies fighting in France it implies, of course, that the greater number of them will be entirely new to the specialty and will have to be "formed" and instructed.

The difficult problem of this "formation" seems to have been solved very satisfactorily, and indeed in the only way that could bring good and rapid results.

The theoretical and practical instruction that has been given to all of those whom I have had the pleasure of seeing in France is of a standard which I acknowledge with admiration and which ought really to give wonderful satisfaction to the men who have devoted their time and efforts to this instruction.

But some practical training in war work is needed by those who were not already specialists, and to this part of the instruction I have given all my attention, having had the great honor of being entrusted with an important part of it.

Conditions of work on the front are of course altogether different from our civil practice and can only be fully realized by those who have been "in it." *There*, roentgenology is practically limited to fluoroscopic examination in which the search for and localization of foreign bodies play the most important part. Mastering a few simple yet accurate methods of fluoroscopic localization must be the dominant occupation of the roentgenologist. He must also be prepared to aid the surgeon in extracting the foreign bodies in the difficult cases either with a compass—the Hirtz compass—or, if a roentgen table is available (and it nearly always is), with the aid of the "bonnette," which means team work with the surgeon. Preliminary personal experience with a few cases is here a necessity for good and rapid work and this experience I have been able to give, thanks to the willingness of our surgeons and especially of Professor Ombiedanne, to all the men who have been under my care in Tours.

The gross study, with the screen, of traumatic bone conditions, and their complete and more delicate observation on the plates, is the next objective in the interest of the war roentgenologist and is readily gained owing to previous general instruction. The knowledge of gas gangrene, traumatic chest conditions, et cetera, is also essential.

But owing to the difficulties in transportation, equipments are not and *cannot* be uniformly distributed. Furthermore, the complex amalgamation of the Allied Forces in actual warfare will often locate roentgenologists of the A. E. F. in a place where French or English roentgen ray equipments alone are available, where Coolidge tubes are unknown. He must therefore be prepared to work with gas tubes and with any form of coils and interrupters.

Preparedness for this emergency is our third principal object in this practical training and is, I believe, readily attained. And this also points out the necessity of simplifying and standardizing equipments to the utmost possible limits. Simple, but of light weight and easy of transportation must be our outfit—conditions which seem well nigh realized, thanks to the persevering efforts of physicists and manufacturers. These have given so constant and hearty a collaboration to the roentgenologists entrusted with the huge task of getting our part of the enormous war system into work. The U. S. Army portable outfits, with the small radiator Coolidge tubes, seem to be an ideal solution of this question.

Last I must mention the importance, for all those engaged in any war work over here, of some knowledge of the language and I need not dwell on its too obvious reasons. The small glossary, which appears on page 483 of this issue, is an endeavor to help out to some extent, however modest, in this line and is only a suggestion for further efforts. This knowledge may greatly facilitate a correct written interpretation of the roentgen findings. The importance of a correct and adequate written statement is considerable and only too often overlooked. I lay great stress upon this point as well as upon a correct classifying and indexing of roentgen findings. A small pamphlet on this subject will shortly be published which, I hope, will be of some help to those not yet quite familiar with the task.

I have indicated but a few of the points which I believe to be important for practical education and complementary instruction of war roentgenologists and I apologize for having dwelt on such commonplace subjects—subjects so well known to all of you.

As a result of my actual experience, I think I can safely state that thanks to the splendid efforts of those who have had the care of roentgenological teaching in the United States,—and to the persevering and incredible energy and activity of those who, like Lieutenant Colonel Case, Major Hickey, Lieutenant Waters, and all the men who have been over here with them —it is possible to form under five months' time, roughly speaking (three months' instruction; one month of practical training in France; and one month for transportation), a series of men who, undoubtedly, will not become in this short interval perfectly and fully qualified roentgenologists unless they were specialists before, but who will be quite able to undertake practical work under the very best possible conditions for the benefit and care of our wounded and the final triumph of our just cause.

I feel proud of having been entrusted with a part of this work. It has brought me into close contact with so many able men in all of whom I have admired the spirit and willingness for self-sacrifice; and has strengthened, if that were possible, my sympathies and admiration for my American colleagues.

THE BRONCHIAL TREE *

ITS STUDY BY INSUFFLATION OF OPAQUE SUBSTANCES IN THE LIVING

BY CHEVALIER JACKSON, M.D.

PHILADELPHIA, PA.

THE wonderful development of stereoscopic radiography has rendered it possible for the expert roentgenologist to see the trachea and, in many patients, some of the larger and some of the smaller ramifications of the tracheobronchial tree, the latter more especially in cases in which more or less pathology is present. A method for increasing the visibility of the tree is a great desideratum. The author believes that intrabronchial insufflation of opaque substances meets this requirement and opens an enormous field for investigation.

The method consists in insufflating or injecting an opaque substance or mixture into the living tree. The injection of the tree in the cadaver has been done many times, and in a few instances opaque solutions have accidentally gotten into the trachea or bronchi from the esophagus, either by overflowing into the larynx or by leaking through a cancerous fistula.[1] Naturally, no one would care deliberately to inject the living tree, unless either (a) the absolute harmlessness of the method were proven, or (b) there was a reasonable hope of bettering that particular patient's con-

[1]BEELER, R. C., *J. Am. M. Ass.*, 1915, LXV, 1178.

* Read before the Meeting of the Laryngological, Rhinological and Otological Society, May, 1918.

dition at no more than slight risk. Indisputably to prove absolute harmlessness, a large number of observations on all sorts of patients will be necessary; and this evidence must come primarily from the second class of observations, namely, those in which there is a reasonable probability of benefiting a patient not otherwise relievable.

Since his first publication[2] in 1907 the author has, in a number of cases, deposited a small amount of bismuth in the bronchi for the radiographic localization of a particular spot, to show the relationship of the spot to a foreign body that was itself not in view, and for the localization of bronchiectatic and abscess cavities, and so forth. In none of these cases was there any after-trouble from the bismuth. In using the method in a case where we obtained the mapping out of a considerable portion of the tree of one lung, Dr. David R. Bowen, with whom I was collaborating, suggested the advantage of stereoscopic plates in such a case.

In the case of a young man, twenty-three years of age, with a metallic foreign body "around the corner" in an ascending branch of the left upper-lobe bronchus, bismuth subcarbonate was blown in with an insufflation tube (see in the accompanying illustration). A radiograph, taken by Dr. David R. Bowen within five minutes after the insufflation, showed a mapping out of the stem bronchus, the upper-lobe bronchus, and some of the branches. One of the bronchi was plugged by the bismuth and caused me some uneasiness, until a radiograph taken by Dr. Bowen twenty-four hours later, showed that all the bismuth had disappeared. Occasional cough and expectoration for the first six or eight hours was rather free, the sputum being of milky whiteness from admixture of bismuth. At the end of twenty-four hours cough and expectoration ceased, and the patient has been normal ever since getting rid of his foreign body. The plugging of a bronchus by the bismuth is doubtless less likely to occur with the bronchoscopic insufflator (see in the figure), but the relative merits of each method have not as yet been fully worked out.

Conclusions.—1. In intrabronchial insufflation with opaque substances, in the living, we have a measure of the greatest usefulness in mapping out the tracheobronchial tree in foreign-body cases where a foreign body is far in the upper-lobe bronchi, or in other small bronchi that cannot be entered by the bronchoscope. A stereoscopic pair of radiographs will show the bronchi *in situ* in the living, and the bronchi can also be followed in the fluoroscope.

2. The intrabronchial insufflation of dry bismuth subcarbonate through the bronchoscope, in sufficient quantities to cast a shadow, did not produce any untoward symptoms, and the bismuth totally disappeared from the lung by expectoration in twenty-four hours.

3. The insufflation of dry powders and the injection of opaque fluid mixtures through the larynx give a degree of visibility to the trachea and larger bronchi in the radiograph; but the results are not as good as when the insufflation of a dry powder is done through the bronchoscope.

4. The method opens up an enormous field for investigation of the action of the living cilia, in health and disease, the lymphatic drainage of the lung, the mapping out of bronchiectatic and abscess cavities, and so forth.

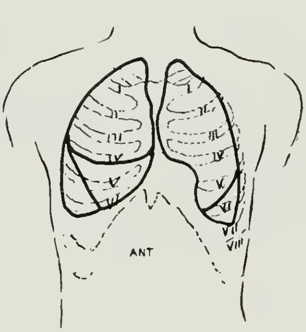
[2] Jackson, Chevalier, "Tracheobronchoscopy, Esophagoscopy and Gastroscopy," p. 69.

LOCALIZATION OF THE LOBES OF THE LUNGS BY MEANS OF TRANSPARENT OUTLINE FILMS

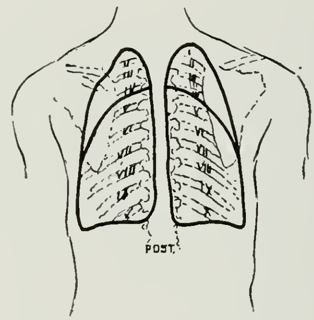
BY CHEVALIER JACKSON, M.D.

PHILADELPHIA, PA.

CLINICIANS have a very good working conception of the size, shape, and topography of each of the five lobes of the lungs, in the living. But when a foreign body is seen in a radiograph there is often radiographic negative have been of great service to me. Twelve sizes of each of four points of view are needed: front, back, right lateral, and left lateral (see *a*, *b*, *c*, and *d* in the accompanying illustration).



a



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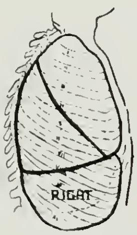

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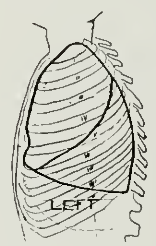

d

a difference of opinion as to which lobe the intruder is in.

In the case of a foreign body in any of the larger bronchi, bronchoscopic finding is a very simple matter. In those infrequent cases of a foreign body, small in one diameter—such as a pin—and located in a small bronchus far out toward the periphery, the finding of the foreign body may be facilitated by very accurate localization. The author's transparent positive films have been of great aid in these cases.

In a number of cases of small foreign bodies far out toward the periphery, transparent outline films for overlaying the

Knowing the lobe invaded, the bronchoscopist limits his search for a lost foreign body to the branches of the stem leading to that lobe.

Conclusions.—For mapping out the outlines of the lobes of the lungs in a radiographic negative, the overlaying of the plate with a transparent positive outline film is very useful. It is necessary to have about twelve sizes of outline films of each of four points of view: front, back, right lateral, and left lateral. These, with a moderate mental endowment of solid geometry, will be of great help in localizing the outlines of the confusingly irregular labor shapes.

SOME CAUSES OF FUNCTIONAL DISABILITY FOLLOWING FRACTURES

BY H. W. DACHTLER

TOLEDO, OHIO

During the last six years I have made a systematic effort to reëxamine fracture cases which I had previously examined since 1900, with the object of determining the end result and, where functional disability was present, of ascertaining the cause, if possible. Since 1900 all plates have been filed and records kept of the original examinations so that the actual condition at the time of the injury could be studied, and comparisons made. It seemed that if a sufficient number of these cases could be reëxamined, material well worth study would be furnished. This expectation has been proven to be correct by the remarkable results shown in some of these cases. The total number of cases examined from 1900 to date for suspected fracture was in round numbers 5000. The percentage of fractures found in this series was not determined, as no cross index of that feature was made. Of the total number of original cases over three hundred have been reëxamined, some of them a number of times. These, together with the cases first seen by me some time after the injury had been sustained but not examined with the *x*-ray at the time of injury, form a series from which some important conclusions regarding loss or impairment of function can be derived. An effort has been made to learn the ultimate functional result of other cases that could not be secured for reëxamination. No attempt has been made to classify numerically the different types of fractures but they will be considered regionally.

In fractures of the metacarpals good function seems assured if reasonable reduction is obtained. A few cases were seen in which reduction was difficult but usually ordinary methods were adequate. One case was seen in which there was a positive history of fracture of the second, third, fourth, and fifth metacarpals in a patient aged nineteen. When examined forty years later no evidence of fracture or change in the bone structure could be detected. The hand had been dressed with the hand clasped around a cylinder about two inches in diameter.

The typical automobile fracture is a fracture of the radial styloid, and the fracture extends into the wrist joint. Usually there is no displacement and but slight separation, and just what injury the periosteum sustains I do not know, but it is probably slight. No callus is seen and bony union is slow. The fracture line can usually be seen two months after the injury and, in one case, was still present four years after the injury. Most of the cases examined from two to five years later showed a complete return to the normal bone picture. Most of the patients examined were young men in perfect physical condition in whom rapid repair would be expected. Fixation should not be applied in these cases unless the fragment is displaced and then for a few days only, following reduction. The ultimate function is practically perfect. Not all fractures caused by an automobile back-firing are of this type, some being typical Colles' fractures. The exact nature of the injury must be known to be intelligently treated.

In Colles' fractures several important points seem conclusive. Eighty per cent. of these fractures show a marked bulging of the posterior part of the lower fragment of the radius, owing to the fractured end of the shaft being driven into it and causing comminution. The anteroposterior diameter of the wrist is increased just under the dorsal annular ligament. If the impaction is not broken up and the fracture reduced, this interferes with the use of the extensor tendons, and loss of function may result. Usually, it is impossible to reduce an impacted Colles' fracture without giving an anesthetic, and even then it may be difficult to break up the impaction. If perfect reduction is obtained and the

Fig. 1. Case No. 6587B. Lateral View of a Colles' Fracture.

This is put up in the full flexed wrist position with moulder posterior plaster splint. At two weeks this patient was writing his records with this hand.

joint is immobilized for the length of time formerly thought necessary in treating these fractures, marked functional disability will certainly occur, and it may be months before a proper use of the joint is possible! If not properly reduced and fixation is applied for a few weeks, most certainly will loss of function persist for months and even years. As flexion of the wrist and fingers has been the hardest motion to obtain following such injuries, it is a strong argument for the use of the full-flexed wrist position recommended by the late Dr. John Murphy in treating Colles' fractures, even though there is no other indication for its use. It, however, offers the further advantage of retaining the fragments in accurate position, with less chance of displacement while bandaging than is possible by other methods. The ability to fully flex the wrist also shows that the posterior bulging of the lower fragment has been corrected. Excessive swelling may also prevent full flexion, and in such cases further x-ray examination will be necessary to determine if reduction has been obtained. The flexed wrist position is not a disadvantage in this examination, as it is only necessary to make the lateral view to determine if reduction is satisfactory. Of the many cases I have seen treated in this manner not one has had difficulty in extending the wrist afterward, and the normal function was obtained in a much shorter time than is usual after treatment in other positions. It should be noted, however, that in all these cases passive motion was begun very early. This is essential to good results. One who has noted the force necessary to break up the impaction in a Colles' fracture under anesthesia cannot but marvel at the fallacy so prevalent among physicians concerning the necessity of immobilizing such fractures as have not been reduced. If an anesthetic is contraindicated and crepitis is not present, they should be treated as sprains and no fixation applied.

Fig. 2. Case No. 6587C. Same Case as Fig. 1, Taken Seventeen Days after Injury.

Before reduction this was one of the worst comminuted and displaced Colles' fractures in my experience.

They can be supported in a sling for a few days, at the end of which period the patient should be encouraged to use the joint. Nineteen cases were seen in which the fractures had not been previously recognized,

Fig. 3. Case No. 27180. Same Case as Figs. 1 and 2, Seven Years Later.

Function perfect. Plate still shows evidence of the old fracture line.

and the patients used the wrists from the time of injury. There was practically no loss of function in any of these cases, although some of them were considerably deformed. A large and varied experience with Colles' fractures treated by both old and new methods forces the impartial observer to the conclusion that the large percentage of cases with functional disability were due to the fixation applied and not to the injury. No lack of treatment can produce the absolute disability I have observed in cases of Colles' fracture where fixation has been continued for four or more weeks. Such procedure is still not uncommon.

Next to the wrist, probably the elbow is the joint of the upper extremity most often fractured. Will the study of these cases help us to understand why such good functional results follow elbow injuries in children and why some loss of function frequently follows injuries to the adult elbow? I think it will. Eighty per cent of the elbow injuries in children do not involve the joint at all. They are usually fractures of the lower end of the humerus entirely above the epiphysis, or a fractured condyle. In the first case, the joint is not seriously injured, and even with extensive displacement of the lower fragment and marked deformity no permanent joint disability is experienced. In the early days of the *x*-ray, many of these cases came in diagnosed as backward dislocation of the elbow and showed a marked tendency to recur after supposed reduction. They were never such! Elbow dislocations must be extremely rare in children, as only one case is found in the series on which these observations are based. Allowance must be made for cases that may never reach the roentgenologist, owing to ease of reduction. Only two cases of separation of epiphysis of the lower end of the humerus occurred in this series. One was not reduced, and the ultimate function will be noted if possible. When functional disability exists after elbow injuries in children, it is usually due to marked change in the carrying angle or to rotation of the lower

Fig. 4. Case No. 9256. Unreduced Fracture of Lower End of Humerus in Patient Eight Years Old.

Picture taken five weeks after supposed reduction. (Plate by Drs. Hill and Thomas, Cleveland, O.)

fragment on the shaft of the humerus, which, uniting in such faulty position, causes some loss in supination. One case in which the normal carrying angle was replaced by an angle of twenty-five degrees in the opposite direction had perfect function of the joint but, of course, marked disability of the arm. Most of these fractures are best treated with the elbow fully flexed and with the palm to the shoulder. Occasionally a case is seen that can only be maintained in reduction with the arm fully extended. Such cases should be carefully watched, however. The good results in these cases are in marked contrast to the functional results following injury, especially dislocation, of the adult elbow. This is due to the fact that in the adult elbow it is the joint structures that are usually injured. The elbow, more than any other articulation, seems prone to new bone formations following slight trauma. This condition has been described under the title of "Traumatic Myositis Ossificans." The study of eight cases examined with the x-ray shortly after a minor injury in which no lesion was found was of much interest. These cases were reëxamined

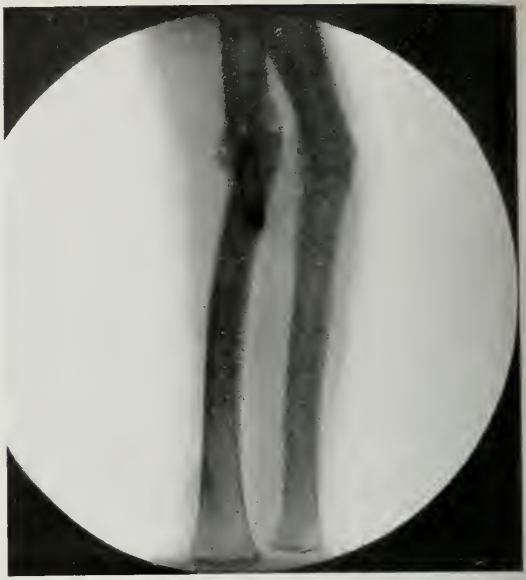

Fig. 6. Case No. 1842.

Forearm of boy, aged six years, examined three weeks after injury.

after varying intervals because of some loss of function which gradually progressed.

Fig. 5. Case No. 9256. Same Elbow Four Years Later.

Picture shows how perfectly nature has corrected the deformity.

Fig. 7. Case No. 1842. Same Case as Fig. 6, Examined Eight Years Later.

With the exception of slight bowing no evidence of the old fracture can be detected.

'he disability was either some loss of exion or extension associated with slight ain at the extremes of motion. In all of hem new bone formations were present. n a few of these cases the new bone for-

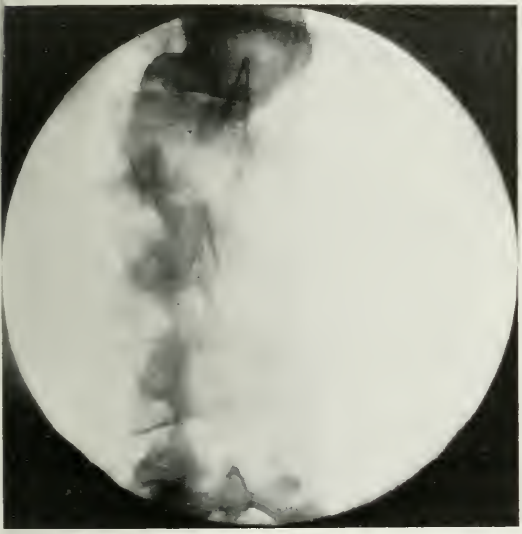

Fig. 8. Case No. 4859. Fracture and Dislocation of Lumbar Spine in Male Aged 23 Years.

The transverse processes of the first, second, and third lumbar vertebræ were fractured and slightly separated.

mations were so marked that a previous fracture would have been suspected if I had not had the original plates showing no evidence of injury. No matter how trifling the injury to the adult elbow I always caution the patient that later such formations may occur. In my experience locomotive engineers show a marked tendency to traumatic myositis ossificans. An injury breaking up the new bone formations will cause much pain and the limitation of motion, perhaps previously unnoticed, may lead to errors in physical diagnosis.

Fractures of the head of the radius are much more common than usually suspected. My experience with over one hundred and fifty cases is that the majority are caused in the same way that a Colles' fracture is sustained, by falling upon the extended hand. Pain on rotation of the forearm is marked, and extension and flexion are limited. Moderate extension or flexion may cause but little pain. Strange as it may seem, in a class of injuries due to the same cause, I have never observed a fracture of the head of the radius and a Colles' fracture in the same arm. One patient sustained a fracture of the head of the radius on one side and a Colles' of the other wrist. In some of these cases, the head of the radius is completely shattered, but the ultimate function will be good if the patient will persist in using the elbow joint.

Fractures of a condyle of the humerus seldom cause loss of function unless associated with a dislocation. Three cases associated with dislocation were seen in which the fractured condyle was drawn within the elbow joint, preventing reduction of the dislocation. Such cases are serious and may require operation for the removal of the fragment. Some loss of function has resulted in all of these cases.

Reference to the elbow joint would not be complete without calling attention to the fractures of the shaft of the ulna,

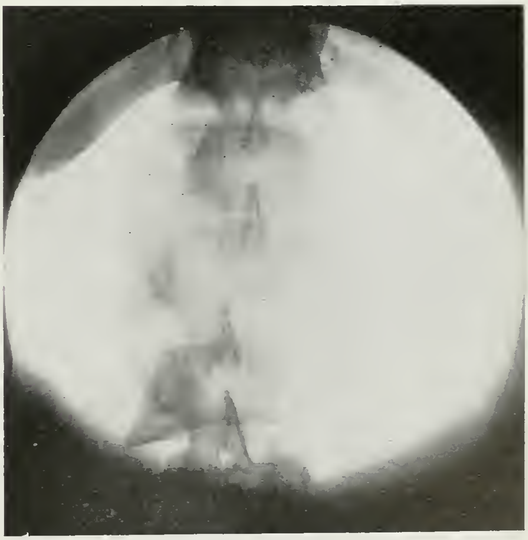

Fig. 9. Case No. 4859. Same Case as Fig. 8, Six Months Later.

Picture shows repair in spine and long union of transverse processes showing that the transverse processes will unite if not too widely separated. This patient has no paralysis and practically no disability.

with overriding of the fractured ends causing a dislocation of the head of the radius. This complication may easily be overlooked. One case was observed in which the dislocation recurred three times,

Fig. 10. Case No. 24004. Unimpacted Fracture of Neck of the Femur in Female Aged 54 Years.

Picture taken four days after injury.

and the ulna had to be plated to hold it in extension before reduction of the dislocation could be maintained.

This series has not furnished anything striking in fractures near the shoulder. A large number of cases have been examined in which there was marked loss of function but no fracture. This is now known to be due to injuries to the soft parts, and, as a class, can be classified as sprains, although the injuries were of various kinds and degrees. In fractures of the surgical neck the extent of the injury to the soft parts will usually determine the loss of function. Two cases of fracture of the anatomical neck with displacement of the fragment, in which the fragments were resected, gave fair functional results.

Marked fractures and dislocations of the vertebræ can occur with surprisingly little disability. Two cases were seen, one with a crushing of the body of the eleventh dorsal and the other of a crushed first lumbar, in which the patients only complained of symptoms that suggested a slightly sprained back. In both cases only slight improvement was noted in four months. Fractures of the transverse processes of the lumbar vertebræ leave the patient with a lame back of which he complains for a long time.

Fractures of the pelvis have shown fairly good function. Some fractured pelves were found in examinations for renal calculi. In all of these the patients had been injured when young, but were not aware that they had sustained fractures. Most of them were caused by falling astride a fence or similar object. There was no evidence of disability in any of these patients, although some deformity of the symphysis pubis was present in each case.

One of the very important regions with which we have had to deal is the hip joint, and the three hundred odd cases of fracture

Fig. 11. Case No. 24004. Same Case as Fig. 10, Six Months Later.

Patient was treated, in hospital, by fixation without operation. Head and neck absorbed. Picture taken before patient had been allowed to use the limb.

in this location show some interesting and instructive features. One important fact that seems proven is that, in fractures of the neck of the femur that are completely intracapsular, and not impacted, old methods of treatment are worthless. Such cases do not go on to bony union, and, without exception, subsequent examination showed an absorption of the neck. When I see such cases I feel justified in saying that function and weight-bearing will not be secured unless the fracture be mechanically fastened or artificially impacted, and in recommending such procedure if the age and condition of the patient justify it. In no other way can the function of weight-bearing be conserved, and, if properly carried out shortly after the injury, good joint function and weight-bearing can be obtained. Fractures at the base of the neck of the femur are partly extracapsular and often impacted. The impacted cases have usually united and show good weight-bearing function after six months. The joint disability will depend upon the amount of shortening, the change in the angle of the neck and the amount of rotation present. Fractures through the trochanters unite in a remarkably short time. If shortening is slight, good function is assured. In some of these cases the lesser trochanter is markedly displaced, and, in these, function may be impaired.

Fig. 12. Case No. 11673. Spiral Oblique Fracture Through Trochanters of Male, Aged 65 Years.

Fractures of the knee are likely to result in some loss of function as very slight displacements may interfere with the weight-bearing ability of the joint or cause severe muscle strain. In addition, the ligaments and cartilages are often injured and, even when no fracture has been sustained, the joint is often permanently weakened. A guarded prognosis should be made.

The most important function of the lower extremities is that of weight-bearing. If good weight-bearing function without undue muscle strain is retained, locomotion is usually assured even though there be a stiff hip, knee, or ankle. Faulty weight-bearing with the attending muscle disability will most certainly cause loss of function. From the foregoing one would

Fig. 13. Case No. 11673. Same Case as Fig. 12, Six Weeks Later.

Bony union so perfect in this short time that fracture could not be detected.

expect angular deformities of the long bones or of the joints of the lower extremities to interfere most seriously with func-

Fig. 14. Case No. 10454. Excessive Callus Formation in Hip of Female, Aged 42, Four Months after Injury which Led to a Clinical Diagnosis of Sarcoma.

In all of the cases observed showing this condition, the shaft of the femur was in contact with the base of the neck and immobilization was not complete.

tion, and this is borne out by my series of cases. Moderate overriding of the long bones and consequent shortening leaves but slight permanent disability. With overriding of the fractured ends and consequent shortening of the muscles there is much less tendency to angular deformities. A fracture of the middle third of the femur with the fractured ends overriding and in opposition, in which the long axes of the two parts are parallel, gives good function even though the shortening be as great as two inches.

Fractures in the upper and lower thirds of the femur are particularly hard to handle. The method of treatment which best prevents angular deformities must be used, and bone plating may be necessary. Do not depend upon the plate to oppose the pull of strong muscles or you will be disappointed. Rather take as much strain from the screws as possible by placing the leg in a position to minimize the strain. Fractures of the femur just above the condyles are subject to displacement by the pull of the gastrocnemius, and the fractured end of the lower fragment is usually found in the popliteal space. In an early series of fourteen cases not one was reduced without an open operation. While many of them were plated, I do not think it necessary. In the adult, it is often impossible to reduce this fracture without some form of traction apparatus or by operation, prying the displaced lower fragment into place with a chisel or other suitable instrument. The tendency then is to plate to maintain reduction, and the leg is put up in plaster in extension or at best with some form of knee splint that allows only moderate flexion. This I think is absolutely contraindicated. It puts a

Fig. 15.

Showing proper angle for insertion of screw in mechanically fastening a fracture of the neck of the femur. In this position the weight of the body will not be borne by the screw but by the bone, the screw preventing the fracture ends from sliding on each other.

severe strain upon the screws used to fasten the plate. This strain should always be avoided, as far as possible, after plating operations. The logical way to treat these fractures would seem to be that used with such success in fractures of the lower end of the humerus, in which the arm is fully flexed. If the fracture is a transverse one, as is often the case, and the leg is flexed, the heel being drawn well back upon the buttock, all tendency to displacement is overcome, and plating or other fixation operation is unnecessary. If the fracture is oblique, a single peg or screw can be inserted if it has been necessary to open to reduce the fracture or, better still, extension can be applied to the condyles of the femur to overcome the shortening. If a cast has been applied, shortening can be avoided by keeping the knee upright in bed, allowing the weight of the leg to rest upon the bottom of the foot. Experience has shown this full-flexed position of the leg to be comfortable and to have no contraindications. This method has given good results in comminuted cases that, in my opinion, could not have been satisfactorily treated otherwise. (See Figs. 16-17-18.)

Fig. 16.
Fracture of the lower end of the femur.

Fig. 17.
Case No. 23073.
Same case in plaster cast with leg fully flexed on the thigh.

Fig. 18.
Same case five weeks later when cast was removed. Ultimate function nearly normal.

In fractures of the lower leg the most important consideration is to preserve the proper axis for weight-bearing and to prevent a lateral tilting of the ankle. I always make an anteroposterior plate of the ankle joint in leg fractures, as it is important in outlining the treatment. Many of these cases were formerly left with faulty weight-bearing that caused permanent disability. In Pott's fractures and other fractures near the ankle, do not neglect to examine the entire length of the fibula. In such cases, the fibula is often broken near the head and, sometimes, in both upper and lower thirds. It is often overlooked, and may result in slight loss of function.

It is with trepidation that I approach the subject of the operative treatment of fractures, having seen such extremes of both bad and good results. Truth compels me to say that many surgeons are poor carpenters. The surgeon wishing to do bone plating could profitably spend some of the time spent in surgical clinics in watching a cabinet maker at work. We have many times been treated to the spectacle of a screw half set, with the head so damaged that it was impossible to remove it or to drive it home. Have you ever seen a surgeon try in a bone the drills and screws of a size he expected to use later in an operation? If they had done so, many of the failures I have seen could have been

FIG. 19. CASE NO. 18561. FRACTURE OF THE LEG IN MALE, AGED 86, FOURTEEN YEARS AFTER INJURY.

Practically no loss of function due to the fact that ankle position is normal.

avoided. Some of the mistakes I have observed are as follows:

1. Not using a drill of the correct size for the screw used. This resulted in the screw not giving the proper fixation.

2. Using screws so long they passed entirely through the bone.

3. Using screws so thick they unnecessarily weakened the bone.

4. Screws placed too close to the fractured ends of the bone.

5. Short plates used on long bones with but one screw on each side of the fracture, which did not maintain proper alignment or fixation.

6. Plates used on bones too near the surface of the body.

7. Improper fixation and support after the operation, resulting in too much strain on the screws. Result: a broken plate or absorption of bone around the screws, causing them to loosen.

8. Careless handling of the patient after operation, causing the plate to be broken.

Notwithstanding the above, I believe bone plating a safe and, at times, a necessary operation.

Operation is indicated in cases in which reduction cannot be attained by other means *provided* reduction is necessary to secure function. A perfect anatomical result is not always necessary to secure good functional results. Operation is seldom indicated from the anatomical standpoint alone. If reduction can be maintained after operation, without mechanical fixation, the foreign body should be omitted. If mechanical fixation is necessary, then fixation must be absolute in order to prevent bone absorption around the screws. For this reason, wiring is seldom to be considered, as absolute fixation by this method is almost impossible. Only in rare cases is wiring indicated. Some types formerly wired can better be fastened by the use of small wire nails or brads. This is especially true of many fractures of the olecranon and of the condyles of the humerus and of some ankle fractures. Bone plugs require considerable manipulation to introduce, do not give fixation, and apparently offer no advantages. Fixation of the hip in intracapsular fractures is best done by forcible impaction or with one screw of the proper length. The angle in which the screw is inserted is of extreme importance. (See Fig. 15.) The screw should not be used to hold the weight of the body but to hold the fractured ends together in such a manner that the strain of weight-bearing is thrown upon the bone and not upon the screw. This is a very important point, and bone absorption is much less likely to occur under such circumstances. Bone is at least as difficult to work as hard wood, and at least the same care should be observed in working it if you wish to be successful.

Conclusions.—In Colles' fracture, treatment, and not the injury, is responsible for much of the loss of function. Under rational methods of treatment the eighty per cent. of cases with functional disability

Fig. 20. Case No. 27491. Fracture of Leg in Male, Aged 27, with Marked Functional Disability Due to Tilting of the Ankle.

formerly observed are practically eliminated.

The majority of elbow injuries in children will later result in perfect function of the joint.

Injuries to the adult elbow, especially dislocation, are quite often followed by new bone formations that impair the function of the joint.

In fractures of the skull all evidence of the fracture has usually disappeared within one year following the injury.

Fractures of the spine may easily be overlooked, owing to the slight disturbances present. Lateral plates are always necessary to exclude spine fractures.

In fractures of the neck of the femur it is important to know the exact nature of the injury, so that proper treatment can be instituted immediately. Delay in diagnosis will, in some cases, result in absorption of the neck and part of the head and will preclude operative treatment later.

In fractures of the lower extremity care must be taken to secure proper weight-bearing. If necessary to accomplish this, open methods of reduction and fixation are indicated.

Bone operations are major surgery of the highest type. They should only be undertaken by those having a proper conception of the technique, and with strict observance of the fundamental rules laid down by Lane. I think it well to add that unless a surgeon is possessed of considerable mechanical ability he is likely to fail.

The younger the patient, the nearer will be the return to a normal bone picture, following fracture. Marked deformities disappear entirely so far as bone structure is concerned.

The absolute disappearance of all signs of fracture and a complete return to normal, as shown by some of the cases, should cause one to be guarded in his statements and testimony in medicolegal injuries.

CONCERNING A ROENTGENOLOGICAL CONCEPTION OF PULMONARY TUBERCULOSIS *

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INTRODUCTION.—That the roentgen examination of the lungs for the detection of the lesions of tuberculosis will ever become an exact science is doubtful. Most of the signs which have been described may be defined as highly characteristic but not infallible. Doubtless there are certain signs, such as Dunham's "fan" or "cone," which when present are pathognomonic, but the writer is the more convinced with increasing experience that no single pathognomonic sign is present in all cases of pulmonary tuberculosis.

Hence, in its present state of development, the roentgen diagnosis of tuberculosis should be regarded as an art which approaches scientific precision in direct ratio to the roentgenological experience and medical ability of the observer. The necessity of correlating roentgen signs with those elicited by physical examination and laboratory study thus becomes apparent. Without the proper coördination between roentgenologist and physical diagnostician the best results in the diagnosis of pulmonary tuberculosis are not possible.

Nor does this statement weaken the strong position of roentgenology in the field of lung diagnosis. It can and will remain the most important factor, without supplanting in any degree the methods of the internist in chest examination.

The roentgenologist who studies his stereoscopic lung roentgenograms with care will, however, find characteristic signs of active pulmonary tuberculosis in many cases which do not manifest the typical physical signs and clinical manifestations of phthisis. And this fact has led the method into much disrepute with many clinicians. It becomes highly essential, therefore, that a roentgenological report should offer more than a mere diagnosis of pulmonary tuberculosis. It should recognize the existence of variable clinical complexes with a common fundamental etiological factor, and should suggest, if possible, the probable complex or type to which the case in hand belongs.

To this end the writer has arranged the following table, attempting to set forth the roentgenological, clinical, and pathological characteristics of four types of pulmonary tuberculosis.

TABLE

Roentgenological	Clinical	Pathological
Type A		
1. Infiltration, peripheral.	1. Poor nutrition. Exhaustion with slight exertion.	
2. Infiltration, peribronchial.	2. Occasionally slight temperature upon exertion.	
3. Tendency to unilateral involvement.	3. No physical signs.	
4. Limited areas of involvement.	4. Reaction to subcutaneous tuberculin—focal, general, or both.	No data.

* Read before the Nineteenth Annual Meeting of The American Roentgen Ray Society, Chattanooga, Tenn., Sept., 1918.

TABLE—(Continued)

Roentgenological	Clinical	Pathological
Type A—(Cont.)		
5. Dunham fan not constant.	5. Improvement under tuberculosis management.	
6. Areas of previous involvement indicated by increased fibrosis.		
7. Progression from one area to another, shown by observations over period of years.		
8. Absence of cavitation.		
9. Absence of massive or conglomerate infiltration.		
Type B		
1. Fine soft shadows of infiltration both peripheral and peribronchial.	1. Temperature curve.	1. Infiltration.
2. Direct extension to hilus.	2. Intermittent physical signs.	2. Fibrosis.
3. Characteristic distribution in 1st and 2nd interspaces (preferably right).	3. Loss of weight with intermittent gains.	3. Pleuritic thickening, especially over apices.
4. Dunham fan more common.	4. Prompt tuberculin reaction	4. Noncaseating.
5. No cavitation.	5. Sputum frequently negative.	5. Absence of amyloid changes.
6. Marked fibrosis.	6. Favorable influence of climate.	6. Absence of cavities.
7. Progression to general involvement of one or more lobes.	7. Infinitely chronic.	
8. Localized density over apex (one or both).		
Type C		
1. Early signs similar to *Type B*.	1. Physical signs typical and early.	1. Infiltration.
2. Massive conglomerate shadows make early appearance.	2. Hemoptysis often occurs.	2. Caseation.
3. Marked tendency to cavitation.	3. Bacilli in sputum early and constant.	3. Cavitation.
	4. Progression unremittent.	4. Amyloid.
	5. Unfavorable response to climate changes or sanatorium treatment.	5. Fibrosis.
	6. Frequent presence of focal infection of tonsils or teeth (especially the former).	
Type D		
1. Absence of characteristic parenchymal shadows and of Dunham fan.	No clinical signs.	1. Calcification.
2. Areas or nodules of great density (calcification).		2. Fibrosis.
3. Broken lung fields (fibrosis).		3. Thickened pleura.
4. Evidence of pleuritic "cap" over one or both apices, with localized extension of fibrosis-like shadows into lung field.		

Type A may well be regarded as a distinct clinical entity, because it is accompanied by few of the clinical manifestations which characterize groups *B* and *C*. The disease appears to involve successively various areas of the lung fields, never rapidly or violently but insidiously. One rarely sees more than one or two of these areas actively involved at the same time but other areas usually show evidence of healed disease. This observation leads to the conclusion that the host is chronically and actively tuberculous, but that the process constantly tends to heal in certain areas as it progresses to others. That the process under discussion is in reality a tuberculous one, and that it is responsible for a long train of symptoms in the host, is a conviction based solely upon a mass of clinical and roentgenological experience from which is deduced the following evidence:

1. The host invariably reacts to 15 mgm. of old tuberculin administered subcutaneously—focal, general, or both. Conversely, all individuals in whom there is a focal reaction in the lung present the characteristic variations in their stereoroentgenograms.

2. The roentgenological signs observed in the stereogram are closely similar to or identical with those observed in known cases of relatively early pulmonary tuberculosis.

3. An indeterminate percentage of cases of *Type A* become changed to *Type C*, following exposure or some intercurrent infection.

The writer has observed a number of such apparent transitions, sufficiently great to suggest that this may be the usual sequence when active tuberculosis seems to develop under these circumstances. The probability is here suggested that the disrepute which the tuberculin reaction suffers in many quarters is due to the common reactions obtained in this type of phthisis, which, without roentgenological visualization, would remain a concealed process.

Discussion.—Many efforts have been made to explain general and focal reactions to tuberculin upon some hypothesis other than that of a tuberculous infection. These efforts seem to have lacked the power of conviction; whereas the close coordination of the focal reaction, at least, with roentgen signs of pulmonary involvement, strongly indicates that the tuberculosis explanation is after all the more correct one in most instances.

In *Type A*, as in *B* and *C*, the changes observed are predominantly unilateral and their earlier seat of choice is in the periphery of the 1st and 2nd interspaces, somewhat more frequently on the right side. It is doubtful whether the so-called cigarette-smoke-cloud effect is ever observed in this type, although it is a frequent characteristic of *Types B* and *C*.

The train of symptoms presented by cases of this group is that of any low-grade infection. Many of them are mistakenly diagnosed neurasthenia, and doubtless a large number of them have been improved or cured by the Weir-Mitchell Rest Cure.

Sufferers belonging to this group are worthy of our most careful consideration, because they are constantly seeking help from the medical profession, who, without roentgenological assistance, will continue to grope blindly, as in the past, for a diagnostic solution of their problem.

The roentgen signs, when typical, are not easily mistaken, and the diagnosis is no less conclusive because the disease fails to progress according to accepted clinical laws, which seem to govern only cases of *Type C*.

A weak link in the chain is an apparent absence of pathological data. This, however, may be due to the simple fact that these patients do not die until age has transferred them to group *D*, or until some other disease more interesting to the necrologist has made its appearance.

In *Type B* the host is more frankly tuberculous, both roentgenologically and clinically. The process extends more rapidly and consecutively than in *Type A*, and the tendency to become isolated and to heal out is not so strong. Roentgen signs may be more prominent from the first. One never observes cavitation, unless it is that of a concurrent bronchiectasis.

Clinically this type may be characterized as a less violently active process than *Type C*. Sputum is not so easily obtained, and bacilli are not constantly present, although they are usually found if persistently searched for. To this type belongs the individual, with whom we are familiar, who often lives for many years in a fair state of health and well being, if he but remains in a well-chosen climate.

Roentgenologically, one soon learns rather distinctive characteristics of the type, which help in its proper classification. It is not claimed that such a differentiation can be made with scientific precision. One suggestive feature is a rather diffuse dissemination of the lesion through the upper lung at an early stage. The absence of any tendency to form conglomerate masses within the lung-field or to break down with resultant cavitation, and the evidence of a thick pleuritic cap over an apex also aid in the differentiation.

Type C offers such a marked contrast to *Types A* and *B*, from roentgen, clinical, and pathological standpoints, that one is forced to the conclusion that some new etiological factor has entered here. The observation of the pathologist that amyloid changes are observed in certain tuberculous lungs, usually in association with cavitation, may point to this factor, since it is well known that amyloid is found in the presence of pus infections. The writer believes that insufficient attention is given to focal infections as a complication of pulmonary tuberculosis. *There seems to be considerable evidence that the factor of mixed infection differentiates Type C from Types A and B* and completely alters the prognosis, as well as the line of therapeutic attack. Roentgenologically, one can often detect this factor by the more conglomerate shadows in the stereoroentgenogram and by the tendency to cavity formation. The typical signs of tuberculosis may, at an early stage, be covered up by these massive shadows which have none of the characteristics which distinguish that disease roentgenologically in its more uncomplicated state. This fact may render the type under discussion a difficult one to differentiate from certain nontuberculous affections such as pneumonoconiosis or bronchiectasis; *but one can usually find some area in the lung field where the uncomplicated tuberculous process manifests itself.*

The writer believes that he has observed cases of *Type C* revert to *Type B* and proceed to symptomatic recovery after the enucleation of caseating tonsils. Probably the same thing occurs after the elimination of dental foci, when these are responsible for the secondary infection.

The explanation of the type under consideration is, so far as the writer knows, purely hypothetical. However, we, as roentgenologists, are more concerned with the fact that such a type exists with its characteristic roentgenological signs than we are with its etiological explanation. It is frequently possible to differentiate the type at a relatively early stage by means of the signs enumerated. And since the prognosis differs materially from that of the other types it is highly important that an attempt be made to do so.

While *Type D*, or healed tuberculosis, has no clinical significance, it is of roentgenological importance because its signs may be misinterpreted as those of active disease. When the observer is convinced that no active lesion is present, it is perhaps better to ignore these signs of healed disease, lest to them be attributed undue importance by the clinician. However, there is often a possibility that an active process may be partially covered up or rendered indistinct and atypical by the shadows of healed lesions, and then the question of activity must be left indeterminate. In the final analysis, in any event, clinical evidence will usually outweigh roentgenological evidence in the determination of the degree of activity of a known lesion.

The term "latent pulmonary tuberculosis" becomes obsolete under the present conception of the disease, because latency signifies inactivity and the only inactive lesion is a healed one. This term has frequently been applied to that form of tuberculosis herein described as *Type A*, but since this type of lesion is productive of symptoms and since there is abundant roentgen evidence that it is a progressive process, the term is patently misapplied.

It must be conceded that certain non-tuberculous conditions may produce changes in the lung fields which closely simulate those of tuberculosis—*Type A*. There are usually certain essential differences, however, which aid materially in the diagnosis. Thus there is not the same tendency to localization, the infiltrating process appearing more evenly distributed through the lung fields, chiefly along the bronchi, and only appearing in the periphery beyond the bronchi when involvement is very extensive. This is especially true of pneumonoconiosis. The lung changes due to chronic congestion of mitral stenosis have chiefly their diffuse distribution to distinguish them. The tuberculous lesion in its early active state offers less obstruction to the rays, and hence casts a shadow of less density than other chronic processes.

Concurrent with certain pyogenic infections of the lower lobes and pleura one may sometimes observe in the upper lobes the type of shadow seen early in tuberculosis. Since this is by no means a constant finding in empyema or lung abscess cases, the writer has been inclined to the view that in such instances the process is in fact a tuberculous one.

If the contention presented in this communication is sustained by future experience and study, it but reëmphasizes the necessity of close correlation of the efforts of roentgenologist and clinician. For the signs of tuberculosis found in the stereogram of the lungs increase in diagnostic value as they are supplemented and enriched by clinical signs and symptoms.

Finally, the writer wishes to acknowledge the helpful suggestions of Dr. E. T. Bell, of the Department of Pathology, University of Minnesota.

ROENTGEN RAY PROTECTIVE MATERIALS

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ADEQUATE protection from the *x*-rays is of increasing importance since the advent of the high-powered interrupterless *x*-ray machine and the Coolidge tube. By these means, *x*-rays of such intensity can be produced that protective devices which were previously suitable may not now give sufficient protection. In view of the proved harmfulness of undue exposure to the rays and of the possibility of the existence of effects, of which as yet we know nothing, the subject of *x*-ray protective materials deserves considerable attention.

When the study of these materials was initiated at the Bureau of Standards, one of the first steps taken was to ascertain the current practice concerning them. In addition, specimens were procured in the open market from most of the dealers in *x*-ray apparatus and supplies and samples obtained from various manufacturers. As a rule no quantitative statement as to composition, or protective power, of these materials could be obtained from dealers. Statements as to composition could generally be had from manufacturers when these were known. About the only information available from dealers were statements that the protective powers of this or that piece of material were "adequate."

It is obviously desirable that the purchaser have information which will enable him to decide to what extent the material furnished meets his requirements, and, further, to judge the relative merits of materials obtained from different sources. The important thing is the extent to which the piece of material used absorbs the x-rays incident upon it. The amount of such absorption depends upon the composition of the incident rays, and upon the amount and kind of the elements which compose the protective material. A knowledge of these last would enable the user to calculate the absorption of his particular piece of protective material, whenever detailed knowledge of the absorption of the elements composing it and the composition of the incident x-radiation became available. Practically all protective materials hitherto used owe their absorbing power almost entirely to the presence in them of lead. Consequently they should absorb x-rays of all kinds in a like manner with lead; and the absorbing power of any piece of such material should be practically equivalent to a certain thickness of lead.

The simplest method, then, of assigning a value to the absorbing power of a piece of protective material is to find the thickness of lead which will absorb x-rays to the same extent. This method, which has been somewhat widely used, has been studied in some detail at the Bureau of Standards. The procedure is simply to prepare a scale consisting of a series of different thicknesses of lead. This scale is placed side by side with the piece of protective material to be examined upon an x-ray plate, the plate being in the usual double envelope. An exposure of proper duration is made and the areas of equal density on the plate are then determined. A piece of material is said to be equivalent in protective power to a thickness of lead giving the same density of image; this thickness of lead is called the *equivalent thickness of lead* or briefly, the *lead equivalent* of the piece of material. Fig. 1 is reproduced from a representative plate made in the manner described.

While our knowledge of the absorption of x-rays by matter seemed to indicate that the protective material and its equivalent thickness of lead should absorb the incident beam of rays to the same extent,[1] still the matter was tested in several ways. The quality and intensity of the incident beam were changed by varying the parallel spark gap at which the tube was operating over the range from three to nine inches and by using filters of from 0 to 3 mm. of aluminum for each value of the spark gap. The value of the equivalent thickness of lead was unaffected by these changes, showing that material and lead transmitted the same amount of energy as measured photographically. It is, of course, possible that the two beams of x-rays simultaneously transmitted by the lead and by the material may affect the photographic plate to the same extent and

Fig. 1.

[1] This, of course, would not be true if the protective material depended upon any element other than lead for its effectiveness. No commercial protective material which does not depend upon lead for its opacity has come to the attention of the author.

yet be different in quality and quantity. In this case, the use of a different detector for the rays should result in a different value for the equivalent thickness of lead. A fluorescent screen was used in place of the photographic plate but without appreciable effect upon the results. (It should be remarked in this connection that measurements made with the fluorescent screen are not quite as accurate as those made with the photographic plate; the principal reason for this is the feeble illumination of the screen due to the great absorption of the x-rays by the protective material.)

The possible presence of soft secondary radiation in different amounts from the lead and from the material was investigated for representative specimens of glass and rubber by placing an aluminum plate (1 mm. thick) between the photographic plate and the object being examined; no change due to its presence could be detected. The presence of extremely soft radiation which would be stopped by the usual double envelope surrounding the plate was investigated, for the same specimens, by placing the lead scale and the protective material in direct contact with the plate. When this was done with lead rubber no change in the apparent equivalent thickness of lead could be detected. With lead glass a decided change was noticed. The apparent equivalent thickness of lead was decreased—for some specimens by as much as 30 per cent. This effect is obviously due to soft radiation coming in greater amount from the glass than from the lead. This soft radiation was investigated by interposing layers of tissue paper between the plate and the protective material and scale. One layer caused a marked decrease in the density of the plate—the exposure, development, etc., remaining the same—but produced little effect on the apparent equivalent thickness of lead. Ten layers placed upon the plate would always cause the equivalent thickness of lead to resume its normal value, indicating the absorption of the larger part of this excess soft radiation by the thickness of tissue paper mentioned. Each sheet of this paper had a mass of 1.68 milligrams per square centimeter; its mineral content was insignificant as was shown by a direct comparison with an "ashless" filter paper, the two papers being placed side by side between the lead glass and the x-ray plate. This result was confirmed by a determination of the amount of ash of the paper in question. The thickness of air necessary to absorb this excess soft radiation can easily be calculated from the above data. As the elements in paper and air have not very different atomic weights we can, as a first approximation, assume that equal masses absorb equally. The thickness of air having the same mass as ten thicknesses of tissue paper is about 14 cm. under ordinary conditions.

The conclusions of the preceding paragraph apply only to the *difference* between the soft radiation given off by the protective material and that given off by the lead. Some idea of the amount and absorbability of this soft radiation from the lead glass alone (which gives off much more of it than does lead rubber) was obtained in the following way: A scale was prepared consisting of a series of different thicknesses of tissue paper from one to ten. This scale was placed between the lead glass and the x-ray plate, the scale being in immediate contact with both plate and glass, and an exposure of proper duration made. The first thickness of paper caused a marked decrease in the density of the plate. The successive decreases due to the immediately succeeding layers were marked, but each was less than the preceding one. After the seventh layer, the different layers could not be distinguished one from the other. A piece of stout cardboard, 1.5 mm. thick, placed below part of the tenth step of the scale caused a further decrease of density which could be detected but which was very small. From the above observations the conclusion is warranted that the ten thicknesses of tissue paper absorb practically all of the very soft secondary radiations from the representative specimens of protective material examined. The density f the bare plate under the lead glass is ery large while that under the ten thick-esses of tissue paper is comparatively mall, consequently the amount of these ery soft secondary radiations is very nuch larger (photographically measured) han the amount of the primary and enetrating secondary rays emerging from he glass. As the blackness of the plate under these conditions is due almost ntirely to the soft secondary rays, a neasurement (photographic) of their mount could easily be carried out if lesired.

Deductions from the foregoing would ndicate the wisdom of keeping any part of the body at least 15 cm. away from the usual protective materials, particularly glass, when there is nothing but air between the protective material and the body.

The effect, if any, of variations in exposure and development has not been investigated in a systematic manner. In the course of the work numerous specimens of protective materials have been examined on different days under different conditions of exposure and development, but the variation in results has been no greater than with several plates all of which have been given the same exposure and have been developed together. The variations that occur under these latter conditions are probably due to variations in the thickness of the sensitive film. It is well known that variations of as much as ten per cent. may occur in the thickness of the film, due to want of flatness in the glass.

The lead scales used in ascertaining the lead equivalents of protective materials had steps one centimeter wide. The difference in thickness from one step to the next was 0.1 mm. for total thicknesses in the neighborhood of 0.5 mm. For lesser thicknesses the difference in thickness from step to step was less than 0.1 mm., and for greater thicknesses the difference was greater than 0.1 mm. A large part of the specimens studied had equivalent thicknesses of lead in the neighborhood of 0.5 mm. The thickness of the various steps was measured with a micrometer caliper, and so could be determined to the hundredth part of a millimeter. The thickness of each step was constant to 0.01 mm. The lead used for the scales was commercial sheet lead, which is known to have a small percentage of impurities (less than one per cent.). The densities of several specimens of commercial sheet lead were determined. The greatest difference in density between any two of the specimens was one per cent.

The comparison of the density of image under the material with the density of image under the scale can be carried out in several ways. A very rough method is to view the plate as a whole. If this is done it is difficult to judge when equality of density has been reached, and errors of as much as one step, or even more, may be made, even with a properly exposed plate, unless great care is taken; at that, much experience is needed if reliable results are to be obtained.

A better method is to use a screen which has in it an opening just large enough to include one step of the scale and an equal area of the protective material. This would be sufficient were it not for the delicate nature of the thin lead scale which makes a support around its edges desirable. The image of this support on the plate causes the areas to be compared to be separated by a certain distance, which interferes with the accuracy of the comparison. With this method no errors of more than one-half step are likely, if due care be taken in making the observations.

In order to secure the best conditions the areas must be brought into contact in the field of view. To do this an optical device is necessary. The one used at the Bureau of Standards consists simply of two glass prisms, with their edges in contact, at a distance of a few centimeters from the plate. It has proved very satisfactory. With the use of a device such as this an entirely inexperienced observer has no trouble at all, with a properly exposed plate, in deciding at once which step of the scale has the same density as the material being examined, or, as is generally the case, between which two steps of the scale the density lies. A little experience will enable the observer to say whether he considers the density to correspond to a thickness of lead half way between that of the two steps, whether it is nearer one step than the other, or whether it almost coincides with one of the steps. This procedure amounts to splitting the steps into six parts, and may seem hardly justifiable at first sight, but with a little experience observers seldom differ by more than one of the above-named parts. The numerical values to be assigned to these various judgments are somewhat arbitrary; those used in the present work were 1/6, 1/3, 1/2, 2/3, and 5/6 of the difference from one step to the next. A representative series of measurements on a set of six plates all taken with the same piece of protective material follow:

Experienced observer

.45, .46, .47, .44, .46, .42 mean 0.450

Inexperienced observer

.50, .45, .47, .46, .47, .41 mean 0.460

It is seen that the maximum difference in the readings on any one plate is only 0.05 mm., which is 11 per cent. of the mean value. The mean values by the two observers differ by 0.01 mm. It will be noted that in the readings taken by an experienced observer the largest deviation from the mean amounted to somewhat less than 7 per cent. The probable error of the mean value in the particular series of observations given above is 1.1 per cent. and the probable error of any one observation is 2.7 per cent. For values of the equivalent thickness of lead slightly larger than those given in the above example the percentage error would be slightly less, and for smaller values would be slightly larger than that given above.

Various metals besides lead have been used to estimate the protection offered by x-ray protective materials. The use of such metals is not to be recommended, as the thickness of metal necessary to absorb the beam of x-rays to the same extent as does the protective material is not a constant but depends upon the quality of the beam. It is understood that aluminum has occasionally been used for estimating the protective power of protective materials. Aluminum, of course, is entirely unsuited for this purpose, if for no other reason than the great thickness necessary, which is roughly 100 times the equivalent thickness of lead.

It is convenient to have a name by which to designate the quality of a material as far as its protective power is concerned. The name "protective coefficient" has tentatively been selected to designate the ratio for any piece of material, of the equivalent thickness of lead to the thickness of the piece. This ratio is independent of the thickness of the material, and is approximately the percentage lead content *by thickness.*

The amount of lead contained in any piece of protective material can be estimated roughly by considering that it is given directly by the equivalent thickness of lead. A more accurate estimate is possible by using the following method: The equivalent thickness of lead is subtracted from the thickness of the material, the difference giving approximately the thickness occupied by the constituents of the material other than the lead. The assumption is made that the absorption of these residual constituents is the same as that of an equal thickness of ordinary glass or rubber as the case may be. The equivalent thickness of lead for this thickness of ordinary glass or rubber is subtracted from the equivalent thickness of lead for the piece, the difference giving the thickness of a sheet of lead having the same amount of lead per square centimeter as the protective material[2]. The table following gives the percentage lead content for various materials as determined by the latter

[2] It has come to the attention of the Bureau of Standards that in at least one case, it was assumed that a sheet of lead glass would give the same protection as a sheet of lead having the same area and weight. This amounts to assuming that the lead glass is *composed entirely* of lead, which is, of course, not by any means true.

method and as given by the manufacturers. The difference in the results obtained by the two above-outlined methods does not exceed eight per cent for lead glass, having a protective coefficient of ten per cent. For better lead glass and for practically all lead rubber the difference is less than this.

Material	Percentage by weight, of lead, mfr.	Percentage by weight, of lead, B.S.	Remarks
Glass	30	35	
"	20+7%Ba	35	Commercial x-ray protective glass.
"	42	40	
"	42	42	Improved protective plate glass.
"	74	70	Experimental lead glasses of irregular thickness.
"	74	67	
"	71	70	
"	71	58	
"	46	49	Improved lead plate glass.
"	54	55	Improved tube shield.
Rubber	78	78	Commercial lead rubber.
"	77	77	
"	77	74	Experimental lead rubber.
"	85	85	
"	83	88	
"	91	94	
"	85	84	

At the beginning of the present investigation 12 pieces of lead glass were purchased in the open market from representative dealers. The range of equivalent thickness of lead for these pieces was from 0.70 to 0.30 mm. The protective coefficient of all but two of the glasses ranged from 9 per cent. to 11. per cent., the average value being 10 per cent. Two pieces were found to offer no more protection than ordinary plate glass. The protective coefficient of these pieces was 0.9 per cent. and the equivalent thickness of lead 0.05 mm. Samples of lead rubber were received from various manufacturers and dealers. The protective coefficients of these materials ranged from 19 to 32 per cent., the average being 23 per cent.

Any desired protection from the x-rays can, of course, be obtained simply by increasing the thickness of protective material employed. This, however, is objectionable from many standpoints. The desirable method is to obtain the increased protection by increasing the lead content, and consequently, the protective coefficient, of the material. In view of the importance of the matter, the Bureau of Standards corresponded with various manufacturers in the endeavor to have them experiment with the object of producing improved materials. The manufacturers coöperated in a most gratifying manner and great improvements were made. Lead plate glass of satisfactory optical quality was made having a protective coefficient of 18 per cent., which is an 80 per cent. increase over the previous average value of 10 per cent. Lead rubber was made having a protective coefficient of 48 per cent., an increase of more than 100 per cent. over the previous average value of 23 per cent. The actual lead content of the glass and rubber mentioned was 49 and 94 per cent. respectively, as determined by the method of the present article, and 46 and 91 per cent. respectively, as given by the manufacturers.

Some of the improved varieties of lead rubber are as flexible as any of the kinds of commercial x-ray rubber hitherto obtainable; it is probable that protective garments of increased protective power can be made from these materials.

In the case of nearly all of the protective materials which have been tested at the Bureau of Standards, measurements of the density have been made. In the case of materials of regular shape this was done by measuring the dimensions and weighing; the density of pieces of irregular shape was determined by weighing in water. A simple,

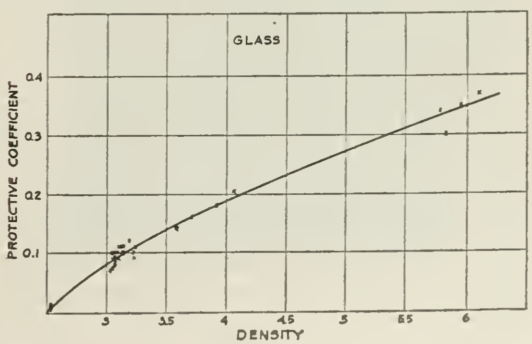

Fig. 2.

approximately linear, relation was found to exist between the density and the protective coefficient. The results are shown in Figs. 2 and 3.

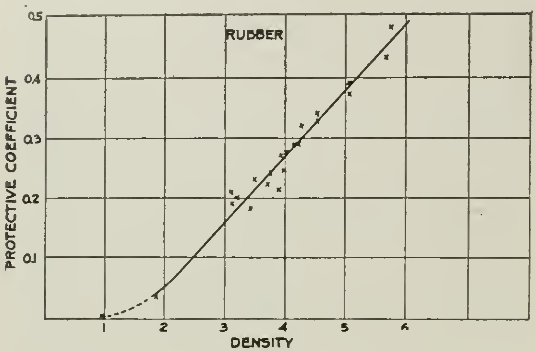

FIG. 3.

The results of the work may be summarized as follows:

1. The method of testing x-ray protective materials by comparing them with sheet lead has been investigated. It has been shown that, for all the materials examined, it is possible to find a certain thickness of lead which will have closely the same effect on a beam of x-rays of the sort used in practice as will the material itself, and that, consequently, the material may be said to have the same protective power as the thickness of lead mentioned; this thickness of lead has been called the "equivalent thickness of lead" for the piece of material in question.

2. A representative assortment of the x-ray protective materials on the market in 1917 has been examined.

3. Considerable improvements in protective materials have been made, at the suggestion of the Bureau of Standards, by several manufacturers of such materials.

Acknowledgment is due to the Corning Glass Works, Pittsburgh Plate Glass Co., The B. F. Goodrich Co., Manhattan Rubber Mfg. Co., and Price Electric Co. for their hearty coöperation in this investigation.

COMMUNICATION FROM THE WAR INDUSTRIES BOARD

UTILIZATION OF PLATINUM IN UNUSED INSTRUMENTS

1. In view of the limited supply of platinum in the country and of the urgent demand for war purposes, it is requested that every doctor and dentist in the country go carefully over his instruments and pick out EVERY SCRAP OF PLATINUM that is not absolutely essential to his work. These scraps, however small and in whatever condition, should reach Governmental sources without delay, through one of two channels:

(a) They can be given to proper accredited representatives of the Red Cross who will shortly make a canvass for that purpose.

(b) They may be sold to the Government through any bank under the supervision of the Federal Reserve Board. Such banks will receive and pay current prices for platinum.

By giving this immediate attention you will definitely aid in the war program.

2. It is recognized that certain dental and surgical instruments requiring platinum are necessary, and from time to time platinum is released for that purpose. It is hoped, however, that every physician and every dentist will use substitutes for platinum for such purposes wherever possible.

3. YOU ARE WARNED against giving your scrap platinum to any one who calls at your office without full assurance that that individual is authorized to represent the Red Cross in the matter.

(Signed) F. F. SIMPSON,

Lieutenant Colonel, M.C., N.A.,

Chief of Section of Medical Industry.

PULMONARY METASTASIS *

BY A. W. CRANE, M.D.

KALAMAZOO, MICH.

ONE of the substantial contributions of roentgenology to clinical medicine is the ready diagnosis of pulmonary metastasis in malignant disease. In pre-roentgen days carcinoma or sarcoma of the lungs was reported almost exclusively from postmortem findings. The diagnosis could rarely be final in the absence of an autopsy, and the frequency of pulmonary invasion was a matter of statistical conjecture. But now the diagnosis can be made at an early stage by the *x*-ray plate with a precision unexcelled by the roentgen diagnosis of any other pulmonary lesion.

The detection of a pulmonary metastasis is of decisive surgical importance. The question of the nature of the primary lesion, the question of operability and the question of prognosis are thus settled. For this reason the *x*-ray examination of the lungs has been established as a routine in some surgical clinics in cases of suspected malignancy anywhere in the body.

One avenue of the invasion of the lungs is from the upper peritoneal cavity through the central tendon of the diaphragm into the mediastinum and thence to the pulmonary fields. This is a lymphatic route, which was beautifully demonstrated by Clark [1] in 1901 in its relation to pulmonary infection following abdominal sepsis. It is one explanation of postoperative pneumonitis and is the chief reason for the Fowler's position after laparotomy, whereby the mediastinal lymph current could be retarded. The lymphatic drainage, therefore, from the upper abdomen is into the mediastinal system, precisely as the drainage from the arm is into the axillary and from the leg into the inguinal glands.

It would be a matter of logical sequence for the diagnostician to examine the mediastinal glands for signs of upper abdominal metastasis, just as he examines the glands of the rectal shelf for signs of lower abdominal metastasis. But the mediastinum is accessible only to the *x*-ray. The differentiation of an inflammatory adenopathy from a sarcomatous invasion, when confined to the mediastinum, offers some difficulties, but the unhesitating extension of a carcinomatous invasion throughout both lungs simultaneously furnishes pathognomonic signs on the *x*-ray plate. Thus a case of suspected carcinoma of the liver without pulmonary symptoms may nevertheless show marked pulmonary metastasis. For example, Mrs. W—had a clear-cut history, extending back many years, of gallstone colics with deep jaundice. A tumor could be palpated in the region of the gall-bladder. A routine screen inspection followed by a stereo-set of the chest re-

FIG. 1. CARCINOMA OF BOTH LUNGS SECONDARY TO CARCINOMA OF THE LIVER.

[1] Elimination of Peritoneal Infection and Preventions of Surgical Peritonitis. *Jour. A.M.A.* 1901, vol. xxxvii, page 360.

* Read at the Mid-Winter Session of Western Roentgenologists, Toledo, O., February 22, 1918.

Fig. 2. Carcinoma of both Lungs secondary to Carcinoma of the right Breast.

vealed an evenly distributed carcinomatous invasion of both lungs (Fig. 1) although no pulmonary symptoms were present. Without the roentgen study of the chest the gallstones might have been removed without satisfaction to patient, family, surgeon or diagnostician.

Metastasis of the lungs following mammary carcinoma shows a generalized pulmonary invasion indistinguishable from a metastatic extension from the liver (Fig. 2). There is here a suggestion a little short only of a demonstration that the pulmonary invasion proceeds, not by direct extension through the chest wall, but by a circuitous route whereby the carcinoma reaches the lymph channels which drain into the mediastinum. The later day practice of surgeons in following down the muscle sheaths from the mamma to the abdominal parietes is a confirmation of this hypothesis.

Parallel to pulmonary metastasis is the extension of abdominal tuberculosis via the mediastinum into the lungs. This is beautifully illustrated by the pericarditic pseudocirrhosis of the liver of Pick (Fig. 3) in which case tuberculosis extends from the liver into the mediastinum and thence throughout both lungs exactly as does

Fig. 3. Adherent Pericardium, Mediastinitis and Pulmonary Tuberculosis. Chest in a Case of Pericarditic Pseudocirrhosis of the Liver of Pick showing clinically marked œdema of legs and feet with ascites. The scanty sputum was loaded with tubercle bacilli.

Fig. 4. Pulmonary Tuberculosis following Tuberculosis of the Peritoneum. Cough and sputum came late in the case. Tubercle bacilli were finally found in abundance.

carcinoma. In Pick's disease, however, we have a distinctive sign in adherent pericardium, although other intrinsic characters make differentiation positive. Such

FIG. 5. CARCINOMA OF SACRUM AND SPINE SECONDARY TO CARCINOMA OF THE PROSTATE. CALCIUM HAS BEEN DISSOLVED OUT OF PORTIONS OF BONE TO BE REDEPOSITED IN OTHER PORTIONS OF THE SKELETON AND ALSO IN THE LUNG. BONE STRUCTURE HAS BEEN LARGELY OBLITERATED.

cases may consistently be termed tuberculous metastasis.

Pick's disease with its peculiarities is believed to be due to the avian type of the tubercle bacillus, but mediastinal infection with extension to the lungs is also true in ordinary peritoneal tuberculosis (Fig. 4). In such patients cough and expectoration are late symptoms and the *x*-ray may give the first definite sign of the involvement. This is one of many reasons why an examination of the chest should never be omitted in abdominal cases.

There is a third form of pulmonary metastasis which is rare but nevertheless of real importance in roentgenology. This is the "calcium metastasis" of Virchow. In malignant disease of bones whether metastatic or primary and in other bone diseases with disturbed calcium metabolism, calcium salts may be dissolved out to be redeposited in distant tissues. This process of redeposition may take place in the lungs to a greater or less extent, sometimes to an extreme extent. At autopsy the lungs may be found of a stiff woody texture owing to the thorough infiltration by calcium. Such lungs are not the subject of either malignant or bacterial disease, and while the process is known as a "calcium metastasis" it is obviously not a secondary transplantation of a disease. The importance of the condition in roentgen diagnostics lies in ready detection of calcium deposits in lung tissue and in the indication of serious bone disease somewhere in the body.

In one case of pulmonary calcium metastasis illustrated in this paper the bone disease was metastatic, the primary affection being a carcinoma of the prostate, so that the lung conditions were the third remove. The patient had a cough with a scanty expectoration which was intermittently blood stained but contained no tubercle

FIG. 6. PULMONARY CALCIUM METASTASIS SECONDARY TO CARCINOMA OF BONE IN A CASE OF CARCINOMA OF THE PROSTATE. THE CALCIUM IN THE LUNG TISSUE IS IN THE FORM OF A FLAKY DISSEMINATION.

bacilli. He also complained of pain in the small of the back and down both legs. He had been troubled with an enlarged prostate for a number of years and the

Fig. 7. Pulmonary Calcium Metastasis secondary to syphilis which presumably affected some portion of the skeleton. The stereoscopic plates show a flaky dissemination of the calcium throughout both lungs. The distribution is symmetrical with relation to the hilum on each side. No pulmonary symptoms of any kind were present.

catheter had become a necessity. The digital examination of the prostate showed an irregular enlargement suggestive of malignancy. A plate was made of the sacrolumbar region for signs of metastasis (Fig. 5). The bones were honeycombed and the normal osseous structure largely destroyed. A screen inspection of the lungs showed extensive changes and a plate was made (Fig. 6). A study of this plate showed a flaky calcium infiltration generalized in both lungs. The distinctive signs of pulmonary carcinoma were absent and the case was considered one of "calcium metastasis." Another case (Fig. 7) is still more distinctive but was not associated with carcinoma. A four-plus Wassermann was present and a bone involvement was probable although not demonstrated.

A consideration of lung metastasis emphasizes the fact that the diaphragm is merely an anatomic separation of the two great cavities of the body and that the chest can rarely be ignored no matter where the disease may be located.

Another corollary lies in the interpretation of the hilus shadows upon plates of the chest. These are usually considered to be the result of drainage from lungs and bronchi, but it is evident that the line of demarcation between a mediastinal and a hilus adenopathy, even upon stereoscopic plates, is impossible. An anatomic separation and distinction of the lymph channels seem at present equally impossible; so that the usual interpretation of the hilus clusters, without a consideration of previous abdominal infections, needs revision.

Furthermore the presence of calcified foci in the hilus or pulmonary areas is not to be taken as unequivocal evidence of a healed tubercular process. Calcium may be deposited in any necrotic bit of tissue. An old, inclosed bloodclot may become calcified. The calcified focus anywhere in the body, the lungs not excepted, in about 30 per cent. of cases, goes on to actual ossification. Disturbed calcium metabolism results, as we have seen, in the redeposition of calcium in lung tissue. Thus it is apparent that in roentgenology as in the medicine of Hippocratic times, "Experience is fallacious and judgment difficult."

ENGLISH—FRENCH GLOSSARY OF ROENTGEN RAY TERMS*

ANATOMY	ANATOMIE
1. Head	La tête.
2. Eye	L'œil, *m.*
3. Nose	Le nez.
4. Ear	L'oreille, *f.*
5. Mouth	La bouche.
6. Tongue	La langue.
7. Tooth	La dent.
8. Lip	La lèvre.
9. Scalp	Le cuir chevelu.
10. Skull	Le crâne.
11. Brain	Le cerveau.
12. Forehead	Le front.
13. Face	La face.
14. Cheek	La joue.
15. Nostril	La narine.
16. Jaw	La mâchoire.
17. Chin	Le menton.
18. Orbit	L'orbite, *f.*
19. Pupil	La pupille.
20. Cornea	La cornée.
21. Hair	Les cheveux.
22. Moustache	La moustache.
23. Beard	La barbe.
24. Mastoid	La mastoïde.
25. Neck	Le cou.
26. Throat	La gorge.
27. Larynx	Le larynx.
28. Trachea	La trachée.
29. Bronchus	La bronche.
30. Lung	Le poumon.
31. Pleura	La plèvre.
32. Diaphragm	Le diaphragme.
33. Chest	La poitrine.
34. Heart	Le cœur.
35. Pericardium	Le péricarde.
36. Aorta	L'aorte, *f.*
37. Blood	Le sang.
38. Artery	L'artère, *f.*
39. Vein	La veine.
40. Blood-vessel	Le vaisseau (sanguin).
41. Pharynx	Le pharynx.
42. Œsophagus	L'œsophage, *m.*
43. Cardia	Le cardia.
44. Stomach	L'estomac, *m.*
45. Pylorus	Le pylore.
46. Duodenal cap	Le bulbe duodénal.
47. Duodenum	Le duodénum.
48. Intestines	L'intestin, *m.*
49. Appendix	L'appendice, *m.*
50. Colon	Le côlon.
51. Rectum	Le rectum.
52. Abdomen	L'abdomen, *m.*
53. Liver	Le foie.
54. Gallbladder	La vésicule biliaire.
55. Spleen	La rate.
56. Kidney	Le rein.
57. Ureter	L'uretère, *m.*
58. Bladder	La vessie.
59. Rib	La côte.
60. Sternum	Le sternum.
61. Clavicle	La clavicule.
62. Shoulder	L'épaule, *f.*
63. Scapula	L'omoplate, *f.*
64. Arm	Le bras.
65. Elbow	Le coude.
66. Fore-arm	L'avant-bras, *m.*
67. Wrist	Le poignet.
68. Hand	La main.
69. Finger	Le doigt.
70. Thumb	Le pouce.
71. Humerus	L'humérus, *m.*
72. Radius	Le radius.
73. Ulna	Le cubitus.
74. Back	Le dos.
75. Spinal column	La colonne vertébrale.
76. Vertebra	La vertèbre.
77. Pelvis	Le bassin.
78. Hip	La hanche.
79. Thigh	La cuisse.
80. Femur	Le fémur.
81. Knee	Le genou.
82. Patella	La rotule.
83. Leg	La jambe.
84. Calf	Le mollet.
85. Ankle	La cheville.
86. Heel	Le talon.
87. Toe	L'orteil, *m.*
88. Tibia	Le tibia.
89. Fibula	Le péroné.
90. Bone	L'os, *m.*
91. Joint	L'articulation, *f.*
92. Muscle	Le muscle.
93. Tendon	Le tendon.
94. Fascia	L'aponévrose, *f.*
95. Nerve	Le nerf.
96. Skin	La peau.
97. Axilla	L'aisselle, *f.*
98. Groin	L'aine, *f.*
99. Buttock	La fesse.
100. Foot	Le pied.
101. Scaphoid	Le scaphoïde.
102. Semi-lunar	Le semi-lunaire.
103. Cuneiform	Le pyramidal.
104. Pisiform	Le pisiforme.
105. Trapezium	Le trapèze.
106. Trapezoid	Le trapézoïde.
107. Magnum	Le grand os.
108. Unciform	L'os crochu, *m.*
109. Palm	La paume.
110. Astragulus	L'astragale, *f.*
111. Calcis	Le calcanéum.
112. Cuboid	Le cuboïde.
113. Internal cuneiform	Le premier cunéiforme.
114. Middle cuneiform	Le deuxième cunéiforme.
115. External cuneiform	Le troisième cunéiforme.
116. Instep	L'avant-pied, *m.*
117. Sole	La plante (du pied).

PATHOLOGY	PATHOLOGIE
1. Projectile	Le projectile.
2. Foreign body	Le corps étranger.
3. Fracture	La fracture.
4. Dislocation	La subluxation.
5. Subluxation	La luxation.
6. Fragment	Le fragment.
7. Metallic dust	Les poussières métalliques.
8. Impaction	L'engrènement, *m.*
9. Periosteitis	La périostite.
10. Osteomyelitis	L'ostéomyélite, *f.*
11. Callus	Le cal.
12. Decalcification	La décalcification.
13. Sequestrum	Le séquestre.

* See "Instruction of War Roentgenologists," by R. Ledoux-Lebard, page 453.

PATHOLOGY	PATHOLOGIE
14. Gangrene	La gangrène.
15. Ankylosis	L'ankylose, *f.*
16. Exostosis	L'exostose, *f.*
17. Tumor	La tumeur.
18. Cyst	Le kyste.
19. Displacement	Le déplacement.
20. Metastasis	La métastase.
21. Abscess	L'abcès, *m.*
22. Sclerosis	La sclérose.
23. Infiltration	L'infiltration, *f.*
24. Solidification	La solidification.
25. Cavity	La cavité.
26. Fluid	Le liquide.
27. Pus	Le pus.
28. Effusion	L'épanchement, *m.*
29. Pleurisy	La pleurésie.
30. Pneumonia	La pneumonie.
31. Adhesion	L'adhérence, *f.*
32. Empyema	L'empyème, *m.*
33. Pneumothorax	Lepneumothorax.
34. Dilatation	La dilatation.
35. Aneurism	L'anévrysme, *m.*
36. Diverticulum	Le diverticule.
37. Ulcer	L'ulcère, *m.*
38. Incisura	L'échancrure, *f.*
39. Perforation	La perforation.
40. Penetration	La pénétration.
41. Hour-glass	Le sablier.
42. Biloculation	La biloculation.
43. Gall-stones	Les calculs biliaires.
44. Obstruction	L'obstruction, *f.*
45. Peristalsis	Le péristaltisme.
46. Retention	La rétention.
47. Residue	Le résidu.
48. Motility	La motilité.
49. Appendicitis	L'appendicite, *f.*
50. Calculus	Le calcul.
51. Calcified gland	Le ganglion calcifié.
52. Arthritis	L'arthrite, *f.*
53. Strain	L'entorse, *f.*
54. Splint	La gouttière.
55. Bandage	La bande.
56. Plaster cast	Le plâtre.
57. Drain	Le drain.
58. Fistula	La fistule.
59. Tuberculosis	La tuberculose.
60. Acute	Aigu.
61. Chronic	Chronique.
62. Active	Actif.
63. Inactive process	Le processus éteint.
64. Cancer	Le cancer.

PHYSICS	PHYSIQUE
1. Electricity	L'électricité, *f.*
2. Positive rays	Les rayons positifs.
3. Cathode rays	Les rayons cathodiques.
4. X-rays	Les rayons X.
5. Secondary rays	Les rayons secondaires.
6. Normal ray	Le rayon normal.
7. Volt	Le volt.
8. Kilovolt	Le kilovolt.
9. Ampere	L'ampère, *m.*
10. Milliampere	Le milliampère.
11. Ohm	L'ohm, *m.*
12. Watt	Le watt.
13. Kilowatt	Le kilowatt.
14. Electro-motive force	La force électro-motrice.
15. Current	Le courant.
16. Direct current	Le courant continu.
17. Alternating current	Le courant alternatif.
18. Resistance	La résistance.
19. Polarity	La polarité.
20. Positive pole	Le pôle positif.
21. Negative pole	Le pôle négatif.
22. Alternation	L'alternance, *f.*
23. Spark	L'étincelle, *f.*
24. Spark gap	L'étincelle équivalente.
25. Inverse	L'inverse, *m.*
26. Induction	L'induction, *f.*
27. Shunt	En dérivation.
28. Arc	L'arc, *m.*
29. Vacuum	Le vide.
30. Velocity	La vitesse.
31. Ground-wire	Le fil de terre.
32. Series connection	La connexion en série.
33. Parallel connection	La connexion en parallèle.
34. Phase	La phase.
35. "Step-up"	L'élévateur de tension, *m.*
36. "Step-down"	L'abaisseur de tension, *m.*
37. Frequency	La fréquence.
38. Electron	L'électron, *m.*
39. Circuit	Le circuit.
40. Make. To (circuit).	Fermer. (Le
41. Break. To (circuit).	Ouvrir. circuit.)
42. Revolution	Le tour.
43. Terminal	La borne.
44. Size	La dimension.
45. Shape	La forme.
46. Position	La position.
47. Angle	L'angle, *m.*
48. Weight	Le poids.
49. Length	La longueur.
50. Width	La largeur.
51. Thickness	L'épaisseur, *f.*
52. Density	La densité
53. Atomic weight	Le poids atomique.
54. Distance	La distance.
55. Color	La couleur.
56. Depth	La profondeur.
57. Radiation	La radiation.
58. Absorption	L'absorption, *f.*
59. Time	Le temps.
60. Exposure	L'exposition, *f.*
61. Reduction	La réduction.
62. Metal	Le métal.
63. Coal gas	Le gaz d'éclairage.
64. Ether vapor	La vapeur d'éther.
65. Alcohol vapor	La vapeur d'alcool.
66. Mercury	Le mercure.
67. Lead	Le plomb.
68. Copper	Le cuivre.
69. Iron	Le fer.
70. Steel	L'acier, *m.*
71. Aluminium	L'aluminium, *m.*
72. Tin	L'étain, *m.*
73. Brass	La laiton.
74. Vertical	Vertical, e.
75. Horizontal	Horizontal, e.
76. Oblique	Oblique.
77. Round	Rond, e.
78. Square	Carré, e.
79. Circle	Le cercle.
80. Black	Noir, e.
81. White	Blanc, he.
82. Violet	Violet, te.
83. Indigo	Indigo.
84. Blue	Bleu, e.

PHYSICS	PHYSIQUE
5. Green	Vert, e.
6. Yellow	Jaune.
7. Orange	Orangé, e.
8. Red	Rouge.
9. Fluorescence	La fluorescence.

PHOTOGRAPHY	PHOTOGRAPHIE
1. Plate	La plaque; le cliché.
2. Film	Le film.
3. Tank	La cuve.
4. Tray	La cuvette.
5. Developer	Le révélateur.
6. Fixer	Le fixateur.
7. Reducer	L'affaiblisseur.
8. Intensifier	Le renforçateur.
9. Dark-room	La chambre noire.
10. Red lamp	La lanterne rouge.
11. Paper	Le papier.
12. Print	Le positif.
13. Envelope	L'enveloppe, *f.*
14. Box	La boite.
15. Lead box	La boite plombée.

APPARATUS	APPAREILLAGE
1. Transformer	Le transformateur.
2. Induction coil	La bobine.
3. Table	La table.
4. Tube	Le tube.
5. Valve tube	La soupape.
6. Rheostat	Le rhéostat.
7. Switch	Le coupe-circuit.
8. Time switch	Le relais à temps.
9. Fuses	Les plombs (fusibles).
10. Wire	Le fil.
11. Interrupter	L'interrupteur, *m.*
12. Foot-switch	La commande à pédale.
13. Milliammeter	Le milliampèremètre.
14. Level	Le niveau.
15. Screen	L'écran, *m.*
fluorescent	fluorescent.
reinforcing	renforçateur.
16. Diaphragm	Le diaphragme.
17. Pulley	La poulie.
18. Counterweight	Le contrepoids.
19. Cone	Le limitateur.
20. Tube-shield	La cupule.
21. Tube-holder	L'étrier, *m.*
22. Tube-stand	Le pied.
23. Filament	Le filament.
24. Sand-bag	Le sac de sable.
25. Plate-holder	Le châssis.
26. Armature	L'armature, *f.*
27. Gloves	Les gants.
28. Apron	Le tablier.
29. Glasses	Les lunettes.
30. Binding-post	L'antenne, *m.*
31. Condenser	Le condensateur.
32. Nail	Le clou.
33. Screw	La vis.
34. Nut	L'écrou, *m.*
35. Bolt	Le boulon.
36. Insolation	L'isolement, *m.*
37. Reel	L'enrouleur, *m.*
38. Clock	L'horloge, *f.*
39. Watch	La montre.
40. Instrument	L'instrument, *m.*
41. Trolley	Le trolley.
42. Stool	Le tabouret.
43. Chair	La chaise.
44. Tool	L'outil, *m.*
45. Screwdriver	Le tournevis.
46. Pliers	La pince.
47. Needle	L'aiguille, *f.*
48. Casette	Le châssis porteécran.
49. Illuminating box	Le négatoscope.
50. Ink	L'encre, *f.*
51. Tattoo ink	L'encre à tatouer.
52. Handle	La poignée.
53. Flame	La flamme.
54. Regulator	Le régulateur.
55. Floor	Le plancher.
56. Wall	Le mur.
57. Ceiling	Le plafond.
58. Knife	Le bistouri.
59. Scissors	Les ciseaux, *m.*
60. Forceps	La pince.
61. Pointer	L'aiguille indicatrice, *f.*
62. Magnet	L'aimant, *m.*
63. Compress	La compresse.
64. Towell	La serviette.
65. Cloth	Le champ.
66. Blanket	Le drap.
67. Pillow	L'oreiller, *m.*

PHRASES	PHRASES
1. Will you?	Voulez-vous?
2. Please	S'il vous plait.
3. Hold your breath	Ne respirez plus.
4. Breathe quietly	Respirez doucement.
5. Take a deep breath.	Respirez fort.
6. Cough	Toussez.
7. Hold perfectly still	Ne bougez plus.
8. Turn around	Tournez-vous.
9. Move to the right	Allez à droite.
10. Move to the left	Allez à gauche.
11. Get on the table	Montez sur la table.
12. Lie on your back	Couchez-vous sur le dos.
13. Lie on your stomach.	Couchez-vous sur le ventre.
14. Lie on your right side	Couchez-vous sur le côté droit.
15. Lie on your left side.	Couchez-vous sur le côté gauche.
16. Turn over	Retournez-vous.
17. Move toward the head of the table	Remontez plus haut sur la table.
18. Move toward the foot of the table	Descendez plus bas sur la table.
19. Bend your elbow	Pliez le coude.
20. Bend your knee	Pliez le genou.
21. Turn your hand over	Tournez la main.
22. Open your mouth	Ouvrez la bouche.
23. Close your mouth	Fermez la bouche.
24. Draw in the abdomen	Rentrez le ventre.
25. Fill out the abdomen.	Gonflez le ventre.
26. Relax	Laissez-vous aller.
27. Where are you hurt?	Où êtes-vous blessé?
28. Is it very painful?	Souffrez-vous beaucoup?
29. Do I hurt you?	Est-ce que je vous fais mal?

PHRASES	PHRASES
30. What wounded you?	Par quoi avez-vous été blessé?
31. Have you had an X-ray examination?	Avez-vous déjà passé aux rayons X?
32. How many times?	Combien de fois?
33. It is a bullet	C'est une balle.
34. It is shrapnel	C'est une balle de shrapnel.
35. It is a shell-fragment	C'est un éclad d'obus.
36. When were you wounded?	Quand avez-vous été blessé?
37. Do not be afraid	N'ayez pas peur.
38. I will not hurt you	Je ne vous ferai pas de mal.
39. Drink this	Buvez ceci.
40. When I tell you	Quand je vous le dirai.
41. Hold the glass in your left hand	Prenez le verre dans la main gauche.
42. Turn off the light	Éteignez.
43. Turn on the light	Allumez.
44. A little more current.	Un peu plus de courant.
45. A little less current.	Un peu moins de courant.
46. More penetration	Plus dur.
47. Less penetration	Moins dur.
48. The tube is too hard.	Le tube est trop dur.
49. The tube is too soft.	Le tube est trop mou.
50. Shut the door	Fermez la porte.
51. Toward you	Vers vous.
52. Toward me	Vers moi.
53. To your right	A votre droite.
54. To your left	A votre gauche.
55. You are just right	Vous y êtes.
56. This is the nearest point	C'est le point le plus proche.
57. There are several fragments	Il y a plusieurs fragments.
58. There is some metallic dust	Il y a des poussières métalliques.
59. It is smooth	Il est lisse.
60. It is irregular	Il est irrégulier.
61. Do you see it?	Le voyez-vous?
62. How long have you been ill?	Depuis combien de temps êtes-vous malade?
63. Take off your clothes	Déshabillez-vous.
64. Put on your clothes	Rhabillez-vous.
65. Sit down	Asseyez-vous.
66. Stand up	Levez-vous.

PERSONEL	LE PERSONNEL
1. Patient	Le malade.
2. Wounded patient	Le blessé.
3. Soldier	Le soldat.
4. Officer	L'officier, *m.*
5. Litter-bearer	Le brancardier.
6. Anæsthetist	L'anesthésiste, *m.*
7. Surgeon	Le chirurgien.
8. Assistant	L'aide, *m.*
9. Nurse	
male	L'infirmier, *m.*
female	L'infirmière, *f.*
10. Sister	La sœur.
11. Technician	Le manipulateur.
12. Radiologist	Le radiologiste.
13. Photographer	Le photographe.
14. Electrician	L'électricien, *m.*
15. Stenographer	La dactylographe.
16. Orderly	L'ordonnance, *m.*

WEIGHTS AND MEASURES	POIDS ET MESURES
1 Grain (Av.)	64,8 milligrammes.
15.4324 Grains	1 gramme.
1 Pound	0,453592 kilogramme.
1.10231 Pounds	1 livre.
2.20462 Pounds	1 kilogramme.
14 Pounds = 1 Stone	6,350288 kilogrammes.
0.0393 Inches	1 millimètre.
0.393 (approx. 2/5) Inches	1 centimètre.
3.93 Inches	1 décimètre.
12 Inches = 1 foot	0,304801 mètre.
3. Feet = 1 yard	0.914402 mètre.
3 Feet 3.37 Inches	1 mètre.
3280.8 Feet (approx. 0.621 Mile)	1 kilomètre.
5280 Feet = 1 Mile	1.60935 kilomètre.
1 Minim	0.061610 c c.
1 dram = 60 minims	3.696 c c
1 Fluidounce = 8 drams	29.573 c c.
16 Fluidounces = 1 Pint	473.17 c c.
2 Pints = 1 Quart	946.33 c c.
1.05671 Quarts	1 litre.
1 Quart, 1 Fluidounce, 391.1 Minims	1 litre.
4 Quarts = 1 Gallon	3.78533 litres

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THE CAMP GREENLEAF MEETING

The nineteenth annual meeting of the American Roentgen Ray Society, held at Camp Greenleaf, Fort Oglethorpe, Georgia, on September 6, 7, 8, and 9, was a most interesting one, due in part to the historical setting and the military surroundings. The attendance of members was larger than expected and was greatly augmented by instructors and students from the various special schools of medical instruction there located, especially from the school of Military Roentgenology. The following program was presented; and papers will be published in forthcoming issues of the JOURNAL.

WEDNESDAY, SEPTEMBER 4TH

Morning Session—9 A.M.—at Camp Greenleaf

1. ADDRESS
   BY THE COMMANDANT, Camp Greenleaf
2. THE ROENTGEN RAYS IN THE DIAGNOSIS OF CHRONIC APPENDICITIS AND OTHER CONDITIONS IN THE APPENDICULAR REGION
   GEO. C. PFAHLER, M.D., Philadelphia, Pa.*
3. LESIONS AT THE DUODENO-JEJUNAL ANGLE
   HARRY M. IMBODEN, M.D., New York City
4. ROENTGEN RAY EXAMINATION OF THE URETERS
   JOHN H. EDMONSON, M.D., Birmingham, Ala.
5. DIAGNOSTIC ERRORS FROM OVERLOOKING SIMULTANEOUS LESIONS
   A. W. CRANE, M.D., Kalamazoo, Mich.
6. COOPERATION BETWEEN THE ROENTGENOLOGIST AND OTHER MEDICAL OFFICERS
   CAPTAIN M. B. PALMER, M.C., U.S.A.

Afternoon Session—1.30 P.M.—at Camp Greenleaf

1. OSTEOMYELITIS
   MAJOR F. H. BAETJER, M.C., U.S.A.
2. HISTOLOGICAL APPEARANCES IN A SERIES OF BONE TUMORS COMPARED WITH THE ROENTGEN RAY FINDINGS
   MAJOR L. T. LE WALD, M.C., U.S.A.
3. OSTEOMALACIA—ITS ROENTGENOGRAPHIC APPEARANCE AND CLASSIFICATION
   GEO. W. HOLMES, M.D., Boston, Mass.
4. SOME OBSERVATIONS OF MASTOID STRUCTURE AS REVEALED BY ROENTGEN RAY EXAMINATION?
   ISAAC GERBER, M.D., Providence, R. I.
5. THE X-RAY INDICATIONS FOR EXTRACTION OF TEETH
   BYRON C. DARLING, M.D., New York City

*Read by title only.

6. A ROENTGENOLOGICAL CONTRIBUTION TO THE POSSIBLE CAUSE OF HEREDITARY OPTICAL ATROPHY
H. K. Pancoast, M.D., Philadelphia, Pa.

Evening Session—8 P.M.—at Hotel Patten

EXECUTIVE SESSION—FOLLOWED BY LANTERN SLIDE DEMONSTRATION
INSPECTION OF COMMERCIAL EXHIBITS

Thursday, September 5th

Morning Session—9 A.M.—at Camp Greenleaf

EXECUTIVE SESSION
SCIENTIFIC SESSION

1. MOBILE X-RAY APPARATUS
Lieut. Colonel A. C. Christie, M.C., U.S.A.

2. LOCALIZATION OF FOREIGN BODIES, WITH SPECIAL REFERENCE TO INFORMATION GIVEN TO THE SURGEON
Major Percy Brown, M.C., U.S.A.

3. SIMPLIFIED ADAPTATION OF CROSS-SECTION ANATOMY LOCALIZATION
Captain E. S. Blaine, M.C., U.S.A.

4. THE TRAINING OF MANIPULATORS
Major H. E. Ashbury, M.C., U.S.A.

5. INTERPRETATION BY A LINEAR METHOD
Major A. W. George, M.C., U.S.A.

6. HYDRO-PNEUMO-CRANIUM AND ALLIED PHENOMENA, WITH REPORT OF A CASE
H. E. Potter, M.D., Chicago, Ill.

Afternoon Session—1.30 P.M.—at Camp Greenleaf

1. STREPTOCOCCUS EMPYEMA—A STUDY OF THE CONDITION AS REVEALED BY THE X-RAY
Major W. H. Stewart, M.C., U.S.A.

2. SOME NON-TUBERCULUS PULMONARY LESIONS
Major A. W. Gray, M.C., U.S.A.

3. CONCERNING A ROENTGENOLOGICAL CONCEPTION OF PULMONARY TUBERCULOSIS
F. S. Bissell, M.D., Minneapolis, Minn.

4. THE UNSUSPECTED FOREIGN BODY AS A FREQUENT CAUSE OF CHRONIC BRONCHITIS
D. R. Bowen, M.D., Philadelphia, Pa.

5. PLEURITIS FROM THE STANDPOINT OF THE PATHOLOGIST
Major R. E. Keilty, M.C., U.S.A.

6. THE VALUE OF THE ROENTGEN RAY EXAMINATION IN STUDYING THE COURSE OF PULMONARY AND CARDIAC PATHOLOGY
Major L. G. Cole, M.C., U.S.A.

7. THE SIGNIFICANCE OF ANNULAR SHADOWS ON CHEST PLATES
William A. Evans, M.D., Detroit, Mich.

Evening Session—8 P.M.—at Hotel Patten

ANNUAL DINNER.

INSPECTION OF COMMERCIAL EXHIBITS.

FRIDAY, SEPTEMBER 6TH

Morning Session—9 A.M.—at Hotel Patten

EXECUTIVE SESSION
SCIENTIFIC SESSION

1. THE USE AND ABUSE OF ROENTGEN RAY TUBES
C. N. Moore, Schenectady, N.Y.

2. THE PRACTICAL USE OF THE WHEATSTONE STEREOSCOPE
H. C. Snook, Chicago, Ill.

3. THE PHOTOGRAPHIC MEASUREMENT OF X-RAY DOSAGE
L. P. Larkin, Ithaca, N.Y.

4. THE PHYSICAL CHARACTERISTICS OF FLUORESCENT INTENSIFYING SCREENS AS APPLIED TO ROENTGENOLOGY
M. B. Hodgson, Rochester, N.Y.

5. ROENTGENOLOGY IN ITS RELATION TO ORTHOPEDIC SURGERY
Major John Ridlon, M.C., U.S.A.*

6. SKIN LESIONS IN SOLDIERS SUCCESSFULLY TREATED BY ROENTGEN RAYS
G. M. McKee, M.D., New York City*

* Read by title only

Afternoon Session—1.30 P.M.—at Hotel Patten

1. X-RAY WORK IN THE NAVY
   L. MARSH DALLOWAY, P.A.SURG., U.S.N.R.F.

2. A RÉSUMÉ OF THE ROENTGEN FINDINGS OF 205 CHEST EXAMINATIONS AT A BASE HOSPITAL IN FRANCE
   LIEUTENANT R. G. ALLISON, M.C., U.S.A.*

3. LE MAL DES IRRADIATIONS PENETRANTES [The penetrating Irradiations Sickness] *
   MEDECIN A. BECLERE OF THE ACADEMY OF MEDICINE, PARIS

4. ADDRESS AU MEDECINE RADIOLOGISTES DE LA SOCIETE AMERICAINE ROENTGEN [Greetings to the American Roentgen Ray Society] *
   MEDECIN-MAJOR (FIRST CLASS) HARET

5. PERTHES' DISEASE—OSTEOCHONDRITIS
   LIEUT. E. L. JENKINSON, M.C., U.S.A.*

* Arriving too late to be read in their entirety, the starred numbers were read by title only—as was also a paper on the "Instruction of War Roentgenologists" by Major Ledoux-Lebard of Tours, France, which appears in this issue of the JOURNAL.

ANOTHER AVENUE OF CONSERVATION

The especial attention of all users of Roentgen Ray tubes is directed to the request for platinum which is made by the War Industrial Board and which is printed on page 478 of this number of the JOURNAL. Platinum is found in all gas tubes in the "seal in" portion of the terminals. All of us have a number of gas tubes which are punctured, broken, cranky or for some other reason have been passed to the junk pile. The Board urges that the platinum in these tubes be recovered and made available for government purpose.

GREETING

The Western Roentgen Ray Society felt that it would fill a wider field of usefulness by having its own official organ. Accordingly they have put forth THE JOURNAL OF ROENTGENOLOGY. The May Number being Number 1 of Volume 1 we bid it welcome to the field of American roentgenological journalism and hope it may have a steady growth and a useful career.

TRANSLATIONS & ABSTRACTS

Pool, E. H., Lee, B. J., and Dineen, P. A., Surgery of Soft Parts, Bones, and Joints. At a Front Hospital. (*Surg., Gynec. & Obst.*, Vol. XXVII, No. 3, 1918, p. 289.)

"The Ambulance l'Ocean at La Panne, Belgium, under the management of Colonel Depage, is one of the best known hospitals in Europe."

"La Panne is a small summer resort on the coast of Flanders, East of Dunkerque and Calais and about six miles from Nieuport-Bains, which marks the northern limit of the Western Front. It is composed of a former hotel with surrounding villas and a number of recently built wooden barracks. It can accommodate about 1,000 patients. An auxiliary hospital is in course of construction at Vinckem, about nine miles south of La Panne, and about six miles west of Dixmude, the center of the Belgian lines. The hospital at Vinckem consists of frame buildings of the barrack type. It is planned for 1,400 beds and can be readily expanded to a larger capacity."

The admitting officer is a roentgenologist who is also the director and is responsible for the coöperation of the assistants and the coördination of the work.

The roentgenological department is of necessity one of the most important features in such a hospital. Practically all cases must pass through it, and the results of the early operations depend largely upon the thoroughness of the roentgenologist's examination and the accuracy of his findings and report. The efficiency of such a department depends largely upon the ability and trustworthiness of the man doing the work. At La Panne a roentgenologist is always on duty.

A patient is taken to the *x*-ray room as soon as possible after admission, before or after being put to bed according to the indications of the case. The routine method employed in a new case depends upon the site of injury. Thus, in difficult cases, such as shoulder, hip, gluteal region, thigh, thorax, and abdomen, the bathymetre of Dessanes is used. For the cranium, plates are always made at once, because it is often difficult to recognize small foreign bodies. For simple cases, such as leg, forearm and arm, the Ledoux-Lebard bonnet is employed; the part is examined from different angles and the depth estimated. In most cases, an effort is made to cause the foreign body to move during fluoroscopy. For this purpose, pressure is made on the skin over the foreign body with the tip of a curved metal rod. Where the foreign body moves most freely, it is probably closest to the skin.

In an incredibly short time, Dr. Peremans localizes all eclats. He marks on the skin the point under which each one lies, making the mark as nearly as possible in the line of, or in relation to, the probable incision. This is usually quite accurately done because the roentgenologist in question has a good knowledge of war surgery and keeps in close touch with the surgical work of the institution. Such coöperation between the surgical and roentgenological departments is of great value, but it necessitates the employment of a broadly trained medical man as roentgenologist. It appears imperative in a hospital doing a large amount of work.

On the history chart, which has already been filled out, is made a note somewhat as follows: "Right thigh, eclat 10 x 55 millimetres, 65 millimetres in depth, under the point marked on skin." Or in a case with fracture, "left leg, fracture of both bones, middle third, much comminution."

Plates of fractured bones are also made, as a rule, at the time of the first examination. If the operator wishes further information, Dr. Peremans is always available and goes to the operating room where his advice is often of much value. With experience the operator acquires the knack of finding foreign bodies quite readily when they have been localized as above indicated. One should remember, however, to mark with a scalpel the points indicated on the skin before painting with iodine. For localization in later cases, especially in difficult regions, such as thorax, brain or pelvis, reliance is placed chiefly on the Hirtz compass. We saw astonishingly accurate localizations by this method. One of us removed an eclat about one centimeter in diameter from the psoas muscle within the pelvis through a trephine opening in the ileum. The foreign body had been localized exactly as to depth and closely as to direction by this method. We likewise saw a small eclat, which lay at the base of the brain in the middle fossa, removed through a trephine opening in the temporal region. In this case, the central rod of the Hirtz compass was introduced to the depth and in the direction established before the operation, the legs of the compass being on the respective points previously marked on the skin. A powerful electromagnet was then placed in contact with the rod which was withdrawn. Attached to it was the foreign body.

For the late removal of foreign bodies from regions in which the field of dissection is not of necessity limited, especially for very small foreign bodies, the method of Ombredanne-Ledoux-Lebard is often employed. For this purpose an operating room is attached to the *x*-ray Department. The room, which can be darkened by shades, is next to the night operating room, from which supplies are furnished. The table is the Ledoux-Lebard pattern with bulb beneath, and protected on three sides by lead aprons.

Plates are always made in examinations subsequent to the initial fluoroscopic observation. In the case of fractures, frequent observations are made.

A movable apparatus is available for use in the wards. For the localization of foreign bodies it is little used. Even bad cases are brought to the *X*-ray room, because localization is much better done on a fixed table. For fractures, however, the movable apparatus is imperative; proper treatment in a large proportion of cases demands frequent *x*-ray examinations without disturbing the patient.

Records of plates for filing with histories are made on tracing paper. The bones are filled in with a soft carbon pencil and this is covered with varnish to prevent smearing. [1] Beautiful and quite accurate records are thus made.

The roentgenological department is managed by two doctors (Dr. Henrad and Dr. Peremans), assisted by two brancardiers, who develop the plates. There is no clerk or stenographer.

An estimate of the work demanded may be had from the following figures:

650 consecutive cases; 110 patients *x*-rayed with plates, average 3 plates; 350 fluoroscopic examinations.

The apparatus is the grand Contact Tournant de Gaiffe, 220 volts, direct. Coolidge tubes are used exclusively. The Bilot table is used in the main room, the Ledoux-Lebard table in the operating room."

[1] Venice turpentine 6⅔ per cent. in alcohol.

JAPIOT. The Posterior Malleolus. (*Progrès méd.*, March, 1918, p. 104.)

The author gives the name of posterior malleolus or the third malleolus to the posterior lip of the tibia, a bony projection which very plainly projects farther down than the anterior border of the bone. He claims that the posterior malleolus impedes displacement of the foot posteriorly when jumping.

For the roentgenographic examination of the posterior malleolus, two plates are necessary, one anteroposterior and one lateral. For the lateral plate, the internal malleolus rests on the plate and the tube is centered over the middle of the joint space. For the anteroposterior plate the heel rests on the plate and the tube is centered over the middle of the joint space. To show better the posterior malleolus it is very good to have a small sand bag under the heel.

In the lateral roentgenograph the shadow of the posterior malleolus is superimposed upon the shadow of the exterior malleolus from which it is very difficult to differentiate when there is a fracture present. To differentiate between the two, it is necessary to trace the contour of the malleolus and the posterior surface of the third malleolus by tracing down the posterior border of the tibia. In tracing the anterior border of the third malleolus in the anterior posterior plate, two landmarks are found; the posterior lip of the tibial surface and the posterior tubercle of the tibiofibular groove.

The posterior lip of the tibial surface is almost parallel to the other lines, which are the articular surface itself and the astragalus. If the foot is sufficiently elevated the posterior lip is superimposed over the shadow of the astragalus or the anterior malleolus which borders this side of the third malleolus. Of the two tubercles which border the tibiofibular groove, the anterior one, farthest away from the plate, is the greater and projects over the shadow of the fibula; the posterior one, closer to the plate and therefore less distorted, is more marked. It describes a curve more accentuated a few millimeters at the side of the fibula.

These relations of the posterior tubercle to the fibula on an anteroposterior roentgenograph must always be very carefully observed. It is a very important diagnostic fact in the condition of the posterior malleolus and, especially, by the relation of the astragalus to the lateral malleoli. These findings are important when we have to do with a fracture of the posterior border or the third malleolus (Destot). In an important case of a posterior fracture of the foot and in every fracture of both malleoli of the ankle joint, it is very important to ascertain the condition of the posterior malleolus. The fracture of the posterior malleolus alone is probably always so rare because it is not sufficiently looked for. It is usually hidden under the signs of a sprain and a systematic roentgenographic examination of a serious sprain would without doubt reveal a much larger number of isolated posterior fractures of the malleolus. P. Lund

Kantor, John L. A Study of Atmospheric Air in the Upper Digestive Tract. (*Am. J. M. Sc.*, June, 1918, p. 829.)

1. From the earliest ages of medicine the presence of air in the digestive tract has played a certain significant part, and the literature on this subject is very voluminous. Hippocrates wrote a book on "Winds and Flatuosities" and many other ancient writers wrote extensively on this subject. In the last century men like Ewald, Schultz, Boas and many others, mostly Germans, were interested in the investigation of gases of fermentation and putrefaction in the stomach. Although these contributions were interesting, they threw light only on one pathological condition, namely, pyloric obstruction with gastric fermentation. Of far greater importance were the later experiments of Schierbeck, Giglio, and Yllpo, showing that the basis of gastric gases under normal conditions is constituted by swallowed atmospheric air. Magendie found that air-swallowing was a rather frequent and, in many cases, an acquired condition. Although many great physiologists have studied this question thoroughly, it was never fully understood that air-swallowing is a perfectly normal physiological process, until Bouveret in 1891 published his experiments on this subject, and his expression "aërophagia" and his views were accepted and confirmed by a large amount of workers. The *x*-ray observations were first reported by Abrams in 1898, and later on by a great number of roentgenologists.

2. Although it is now generally recognized that aërophagia is a normal condition, there is still a doubt that the derivation of the stomach gases is entirely from the atmospheric air. Some writers claim that this is the case, while others are of the opinion that there is a sudden relaxation of the pylorus with regurgitation of intestinal gases or of alkaline duodenal contents into the acid stomach with a consequent liberation of carbon dioxide. Hoppe-Seyler's theory is that there is a marked difference in the amount of carbon dioxide found in the stomach and in the amount in the atmosphere. The amount regained from the stomach was at least equal to, if not larger than, the carbon dioxide in the atmosphere: this is a proof of the old theory of "alimentary respiration."

3. *Air Swallowing.*—The author found that this physiological action is present in a great majority of people; while some people are unable to perform it, others do it unconsciously all the time. This act can either be conscious or volitional, subconscious or reflex. Air enters the stomach in two ways, either with food or alone. The first way occurs in every individual and is a subconscious act; it is found by experimenting that the second swallowing sound, heard over the cardia 5-7 seconds after deglutition, was caused by the entrance of air into the cardia (Meltzer and Kronecker, 1883, 1887). Hertz (1907) and Kraus (1912) tried to show under the fluoroscope how the second sound was caused by air penetrating into the stomach. To establish more precisely the relation of penetration of air into the stomach to the swallowing sound, the author studied ten normal men with a combined fluoroscope and auscultating procedure, while giving them the standard opaque meal. He found that the bubble of air was always present on top of the food, while going through the esophagus, and that the second swallowing sound was always heard with the disappearance of the last portion of food; it was, of course, impossible to recognize as such the passage of air into the stomach when it preceded and even followed the opaque shadow, but when a bubble

of air was completely incorporated within the bolus the characteristic sound was heard as it passed the cardiac boundary. When the observation was made in the reclining position, a succession of sounds was heard as the whole bolus divided up in fractions and the air also passed through the cardia in fragments. The production of the swallowing sound seems to be due to two factors: the presence of air in the bolus and the force of gravity. If the cardia is open when the bolus of food arrives, some of the air may precede the food, and so produce the first swallowing sound, while if the cardia is contracted, the air rises to the top of the fluid, and we get only one sound, the second swallowing sound.

In the fasting condition there is, as a rule, no distinct *Magenblase* or air bubble. With the first swallowing sound a clearly defined bubble of air appears and increases in dimensions after each swallowing. In the stout individuals with high oblique stomachs the *Magenblase* appears flat, and the swallowing sound becomes fainter and fainter until the air is discharged and the swallowing sound restored. On the other hand, in individuals with ptotic stomachs, the *Magenblase* retained its round form, and the swallowing sound was loud and unchanged throughout the entire filling.

The actual amount of gas ingested seems to depend very much on the condition of the cardia. If the swallowing sound is heard after each deglutition, the cardia is patent, while if it is less relaxed, a smaller amount of air is admitted and only one swallowing sound is heard when the whole column of food from many deglutitions enters the stomach.

The swallowing of air alone or "air gulping" is the second way of aërophagia; if the cardia is relaxed and a good force is applied to a so-called "empty" swallow, one may see the air enter the stomach two seconds after the empty deglutition. Many writers claim that certain respiratory phenomena accompany the air-swallowing, but the author finds that air enters into the stomach as easily during deep inspiration as in deep expiration.

4. Fate of air in the stomach: Most of the air escapes through the esophagus by eructation—a true reflex act caused by different factors, such as the intragastric pressure, the gastrohyperesthesia, posture, acidity, peripheral reflexes, belching and further aërophagia. Some air might escape into the intestines, or be absorbed by the mucosa, especially if there is oxygen.

The summary of Dr. Kantor's experiments and studies leads us to the following few main points:

1. Gaseous accumulations in upper digestive tract have atmospheric air as their basis.

2. Air is introduced with food or by "gulping."

3. Gravity causes the difference between the swallowing of air and of food.

4. By fluoroscopic observations it is demonstrated that the so-called swallowing sounds are produced by the entrance of air into the stomach.

5. The act of deglutition consists of three instead of two classic periods; beside the buccopharyngeal and the esophageal, we have the period of the receptive relaxation of the stomach and the inhibition in cardiac tone—the cardiogastric period.

Mantoux and Magnot. Les images cavitaires dans la tuberculose pulmonaire. (*Revue de La Presse Médicale. Arch. d'electric méd.*)

The authors, experts in the roentgenography of tuberculosis of the lungs, describe the varied aspects of the cavity according to its content of fluid or air, or to the position of the patient. These are the shadows which Bouchard described, but the present authors give the following roentgenographic interpretations:

"On an area more or less extensive, rather dense in character, are seen darker lines, forming a series of incomplete circles, which superimpose on one another and circumscribe clearer areas. The whole reminds one of crumbs of bread well raised, with its unequal and multiple alveoli; therefore, let us give this the name "bread-crumb appearance." At the moment of coughing the bread-crumb image is liable to change its appearance and outline.

Another appearance of cavities is described. The shadow is markedly different, all the clear spaces having almost the same dimensions, about 1 centimeter in diameter. Often the smaller ones have a polygonal shape, and are very slightly separated and occur only a few in a group; they are usually seen on a gray shadow and on account of their shape they are named the "honeycomb appearance."

The "honeycomb" appears mostly in the upper half of the lungs. It is not seen fluoroscopically and is visible only on plates. At the moment of coughing the "honeycomb" shadow changes less in position than the "bread-crumb" shadow.

These two classes of roentgenographic shadows are characteristic. The "bread-crumb" appearance is more frequent than the "honeycomb." The bread-crumb and honeycomb appearances coincide very often with the air-bubble shadow and are found only in one of seven cases of confirmed fresh tuberculosis. They did not appear once in 250 healed up and suspect cases of tuberculosis.

The auscultating signs confirm in four-fifths of the cases the presence of cavities revealed by bread-crumb and honeycomb shadows. The post-mortem examinations have constantly shown small or middle-sized cavities in the region of the lungs where the *x*-ray had revealed these shadows.

Without stating that the bread-crumb or honeycomb shadows are pathognomonic of tuberculous cavities, they might be considered most characteristic signs. P. Lund

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RECENT ADVANCES IN ROENTGEN RAY METHODS

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THE war has brought home even to the least observant the enormous utility of roentgen-rays when properly applied. The essentials of proper application under military conditions are, in the first place, standardization of apparatus, and, in the second, instruction of operators. It is a matter of great satisfaction to the writer to find that the American army is proceeding upon such excellent lines in both these respects. Their field apparatus embodies the new Coolidge tube of the "Radiator" type, which possesses such marked advantages for use with portable sets in field work. Thus they have an instrumentation which is at once reliable and convenient. The introduction of the Coolidge tube has entirely revolutionized roentgen-ray work, and has opened up a number of fresh possibilities. The gas tubes, however good they may be in themselves, can in no way compete with it, either from the point of view of efficiency or durability, and seeing that the tube is the most crucial and very often the weakest point in the roentgen-ray outfit, it is a pleasure for us over here to observe with what characteristic resolution and thoroughness American engineering has tackled the problem.

In the second respect, that of teaching the operator, the American method again sets us all a good example. The establishment of teaching centers for roentgen-ray medical officers is an admirable policy, and it would be well if our British War Office had adopted a similar course of action: but "better late than never." We in England have recently formed a "*British Association of Radiology and Physiotherapy*," whose object is to ensure proper teaching for roentgen-ray workers. It is hoped before long to have not only excellent teaching centers established in London, and possibly also in the provinces, but to enable the student to obtain the Cambridge Diploma, in the matter of which the University has been most helpful and sympathetic. This movement ought to attract many workers from the Colonies, and possibly also from the United States. One aim of the Society will be to try to arrange for the education and regulation of lay assistants, a matter of great importance in view of the unfortunate encroachments which have been made upon purely medical domains. It goes without saying that the work of lay assistants must be carried out under a system of the most complete control and supervision by properly qualified medical men. It is also proposed to establish a central institute for post-graduate teaching, arranging for the various hospitals to coöperate in the scheme. This ought to be welcomed by our visitors from overseas.

Apparatus for Rapid Localization.—War conditions have also emphasized the need for speed in x-ray examination, though never at the cost of precision, and the extreme importance of exact localization of foreign bodies on the screen. The use of the screen for rapid diagnosis at the front seems to be essential, as it often happens that there is not time to take roentgenograms: though it must never be lost sight of that a good negative is enormously superior to any shadow on the screen, however good the latter may be. It seemed advisable, therefore, to construct an apparatus which, while enabling the most precise localization of foreign bodies to be carried out, should yet be so simple that any ordinary roentgen-ray worker could be rapidly instructed in its use and be able in a short time to produce results for the surgeon. The apparatus which the writer has devised for this purpose consists in the first place of a couch or an ordinary army stretcher with a roentgen-ray tube supported below, the latter being surrounded by a protective shield or contained in a lead-lined box. By means of two arms which are carried outside the tube-box through a zigzag opening, the tube can be raised and lowered easily. These arms are attached to an upright supporting pillar from the upper part of which is carried a hinged horizontal piece projecting over the couch by a rack-and-pinion arrangement moving in exact conformity with the tube below, so that the distance between them is constant. At the end of this horizontal piece is a square frame holding a hinged fluorescent screen together with the cross-wire device, the wires intersecting exactly above the spot on the anticathode of the tube at which the rays originate.

To use this apparatus, the tube is first roughly adjusted to the required position, and the final centering is done by suspending a small plumb-bob from the intersection of the wires. The screen is then closed down upon the wires, with the plumb-bob hanging two or three inches below, and when the tube is excited, the circular shadow of the plumb-bob is observed. By the turn of a screw the point of intersection and the center of the shadow of the plumb-bob are brought into relation, and when this has been done the adjustment is perfect, and the tightening of a clamp makes displacement impossible. In order to locate the foreign body, the patient is placed in position, and the operator, holding the handles of the two arms already described, moves the tube-box underneath backwards and forwards and across, so that the patient can be examined if necessary from head to foot. When the foreign body is detected, the apparatus is carefully adjusted until the shadow of this foreign body coincides with the intersection of the cross-wires, whereupon the tube-box is clamped, the screen hinged back, and the patient marked at the point of intersection, vertically below which, of course, the foreign body is lying.

It remains to ascertain the depth of the foreign body below the surface, and the manipulation in this case is as simple as in the other. The screen is replaced; the upright T-piece is rotated counter-clockwise, and the tube-box and support are thereupon displaced to the left, to the precise distance of 6 cm., thus causing the shadow of the foreign body, which had been previously accurately centered, to be displaced to the right of the intersection. As the distance between the tube and the cross-wires is always known and constant (*e.g.*, 50 cm.), the displacement of the shadow varies with the depth and can easily be calibrated. To measure the amount of displacement, a very fine micrometer wire is made to travel across the screen horizontally, parallel with one of the fixed cross-wires, by being attached to the nut of a two-thread screw. When the position of this wire corresponds with that of the displaced shadow of the foreign body (or with that part of it which was originally centered by the cross-wires), an rrow-head indicator on a calibrated scale urnishes automatically the depth of the oreign body, that is to say, the distance f the foreign body from the cross-wires n the supporting frame. It should be added that it is quite a simple matter to arange this apparatus for photography, ither for the single picture or the stereocopic pair. The point where the wires inersect indicates the vertical ray, and this eing directly over the area which is to be hotographed, a little mark can be made n the skin vertically below the crossvires, the horizontal arm in its entirety hen swung back, the plate in its holder laced as usual in this position on the paient's skin, and the exposure made, together with a second exposure after the ube shift.

Proposed Localizing Stand for Working with the Tube in Three Positions.—In order still further to simplify and "mobilize" this method of localization, the author proposes constructing a tube-and-screen stand, which shall move on castors so as to permit of ready manœuvre in any relation to the couch. This stand will have near its base an arm carrying the tube, and from its upper part will project another arm carrying cross-wires and screen. These two horizontal pieces will always be a fixed distance apart, and can be raised or lowered conjointly as required. The procedure of getting the shadow of the foreign body in the center of the cross-wires and marking the patient's skin at that point is carried out in the ordinary way. However, an arrangement will be incorporated in this mechanism by which the arm carrying the tube can be swung to one side like a pendulum, still maintaining a fixed distance from the other arm holding the screen. When this is done, the shadow on the screen is, of course, correspondingly shifted in the opposite direction, and by means of the calibrated indicator, the depth is ascertained forthwith. The advantage of this pendulum action is that the tube, in being shifted to one side, is moved not linearly but along the arc of a circle, so that if a fine stop is in front of the tube the central ray can be directed through the center of the aperture.

A stand of this kind has the additional recommendation that the tube can be swung further, even to an angle of 90 degrees, occupying a vertical instead of a horizontal position in relation to the central pillar, and the arm holding the screen is, of course, swung at the same time and by the same movement. This furnishes all the arrangement necessary for examining the patient in the upright position. It is even possible to carry this principle still further, and to swing the tube another 90 degrees, so that it then occupies a position *above* the screen-supporting apparatus instead of, as formerly, below it, thereby permitting the work to be done from above instead of from beneath. In this way the stand, if properly made, with a good solid bearing for the arm support, can be used for working at will with the tube below the patient, at the side of the patient, or above the patient—all by the simple rotation of the tube support.

One of the chief advantages of a stand of this kind is that it could not only be used for a patient on a stretcher or for a patient sitting up, but could also be used under an operating couch, and the surgeon could at any moment, by viewing through a hood or by darkening the room for a while, ascertain the exact position and depth of the foreign body as measured from any instrument he chose to introduce into the wound. The observing screen need never touch the wound, so that no question of disinfection could arise, and the accuracy of the measurements is not influenced in any way by the distance of the wound from the screen. Simplicity in procedure and extreme accuracy in result are the two desiderata in any roentgen-ray method for dealing with war casualties, and the writer believes that these have been achieved in the method he has indicated. However lengthy and tedious the procedure may appear in description, it is a matter of only one or two mechanical adjustments in actual practice, and occupies but a few seconds.

THE "PENETRATING-IRRADIATIONS-SICKNESS" *

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IN admitting me to its list of honorary members, The American Roentgen Ray Society has bestowed upon me a favor of whose worth I am keenly appreciative, and for which I am most grateful. I am sending this paper as a modest testimony of my gratitude, and to show its members with what interest I am following their productions.

The war, while it has more firmly bound together the ancient bonds of friendship and of fraternity of arms between the United States and France, has at the same time revived the warm union between the radiologists of the two countries. As a matter of fact I read THE AMERICAN JOURNAL OF ROENTGENOLOGY with great pleasure; and it was with equal delight that I had an opportunity recently of seeing in Paris its editors, my excellent friends Colonel Case and Major Hickey, and of admiring the remarkable activity that they are displaying in the organization and the direction of the roentgenological service of the American army on French soil.

In the JOURNAL of last January I read with a very special interest the article written by my friend Dr. Pfahler on "The Cause and Prevention of the Constitutional Effects Associated with the Massive Doses of Deep Roentgenotherapy," and also the article on the same subject by Doctors Llewellyn Jones and Paul Roth based upon experimental researches inspired by Dr. Case. These two papers have suggested some thoughts to me which I wish to present to the American Roentgen Ray Society.

The group of more or less disagreeable disturbances which sometimes follow sessions of roentgenotherapy constitute a morbid picture—a syndrome—which deserves to be called by a special name. The German authors call it "*Roentgenkater*." The German word "kater" means "the disturbance which follows an excessive amount of wine or beer." Without doubt they found some analogy between this type of upset and the disagreeable syndrome sometimes provoked by roentgenotherapy.

The morbid state in question is not provoked by the therapeutic use of the roentgen rays alone, but also by the use of the salts of radium and of other radio-active substances. In the latter case the German authors call it "*Radiumrausch*," which means literally "a drunkenness from radium," and makes a very worthy addition to "*Roentgenkater*."

Professor Sebastian Recasens of Madrid and Dr. Victor Conill of Barcelona, in their work "Radioaterpia profunda y Radiumaterpia in Ginecologia," do not accept the terms employed in Germany, and the reasons for their refusal are very interesting.

The proverbial sobriety of their countrymen is the reason, they say, why there is no equivalent in the Spanish language, rich as it is, for the German word "*Kater*"; and they do not wish to inflict a barbarism on this harmonious language. Besides, the comparison between the disturbances which follow an excess of liquors and those which are produced by roentgenotherapy appears to them not only inexact, but also discourteous to the sick people who are thus afflicted.

They therefore call the language of Hippocrates to their aid, and with the Greek word "*aterpos*" (disagreeable) they manufacture the new words "*roentgena-*

* Prepared for Presentation at the 19th Annual Meeting of the American Roentgen Ray Society, September, 1918. But arriving too late was read by title only.

terpia" and "*radiumaterpia*," which they use in opposition to the "*Roentgenkater*" and "*Radiumrausch*" of the Germans.

In preference to this word "*aterpie*," whose sound is too similar to "*therapie*," and in order to avoid confusion, may I be permitted to propose a new term, The "*Penetrating-Irradiations-Sickness*" (Le mal des irradiations penetrantes).

This term, if it were adopted, would have the advantage of uniting and including together the disturbances caused by roentgenotherapy and by radiotherapy. Likewise, without attempting in any way to presume the intimate mechanism, still obscure, of the morbid state in question, it would bring to mind another universally known disturbance to which it bears, I think, much closer resemblance than to drunkenness or the effects of excessive drinking; I refer to "*sea-sickness*" (mal de mer).

Although it is not necessary here to enter into a detailed discussion of its multiple elements and of its various degrees of intensity, it may be stated that the syndrome in question consists essentially, just as does sea-sickness, in a general malaise, characterized chiefly by a state of nausea, which sometimes ends in vomiting, and sometimes does not.

In attempting to solve the problem of the etiology of this mysterious syndrome, it is not improper to take into consideration all the possible sources of information; the data of normal and of pathological physiology; the clinical observation of the sick people; and the results of animal experimentation.

Anatomo-physiological data.—What are the teachings of physiology with regard to this condition?

We know that vomiting is an involuntary movement, a reflex act, whose center is in the medulla. We know also that the centripetal excitation of this reflex arrives sometimes by a nervous path, over the sensory nerves, when their periphery undergoes some irritation; and sometimes through the vascular system, when the arterial blood is loaded with substances such as tartar emetic. This was the condition in the old and famous experiment of Magendie, who provoked vomiting in the dog by an injection of this emetic into the veins. The action of apomorphine is also similar, although of much more recent discovery.

Among these substances, known as emetics, whose introduction into the blood-stream, by whatever route, provokes the state of nausea and vomiting, there may be classed nicotine. This classification seems logical because the disturbance brought about in the novice by the inhalation of tobacco smoke presents a striking resemblance to sea-sickness, and to the disease studied in this paper.

With regard to the vomiting succeeding an excitation of the nervous system, all sensory nerves do not seem to provoke this reflex with equal promptness.

Among the cranial nerves, more particularly among the nerves of special sense, the reflex is produced very easily, and in the following order of frequency: the nerves of smell, taste and sight; that is the olfactory nerves, the glosso-pharyngeal, the chorda tympani, and the optic.

Thus we speak commonly of nauseating odors, of nauseating flavors, and of nauseating spectacles; yet we never speak of nauseating sounds or noises. At the same time, it must be remembered that in the labyrinth of the internal ear, certain lesions of the auditory nerve may produce a combination of disturbances, the syndrome of Ménière, in which vertigo, the nauseous state and vomiting play a prominent part.

On the other hand the general sensory nerve such as the trigeminal and the peripheral branches of the spinal nerves, produce vomiting only exceptionally. The sharpest neuralgia, either facial or sciatic, or the most violent attack of gout is hardly ever accompanied by a nauseous state. However, a slight blow against the inner portion of the olecranon, on the ulnar nerve, may be enough to produce in addition to the ordinary feeling of pain, another special sensation of being "sick in the stomach."

The nerves which govern the obscure and complicated sensibility of the viscera, are very frequently the paths over which travel excitations towards vomiting. These are the centripetal fibres, which are very closely united and anastomosed partly to the vagus system, which supplies sensibility to the heart, the respiratory apparatus, and to a large part of the digestive tract; and partly to the great sympathetic system, whose domain covers all the viscera, from the pharynx to the pelvic organs.

From the pathological point of view, we know how frequently a more or less painful and often unconscious irritation of the mucous membrane of the pharynx, the stomach or the intestine, the passage of a stone through the biliary or urinary tracts, or the presence of a foreign body in the uterine cavity may be the basis for the production of this reflex.

From the physiological point of view, we know how frequently pregnancy, especially in its early stages, is accompanied by nausea and vomiting. This symptom, although it may be regarded as normal when it is moderate, can become under certain circumstances, by its persistency and intensity, one of the most serious complications of pregnancy.

Although this nauseous state of pregnancy constitutes an essentially physiological condition, seen daily among many young and healthy women, its mechanism is by no means clearly understood. Writers are not at all in agreement. While some believe the bulbar excitation is of nervous origin, produced by irritation of the sensory nerves in the uterus, others maintain it is of vascular origin, and is the result of a true chemical intoxication, not very clearly defined, the autointoxication of the gravid.

In concluding this short review of the anatomo-physiological data which furnish a comparison of the more common nauseous states, I will mention a phenomenon which it is important to bear in mind.

Every nauseous state, whether produced from the uterus, the stomach or elsewhere, manifests itself, among other symptoms, by an extraordinary hypersensibility of smell, so that the slightest bad odor, although only barely perceptible, may be enough to precipitate an attack of vomiting which up to that time had only been threatening. Under these conditions it is not rare that the patient, ignorant of the primary cause of his trouble, should attribute it to an odor, when the physician can only consider the latter as an accessory or secondary cause.

In seasickness particularly, the chief cause is the rocking of the body produced by the oscillations of the boat. Disagreeable odors—especially those from fish, and, since the invention of steamboats, those from the engines—only constitute an exciting cause in the production of the vomiting. In spite of its secondary character, however, among very nervous subjects this cause may assume such an importance that even when on terra firma an odor of sea-fish may be enough to evoke the first symptoms of sea-sickness.

Clinical Data.—The mere clinical observation of these patients will not by any means be sufficient to solve the causal problem. We will gain some very valuable information, however, if we set about making our observations precise and detailed—without any preconceived bias—noting with care the conditions inherent in the patient himself: age, sex, constitution, state of nutrition and strength, mental and physical states, functional conditions of the various organs, the disease treated, the region irradiated, the sensations experienced in the course of the treatment, the time of appearance of the first trouble, the character, evolution and duration of the symptoms, etc.; likewise the various extrinsic conditions, the choice and penetrative power of the therapeutic rays, the method of employment, the dose given, the duration and the time of repetition of treatments, et cetera.

First of all in the interpretation of these phenomena it is important to note the psychic factor, as Dr. Pfahler has justly remarked. I mentioned the action of this factor in those hypersensitive people to whom the smell of sea-food or even the sight of a boat was enough to start an attack of "sea-sickness." It also certainly played a part with the patient mentioned by Dr. Pfahler who could never smell the odor of an automobile without having the same disturbance as after a treatment. One may even speak of autosuggestion in regard to that other patient, described by the same observer, who had only to cross the threshold of his physician's office, in order to feel all the disagreeable disturbances in question.

Aside from this psychic feature, the only other important factor in the room where roentgen irradiations are taking place is the air, which is subjected to many complicated changes unnecessary for me to recount here. It is sufficient to state that these alterations are manifested by a complex odor, in which that of *ozone* predominates. Most of the patients treated notice and pick out this odor; many of them complain of it strongly; some even blame it for all the sickness they feel during or after the treatments.

It is to the action of this odor, or more exactly to the inhalation of the noxious gases which produce the odor, that Dr. Pfahler attributes the chief cause (he does not say the only cause) of the "penetrating-irradiations-sickness." His various publications on this subject bear out this idea.

This opinion of Dr. Pfahler, which is very important because of the just authority of the author, doubtless contains some truth, as is proved by the following observation: from the moment that he set out to assure himself of the purity of the air in his treatment room, even though this was only imperfectly done, the proportion of patients affected with a reaction —which previously had been one in four—dropped to one in ten.

In spite of this good result, and without in the least detracting from the practical value of the rules which he follows, it may be stated that in this sickness, just as with sea-sickness, the inhalation of a vitiated or bad smelling air serves only as a secondary or accessory cause. We must still look for the primary cause, the only one which really deserves to be so considered.

With perfect good faith, Dr. Pfahler has reported an observation which contradicts his own opinion. This was the case of a woman with a fibroid of the uterus, in whom all the treatments provoked reactions, with the exception of the one in which he interposed a lead screen to absorb all the rays, without changing any of the other conditions of the apparatus. It is true that this experiment was unique and incomplete. The interposition of the lead screen took place only when the patient was cured, and during her last treatment. It would be very important to repeat this experiment with other patients equally predisposed to penetrating-irradiations-sickness, frequently alternating a fictitious with a real treatment, without the patient's knowledge.

Dr. Jones has already properly objected that the roentgenotherapeutist, his assistants, and all those who are present as mere spectators of the treatments, remain free from the reactions which are produced in the patients by the direct irradiations.

To this irrefutable objection I may add that the physician and his assistants are able to inhale with impunity, daily and for many hours each day, those gases whose inhalation for only a few minutes, and at long intervals, is said to be so noxious for the irradiated patients.

I will conclude with what I believe to be the chief argument. In a woman who has an organic disease of the uterus, treated by the introduction into the cavity of the uterus of a metallic holder containing some salts of radium or other radioactive substances, we may observe exactly the same symptoms as with a woman subjected to the x-rays. This is decisive proof that it is not necessary to look for the true cause of the symptoms in the atmosphere of the treatment room, in the form of odor or of gas. They may be attributed solely to the penetrating irradiations themselves,. whether in the form of roentgen rays or in the form of the gamma rays of radium.

Thus I believe that the title of the present paper is justified. Since we know today that the roentgen rays and the gamma rays of radium are of the same nature, and in proportion to their penetrative power have practically the same properties, their only real difference consisting in an inequality of wave-length—therefore a type of action which is demonstrated to occur with one should also exist with the other.

Limiting myself here to a discussion of the roentgen rays: By what mechanism of action are they able to affect deep-seated organs so as to produce the state of nausea and vomiting? There appear to be two hypotheses. Either they irritate the periphery of the sensory nervous system, or they provoke the passage into the blood-stream of soluble substances endowed with emetic properties.

Let us examine the first hypothesis. From the physiological point of view, the x-rays would appear to be incapable of affecting the organs of special sense, since in the normal individual who is exposed to their action no sensation occurs that he is able to notice. However, this rule appears to have some exceptions; and I am led to suspect that such is the case when there is a pathological condition present, such as a neuritis of the peripheral nerves, which makes them hypersensitive. I have had the opportunity of observing two persons, one a maker of instruments and the other a physician, both of whom had a chronic radiodermatitis of the fingers, which presented obstinate ulcers, very sensitive to the least touch. Whenever these diseased fingers were in a field of radiation from an x-ray tube they immediately became the seat of a very disagreeable pricking sensation, together with a feeling of crawling, which disappeared with the interruption of the radiation. In addition, I have been told that among the large number of wounded soldiers who have had limbs amputated and whose stumps have been roentgenographed, certain of them complain, during the exposure, of disagreeable, and even of painful sensations in the region radiated. I believe that if any roentgenologist would seriously devote himself to a really scientific study of this problem, he would not fail to make many interesting discoveries.

In the course of treatments, the region exposed is not as a rule the seat of any sensation. This rule, however, has some exceptions. Of the very few cases of this sort that I have seen, the following is the most striking: I had a young woman patient, whose left breast had been removed on account of cancer. The disease had recurred, and the entire precordial region was covered with numerous nodules, some in the skin and some in the subcutaneous tissues, the latter adherent both to the skin and to the ribs and adjacent rib-cartilages. The patient, who lived in Switzerland, was treated there regularly. It was during her trips to Paris that I treated her four times in the course of thirteen months. She was reasonable, courageous, knew her disease, and was willing to do everything to help cure it. Yet she really feared the courses of treatment more than she desired them—for each treatment, whether in Paris or in Switzerland, led invariably to painful symptoms which resembled both angina pectoris and a febrile chill. A short time after the beginning of the treatment the precordial region, which had been irradiated, became the seat of a very painful sense of constriction, which soon spread into both upper limbs in the form of tingling. The patient meanwhile felt a general sensation of cold, and one could see her teeth chatter. The appearance was very much like that of a malarial chill, but there was no effect whatever on the temperature. All these phenomena gradually increased in intensity during the course of the treatment, which often had to be shortened or stopped when they became unbearable. The symptoms stopped almost at once after the irradiation.

This rare case shows without doubt that, under certain pathological conditions, the x-rays are capable of directly affecting the ganglionic sensory nervous system. Whether they affected the conducting nerves, or the nerve cells themselves, especially the ganglion cells of the cardiac plexus, is a question which I am unable to settle. In order to determine this problem, rather delicate animal experiments would be necessary.

In the case in question, the disturbances observed manifestly had their point of origin in a painful sensation localized in the region exposed to radiation. This condition, however, is not a necessary one. It is very possible for the x-rays to affect directly some plexus or ganglionic nervous system, deep down in the region exposed, without the patient having any sensation whatever. It is one of the properties of the nervous system to be endowed with acute sensibility, and very often, as pathology teaches us, a general disturbance such as the nauseous state, may be produced by a localized visceral irritation, of which the patient has no feeling and no knowledge.

In order that symptoms evoked by penetrating irradiations might be attributed legitimately to a direct impression upon the ganglionic nervous system, on the vagus or the sympathetic, it would be necessary for these symptoms to begin a short time after the commencement of the irradiation, and not last very long after it stopped. This was the case with the woman whom I reported above. On the other hand it is quite the contrary with the common observations where symptoms of nausea and vomiting, different from those in the patient above, appear only when the exposure is over, and even after a period of incubation, lasting several days, or even as long as several weeks. This would certainly not agree with the hypothesis of a direct action of the roentgen-rays on the nervous system.

We are now brought to the second hypothesis, that of the passage into the blood of certain soluble substances endowed with emetic properties.

Up to the present time no one has been able to find by chemical examination any foreign substances in the blood of patients exposed to deep radiations.

The contention of Dr. Lange that the trouble was due to an excess of acidity in the blood appears to have no confirmation, since the researches of Doctors Llewellyn Jones and Paul Roth, based on the study of carbonic acid in the expired air, showed that there was not the slightest sign of acidosis after courses of roentgenotherapy. They even found that in cases where some acidosis existed prior to the treatments, that the latter did not produce any increase.

Judging merely from the observation of the time of the appearance of the symptoms and the time of their termination, and noting the more or less degree of delay in their starting as compared with the end of the session of treatment, one is forced to believe that the radiation has provoked the formation of emetic substances, whose passage into the blood is not instantaneous but gradual, and whose elimination by the renal filter requires a certain length of time.

This hypothesis appears more probable when we observe the coincidence of the symptoms in question with the diminution in size of the lesions radiated. This is particularly the case in the various neoplasms, such as lymphadenomas, enlarged leukemic spleens, or uterine fibroids.

The hypothesis seems supported by the relation that exists between the duration of the period of incubation that precedes the trouble, and the degree of rapidity with which the radiated tumor begins to regress. Two cases that I have observed will help to make this point clear.

The first case was that of a little girl, seven years old, with Hodgkin's disease. The entire course of her disease from its beginning to the fatal termination was twenty-three months. It was only in the eleventh month that she was first treated by roentgenotherapy, at which time the lymph-nodes of the neck, axillæ, groins and mediastinum were considerably enlarged, and there was also an enlarged spleen. She was a remarkably bright child, with a mind well in advance of her age. She never made the least complaint or said that she felt in any way uncomfortable during the treatments, which took place as a rule in the early afternoon. Yet several hours later in the evening she would be attacked almost invariably by nausea and vomiting, which was often repeated the following morning when she woke up.

One point to notice was that the vomiting took place several times when only the cervical lymph-nodes had been exposed. This is in contradiction to the opinion of Doctors Jones and Roth, who observed that in radiated patients, especially in cases of Hodgkin's disease, nausea and vomiting took place only after abdominal exposures, and were not seen after exposures of other regions of the body.

Another important fact was the rapidity with which the exposed nodes diminished in size, under the influence of the treatment. With the glands of the neck, this diminution was noticeable on the second day after the very first treatment.

The second patient was a woman of fifty years of age. I treated her for a fibroid of the uterus with metrorrhagia, according to my usual method, which consists of exposures at seven-day intervals for about twelve to fourteen consecutive weeks. During the first few weeks of her treatment, the exposures did not produce any reaction. Later, however, every course of treatment was followed regularly by a constant chain of symptoms. The treatments were given on Friday afternoon. During the exposure nothing was felt, and the next day the patient also felt well. Forty-eight hours later, on Sunday, she would begin to feel a general malaise, lose her appetite, and complain of headache and nausea. These symptoms would gradually increase in intensity, reaching their height on Monday, three days after the treatment. They would then disappear on Tuesday. To describe her illness, the patient was fond of using the following phrase: "A sea-sickness which did not come to a head."

It is well to recall here that under the influence of roentgenotherapy a fibroid of the uterus does not diminish in size as rapidly as do the enlarged lymph-nodes in Hodgkin's disease. When the fibromatous uterus can be palpated through the abdominal wall, and the distance of its upper pole from the symphysis can be measured, it is found in the favorable cases that this level is lowered at the rate of about one centimeter each week.

The two cases quoted above bring out the relation between the degree of rapidity of regression of the neoplastic tissues and the length of duration of the incubation period preceding the nauseous state. This connection is especially apparent when the doses used are not very large. I believe that the reason I have had an opportunity of observing this relation is because I hardly ever employ the so-called "intensive" roentgenotherapy. It is clear that with an increased dosage, and a consequently more extensive and more rapid destruction of the cellular elements of the neoplasm, the period of incubation would tend to shorten and finally disappear. At the same time the symptoms would become more severe.

This is what we are observing as the result of the improvement in our apparatus —especially since the introduction of the Coolidge tubes, which permit us to use much more penetrating rays, in greater amounts, and with thicker metallic filters, so that the deep organs can receive a much greater amount of radiation without injury to the skin.

At the same time we must remember that in the uterine walls, and in the lymph nodes, it is not merely the diseased cellular elements which are exposed to the destructive action of the x-rays. The latter affect also certain of the normal cellular elements, especially the lymphocytes of the blood and the lymphoid tissues. It has been known for a long time that these are especially vulnerable to the rays, and very rapidly destroyed.

From the study of the clinical data, therefore, it would appear that the chief cause of the disturbances which may follow deep radiations is the passage into the blood stream of certain soluble substances, more or less toxic, resulting from the disintegration of normal and pathological cellular elements. To this must be added, in a small proportion of the cases, the direct effects of the penetrating rays upon the ganglionic nervous system of the viscera.

Experimental Data.—The careful observation of sick people treated by roentgenotherapy constitutes in itself a true experimentation, and probably the most instructive sort. It is a fact that up to now animal experimentation has offered very little towards the solution of our problem, but this may perhaps be because it is too much to expect a guinea-pig in healthy condition to solve the secrets of human pathology. It would be preferable to pick as subjects for experimentation animals who are diseased, and are affected with conditions justifying roentgenotherapy. Leukemia, cancer, sarcoma, and many other diseases are common among various animal species, as well as human beings. It might be advantageous for example to experiment on dogs with malignant tumors.

Still, experiments on healthy animals, such as those performed by Dr. Pfahler, have their value when repeated on a large number of subjects. I might mention one that it would be very useful to try. From the heart there go out certain centripetal nerves, the depressor nerves of Ludwig and Cyon. These are blended with the vagus in the dog, but are separate in the rabbit, the cat, the horse and the tortoise. The excitation of the central end of these nerves causes a fall in arterial pressure, and a slowing of the heart-beat. It would be interesting to attempt to expose these nerves to the action of x-rays. With this type of research we might be able to solve the problem of whether the ganglionic nervous system is affected directly by the rays during exposure. There would also be an advantage in studying, on animals heavier and more resistant than mice or guinea-pigs, the effects of leucocytic destruction by deep radiations.

Conclusions.—The "penetrating-irradiations-sickness," produced by either the x-rays or the gamma rays of radium, is caused chiefly by the adulteration of the blood with toxic substances, resulting from the disintegration of the pathological or normal cellular elements destroyed by these radiations.

The inhalation of a vitiated atmosphere and bad odors play only a secondary rôle in the production of the symptoms, but still at times may be important. From a practical point of view, precautions for assuring the purity of the air in the treatment room may be desirable, but they will not prevent the disturbances.

In spite of all precautions, it can be predicted that with the widespread use of Coolidge tubes, we shall see the number and intensity of these accidents increase.

The intenser radiation and greater penetration of these admirable tubes, together with much thicker metallic filters, allow us to deliver much stronger doses in the depths of the tissues, and produce a much more rapid and more massive cellular destruction.

Since, at present, by means of the Coolidge tubes we can obtain roentgen rays which are at least as penetrating as the lesser penetrating gamma rays of radium, there is no reason, theoretically, why the power of their penetration cannot be very considerably increased as time goes on.

Intensive roentgenotherapy, the technique of which is far from perfection at present, is certainly destined to produce a therapeutic revolution. It will not only enable us to reach more rapidly the results to which we have been accustomed, but also to obtain results that we have up to now never hoped for.

However, it is important to consider whether one ought to employ intensive roentgenotherapy in all cases without exception.

It appears to me that the best method of avoiding the "penetrating-irradiations-sickness" (or, at least of restricting its effects) would be to limit the use of intensive roentgenotherapy to those cases where the nature and the course of the disease treated were such as to demand the most rapid type of treatment. In most of the other cases a milder and less rapid treatment would be preferable.

An analogy may perhaps make my point clearer. In the course of syphilitic disease, if cerebral complications should menace the life of the patient, or if ocular disturbance should menace his sight, it is necessary to use as intensive a treatment as possible. If the treatment is to be mercurial, the fear of a stomatitis should not halt the physician. On the other hand, if the lesions are milder, such as those of merely the skin or mucous membranes, then the treatment should be modified so as to avoid this disagreeable complication.

THE NEW BASIS FOR RADIOTHERAPY

WEIL states that our knowledge of the roentgen rays and how to manage them has been much increased lately, broadening their sphere of therapeutic action while augmenting their efficacy and their harmlessness. Benoist, for instance, has established that the specific opacity of simple bodies is a determined function and generally increases with their atomic weight. Certain substances, the radiochroic substances, sift out the rays, and the rays with short waves are the ones for therapeutic use, as they have the elective biochemical action.

Another law he cites is that the therapeutic action on the living cell is due chiefly to the secondary rays which the roentgen rays generate in the tissues; it is not due to the dose absorbed. The susceptibility to the roentgen rays is greatest in tissues whose reproductive power is greatest, whose karyokinetic future is longest, the reproductive power greatest, whose morphology and functions are the least definitely established. Weil concludes his review with the remark that many persons judge radiotherapy by the results they obtained with it during the early years of the use of the roentgen rays. They forget that the radiotherapy of today differs from that of yesterday as fundamentally as the surgery of the day differs from that of the era before Pasteur. (*Paris méd.*, Jan. 12, 1918, VIII, No. 2, p. 33.)

OSTEOMALACIA

ITS ROENTGENOGRAPHIC APPEARANCE AND CLASSIFICATION

BY GEORGE W. HOLMES, M.D.

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OSTEOMALACIA is a comparatively rare disease. There are only four cases in the records of the Massachusetts General Hospital; and only a comparatively small number have been reported in the literature. The disease is particularly rare in this country, but more common in the Rhine Valley and in Northern Italy.

I should not feel justified in taking your valuable time to present this subject to you if it were not for the fact that osteomalacia is occasionally confused with primary malignant tumors of the bone and that the differential diagnosis is a matter of considerable difficulty.

In the past two years I have seen two cases in adults and on both occasions failed to make a correct diagnosis. The diagnosis may depend largely upon the roentgenographic interpretation and if based on an incorrect one, the treatment may be radical. The importance of keeping this disease in mind has been impressed upon me, through my failures; and it is with these cases in mind that I bring the subject to your attention.

FIG. 1. THE HYPOPLASTIC TYPE OF OSTEOMALACIA —IN CHILDHOOD DIAGNOSED AS OSTEOGENESIS IMPERFECTA.

There is a fracture of the femur, also one of the fibula.

A review of the literature gives one very little help regarding the x-ray findings. The only article I was able to find (which contained illustrations) was one by Osgood, Painter and Goldthwaite. Nearly all writers fail to mention the x-ray findings or describe them incompletely; and the subject is confused, in roentgenographic and in clinical literature, with osteogenesis imperfecta, achrondroplasia, fragilitus ossium, rickets and Paget's disease.

The pathological literature, however, is very complete. Von Recklinghausen, in his excellent work on the subject, has given us a classification based upon the pathological appearance of the disease in which he includes under the heading "osteomalacia," Paget's disease and rickets, as well as osteogenesis imperfecta and its allied conditions.

By the use of the prefixes hypo-, hyper-, myelo-, et cetera, he is able to describe the various types of malacia. This seems to me to be a very satisfactory way of avoiding confusion. The term osteomalacia, as generally applied, means a disease of the bones characterized by softening of the long bone, with loss of the earthy constituents, occurring in adults. This, in fact, is Gould's definition. It is, however, often applied to a similar process in the bones of children, in which there is hyperplasia and deformity as well as softening and loss of lime salts.

McCollum in his book on "Pathology" describes osteomalacia as being a disease in adults which resembles very closely that of rickets in childhood. From the point of view of the roentgenologist there are two distinct types of this disease, both of which occur in childhood as well as in adult life, and hyper- and hypoplastic malacia.

In adults, the hypoplastic form is seen more often in the female and is likely to occur during, or shortly after, pregnancy. The complaint which brings the patient to the roentgenologist is usually that of fracture. There is an absence of sufficient trauma. The bone presents an indistinct, hazy appearance, with lack of contrast between it and the soft tissues. The medullary cavity is increased and the cortex thinned. Often there will be present periosteal changes or callous formation which gives the appearance of the proliferation seen in periosteal sarcoma.

The bone most commonly involved is the femur. In fact, some authors state that the process is always below the belt line.

Fig. 2. The Hypoplastic Type of Osteomalacia in Adults.

Fracture has occurred and there is considerable callous formation present. The diagnosis in this case was based on the pathological report.

The lesion may be single but is usually multiple. It affects the shaft of the long bones, the bones of the pelvis and spine, but does not involve the joints. The general appearance in the cases which I have had an opportunity to observe has been that of osteomyelitis. In fact, that is the interpretation usually given.

Fig. 3. Lateral View of Fig 2.

The clinician will then inform you that the patient has no temperature or white count, and one is then apt to fall back on a diagnosis of syphilis, only to be told that there is no syphilitic history and that the Wassermann is negative.

At this time he should think of osteomalacia and should examine the other bones of the pelvis and lower extremities however much he is inclined to believe that he is dealing with a medullary sarcoma through which there has been a fracture.

The differential diagnosis from a single plate after fracture has occurred is extremely difficult; but the finding of similar changes in other bones would help. The great extent of the lesion in a single bone, without thickening or localized destruction of the cortex, is also evidence against malignancy.

The following is a report of one case which I had the opportunity to observe and which was carefully studied at the Massachusetts General Hospital:

Patient.—American (female), age 39 years; white, single; born in Massachusetts. Referred to the hospital for fracture of the femur.

Family and Previous History.—Family history negative. Typhoid, "jaundice and pneumonia" when patient was between twelve and sixteen.

Present Illness.—Eight days before admission to the hospital, while walking across the room, the patient felt sudden pain in the left thigh. Her leg gave way and she fell to the floor. She was removed to a nearby hospital where she was kept on light extension until today, when she was brought into this hospital. Previous to the injury she had complained of neuritis in the left thigh.

Fig. 4. Hyperplastic Type of Osteomalacia—in Childhood sometimes Diagnosed Osteogenesis Imperfecta.

Note the coarse trabeculation in the shaft of the femur.

Physical Examination.—Patient was rather stout with normal skin and mucous membranes. The pupils reacted normally to light. Chest and abdomen were negative. The reflexes were normal. The left leg showed deformity and tenderness in the upper thigh but no crepitus was made out.

Fig. 5. Plate Taken of the Femur after Amputation.

It shows the structure of the bone in more detail.

The patient was examined by the x-ray on April 14th, and a report of a definite pathological process with fracture involving the middle third of the femur (probably periosteal sarcoma) was made. A re-examination on April 17th confirmed the previous findings. The note stated that in the absence of previous injuries this was probably periosteal sarcoma.

A Wassermann which was negative was reported on April 18th. On the 20th, an x-ray examination of the lungs for a question of metastasis was negative.

The patient was seen in consultation by

three different surgeons and one syphilographer. All three surgeons advised amputation based on a probable diagnosis of malignancy.

The expert in syphilis stated that he saw no evidence of this disease in the patient. Her temperature before operation was slightly irregular, varying from normal to 101°. The pulse also varied from 80° to 100°. The urine was of rather high specific gravity and alkaline. The white count was 34,000.

On April 27th, the patient was operated upon and the leg amputated at the hip. She made an uneventful recovery from the operation and a note made one year later stated that she was feeling fine, had secured an artificial limb and that the stump was completely healed.

The following is a copy of the pathological report based on the surgical specimen:

"The leg was amputated in the upper part of the femur. At the middle there is a comminuted fracture, the ends of the bone roughened and irregular; the tissue about infiltrated with blood and fibrous bands of tissue between the bundles of muscular fiber. Periosteum is thickened and can be stripped off from the bone, leaving a granular surface. The medullary cavity was filled with rather dark marrow. Walls of the bone not materially thinned except at the point of fracture.

"Microscopical examination of muscle showed round cell infiltration with formation of fibrous tissue and atrophy of the muscular fibers. In one of the large vessels was a soft white thrombus adherent to the wall on microscopical examination, showing it to be composed of blood and fibrin. Section of the bone at the site of fracture showed the trebeculæ rather thin and medullary spaces filled with rather a fibrous tissue in places with considerable round cell infiltration. In one area there were numerous large multinucleated bodies suggesting osteoclasts. From the study of the preparations up to the present time, differential diagnosis seems to be between an inflammatory process and one of the trophic disturbances. There is no indication of a new growth. 16,4-139."

I saw the other case only in consultation and I shall not report it in detail, as the findings were not complete.

After a review of the literature and study of all the plates I was able to obtain on cases of osteogenesis imperfecta, fragilitus

Fig. 6. Case Diagnosed Clinically as Osteomalacia.

Its appearance is atypical. There is proliferation as well as destruction of bone taking place. The destructive process apparently predominates.

ossium, osteomalacia and Paget's disease, I feel that there are two distinct types of the disease—a hyperplastic and a hypoplastic with various gradations between—and that it may occur either in adults or in children.

It seems to me that these cases could be grouped together roentgenographically even more easily than pathologically, classing them all osteomalacia as von Recklinghausen has done.

In the hypoplastic group in children are the cases generally classed as osteogenesis imperfecta or fragilitus ossium. In these cases there is loss of lime salts and thinning of the cortex which produces a diminution in density. The trabeculæ remain normal. Change in the size or shape of the bones does not occur unless fractures are present. A large number of these cases do show multiple fractures with deformity and more or less callous formation.

In the hyperplastic group are the cases occurring in infants and early childhood sometimes diagnosed as osteogenesis imperfecta and sometimes as osteomalacia. These cases show both destruction and proliferation of the bone and the trabeculæ are irregular. There is a diminution of lime salts and an increase in the fibrous tissue.

The long bones are widened, particularly at the diaphysis, and there is extreme bowing and deformity. The pelvis and spine are also deformed. The picture re-

Fig 7. Case Diagnosed Clinically as Osteomalacia.

The radiographic appearance suggests the condition usually diagnosed as osteogenesis imperfecta. It can be classed as hypoplastic malacia.

Fig. 8. Paget's Disease. The Hyperplastic Type of Osteomalacia in Adults.

sembles rickets but does not show the characteristic changes along the epiphyseal line. Fractures are less common in this type.

The hypoplastic type in adults (commonly called osteomalacia) may be localized or general. There is thinning of the cortex and absorption of lime salts without proliferative changes or deformity.

In the hyperplastic type in adults multiple fractures are not common. We have proliferation and lying-down of the new bone along with the destructive process.

The trabeculæ are coarse and irregular. The bones are large, bowed and deformed —the picture seen in typical cases of Paget's disease.

Of course, there are cases which fall between these groups; but usually one or the other forms will predominate and the class can be readily grouped. At any rate, it would avoid the use of definite names for diseases which overlap and run into one another and it gives the roentgenologist a definite pathological basis upon which to base his interpretations. The differential diagnosis in children is from rickets and achondroplasia, both of which conditions show their greatest activity along the epiphyseal line and in the epiphysis, whereas osteomalacia is a disease of the shaft as well.

In adults, the differentiation is from primary and metastatic malignant diseases, syphilis and osteomyelitis. The wide extent of the local lesion or the presence of multiple lesions will usually differentiate it from primary malignancy. Differentiation from metastatic malignancy (carcinomatosis) is more difficult.

The local lesion is apt to be more extensive and the bones of the upper extremities and skull are less often involved.

Syphilis, when general in the bones, is usually periosteal in type, whereas osteomalacia is a disease of the cortex and medullary portion of the bone.

In differentiating Paget's disease from syphilis, I have found the absence of involvement of the epiphysis in syphilis and early involvement in Paget's disease of definite help.

Osteomyelitis, while usually a localized process, may involve several bones. Periosteal changes are the rule, while they are generally absent in osteomalacia.

Clinically, cases of adult osteomalacia may have a rise in temperature and an increased white count; but they do not present these findings to any such degree as osteomyelitis. In the hypoplastic type the amount of lime salts in the urine is increased.

The prognosis as far as cure is concerned is bad. Some cases of the adult hypoplastic type have been benefited by castration. Roentgen therapy directed to the ovaries should be considered.

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ECHINOCOCCUS DISEASE OF THE LUNGS

BY LLOYD B. CROW, M.D.

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ECHINOCOCCUS disease of the lungs is sporadic throughout the world, but it is not commonly encountered outside of Iceland, where it seems to be quite prevalent, and in certain parts of Austria, Australia, Italy, Germany and the Argentina. It is interesting to note that the echinococcus may attack any organ of the body, but appears to have a special predilection for the liver, occurring in that organ in about forty to seventy per cent of cases.[1] The echinococcus does not show the same partiality for the lungs; compiled reports showing them to be the seat of the disease in only about twelve per cent of the authentic cases known at the present writing. Somewhere near two per cent occur in the kidneys, and the rest of the organs of the body are indifferently attacked by the parasite.

An echinococcus cyst of the lung shows in the radiograms as a distended bladder, casting a fairly dense shadow and occupying a central position in the lung tissue, ranging in size from five to twelve centimeters in diameter. Ordinarily only one cyst is seen in the lung field, though there may be a juxtaposition of several on both sides of the chest.

The work of Paul Krause admirably shows the difference in degree of absorption of the x-rays by cystic fluid and ordinary pus. It would appear from his deductions that the fluid of a hydatid cyst does not possess any great power of absorbing x-rays. After the cyst has become infected, and pus has formed within the cavity, gas generates and is seen in the fluoroscopic screen, or in the radiogram, as a dark ring. The conclusions of Krause were obtained by taking several cysts and filling them respectively with cystic fluid and pus. These were placed in artificially distended lungs and their relative powers of absorption obtained.

In the dark ages of medicine and even of later years, the diagnosis of echinococcus cyst of the lung was made by watching the patient until a vomica would burst into a bronchus, and the resulting expectoration of the daughter cyst had clearly defined the nature of the malady. We were rather surprised to read in a number of the "Bulletins et mémoires de la société médicale des hôpitaux de Paris" of a case reported by Ramond which was allowed to go two years before the characteristic expectoration occurred with its diagnostic detritus. Radioscopy unfortunately was only utilized after the cyst had ruptured. Today the diagnosis of echinococcus cyst has fortunately been placed on a more scientific basis and, we believe, a more gratifying one to the patient. There are three chief factors on which the diagnosis may be based: first, the x-ray examination; second, the eosinophilia; third, the Bordet-Gengou fixation of the complement, or what is otherwise known as the Weinberg Parvu test for determining the presence of an echinococcus infection. The second and third are of no great value as they are not constant.

We were quite astonished, in reviewing the literature of echinococcus disease of the lungs, to note how well the early roentgenologists were orientated on this subject and we deem the following incident worthy of insertion in our publication. In 1900 P. Helpeln reported a case of aortic aneurysm to the medical society of Riga. Now it appears that a roentgenologist named Sengbuch, just one year prior to this, had seen the case and proclaimed it an echinococcus cyst of the lungs from the roentgen findings although he was positive that he could

[1] Charles Bles, (Amsterdam). Fortschr. a. d. Geb. d. Röntgenstrahlen, Hamb.

feel a thrill over the chest. In 1912 P. Helpeln reports the same case in the *Berliner klinische Wochenschrift* as an echinococcus cyst of the lung.

The history of our case is quite interesting as will be seen in the following brief anamnesis. A young man, thirty years of age, a native of Spain and by occupation a farmer, came to us in the early part of

Fig. 1. Roentgenogram Taken in the Anteroposterior Position.

November 1917. He stated that his present trouble began five years ago by sharp intermittent pains striking him in the upper part of the back about the shoulder blades. At first these pains were of no consequence but after a few months they materially hindered him in his work. Some six months later he began to complain of gastric distress and the usual signs of indigestion. It appears that a few minutes after eating the patient experienced a sensation of fullness in the epigastrium associated with eructations of gas. After a time these distressing symptoms disappeared and left him with a sensation of nausea. A very interesting factor in the history at this period of his illness, was that walking or standing relieved this temporary indisposition on the part of the digestive apparatus. In the latter part of his illness the patient began to experience pains in the back during the late sleeping hours of the night and suffered from insomnia. Eating did not relieve the stomach distress nor did the pains appear at any special time after eating.

Past History.—Patient had typhoid at age of 14; malaria ten years ago; and has had many subsequent attacks since.

Family History.—Negative.

Habits.—Does not use alcohol. Is very fond of dogs.

Physical Examination.—Physical examination was negative and the patient was referred to the *x*-ray laboratory for a gastro-intestinal examination.

Roentgenological Examination.—Viewed in the anteroposterior position the cyst was visualized quite plainly in the fluoroscopic screen occupying a position in the inferior portion of the chest cavity some two centimeters above the diaphragm.

Fig. 2. Roentgenogram Taken in the Posteroanterior Position.

The lateral diameter of the cyst was computed to measure about twelve centimeters and the vertical about ten centimeters. Stereoscopic plates were taken and from these we advanced the opinion that the cyst was connected to the mediastinum. Suggestion was made that the cyst be punctured under guidance of the fluoroscopic screen, but we advised against this procedure as we were afraid of producing an anaphylactic shock and endangering the life of the patient. Miraillie collected forty-three cases in which simple puncture was performed with two cures, twenty-two deaths, and ten negative results. According to Dieulafoy there is only one procedure to follow in these cases and that is pneumotomy. A cure is obtained in about ninety per cent of operations.

Operation.—On November 19, 1917, the patient was given a nitrous oxide anesthetic and the operation performed as follows: a lateral skin incision was made along the right border of the sternum extending from the upper border of the third rib to the lower border of the fifth rib. Very small incisions were made over the third, fourth and fifth ribs in the mammary line. The incision was carried along the upper border of the third rib to the parasternal line and likewise the incision was made from the mammary line along the fifth rib to the sternum. The ribs were next fractured in the mammary line and the cartilages cut along the border of the sternum. When the incision was complete, the square flap thus formed measured about twelve centimeters. The intervening soft parts were now cut and using the external border of the flap as a hinge, an attempt was made to lift it. In making this attempt the pleura was torn with the resulting collapse of the right lung. After the flap had been laid to one side a good exposure of the collapsed lung was obtained and imbedded in its tissue was seen the white glistening mother-of-pearl-like surface of the cyst. The cyst was attached to pericardium and the pleura.

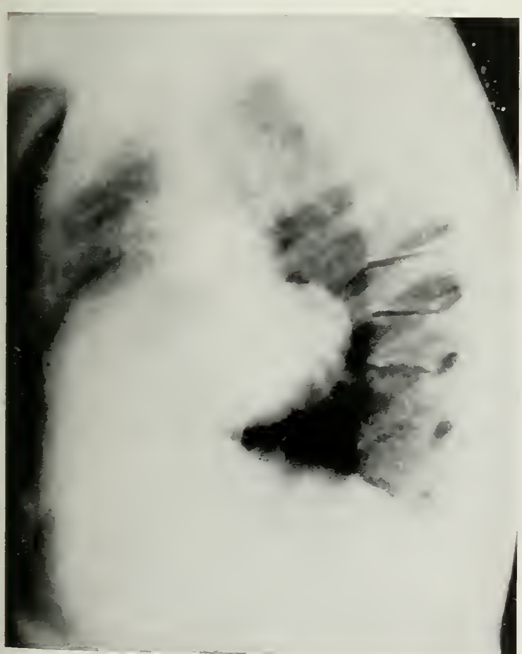

FIG. 3. ROENTGENOGRAM TAKEN IN THE LATERAL POSITION.

FIG. 4. PHOTOGRAPH OF CYST AFTER REMOVAL.

The inner layer of the cyst was dissected away from the outer fibrous layer and when free, lifted through the opening where it unfortunately burst and allowed the contents to spill in the chest cavity. The cavity was well sponged, and after thorough cleaning, an attempt was made to remove some of the outer fibrous layer, but in this we were compelled to desist as the slightest traction on the lung caused immediate cessation of respiration. The cavity was packed with gauze dipped in a ten per cent formol glycerine solution, enough of the gauze being left to give adequate drainage. The flap was stitched in place with silkworm gut and the incision closed. The patient was transported to his bed in a very low condition. During the first forty-eight hours the patient remained in a state of shock bordering total collapse. On the 18th, three days after the operation, the temperature rose to 102, pulse 140, and respiration 46 to the minute. A profuse expectoration of brown muco-purulent pus, accompanied by severe attacks of coughing, occurred at this time.

On the 2nd day of November the condition of the patient was very bad. He was cyanosed and at the same time quite delirious. Another alarming condition which annoyed us greatly was the sucking in of material through the opening of the flap. This we combated by taking a large rubber dam such as dentists use and spreading it over the opening into the chest. The sides were held down by adhesive plaster and bandages. One side was allowed to remain open so as to allow air to escape during expiration. After a few days the lung began to expand and resume its normal function.

For two weeks the patient ran a septic temperature but gradually his condition improved to such an extent that he was able to sit up and take nourishment. On December the cough had subsided and he was practically without fever during the day having only a slight rise in the evening.

By the first of January his condition was very gratifying to us as he had gained 20 pounds and we contemplated allowing him to leave the hospital in a few days. Much to our chagrin, the patient was taken with a fit of coughing and expectorated a large quantity of muco-purulent material. There was a return of the fever with an occasional night sweat.

At the present time the patient has recovered and will soon leave the hospital as cured.

My acknowledgment to Doctor Mario Isnardi for the case referred and the clinical data furnished.

PRESIDENT'S ANNUAL ADDRESS*

BY WILLIS F. MANGES, M.D.

Lt.-Col., M. C., U. S. A., President.

GENTLEMEN OF THE AMERICAN ROENTGEN RAY SOCIETY, AND OUR GUESTS: We are here to open a new page in the history of our Society. We hope that it will be one worth writing and one worth remembering. I have the unusual honor to preside at a military medical training camp—the first time that any medical society (that is, outside of the military organization) has met on such ground. This has been made possible and desirable largely because of the farsightedness and broadmindedness of our Commandant. For it was he who, while still in the Surgeon General's Office, decided that the best place to teach roentgenology to military men was at a military training camp; that the preliminary training at least should be given under such conditions.

We are ready to present to you for inspection and consideration the efforts put forth by those who have been here to take charge of the teaching of roentgenology. The results you will see are not due to any personal ability in the way of organizing or administering, but rather to the coöperation of the Commandant and his entire staff on the one hand, and the hearty support of the Surgeon General, through the X-ray Division, on the other hand. Ample space and equipment have been obtained with the least possible delay. Every assistance has been given in the matter of selection of officers for the course of instruction, and we believe this has been better accomplished here than it could have been done elsewhere. There have been times when we could not obtain as many student officers as were desired in the school, but this was for the reason that officers were not available.

There are many reasons why this is an ideal place for such a school. In the first place, the military atmosphere, so to speak, keeps a man at his best physically and mentally, and also more in the spirit of the purpose for which he is training.

Here there are always men who are doing their utmost to advance and become leaders. It is this sort of example that makes every other man apply himself seriously.

This school organization is only a small part of the great training camp, but it is the more positively an organization since it is a working part of a perfectly organized plan, commanded by an officer of great ability and wide experience.

The end results of any organization are directly dependent upon the coöperation that exists within the personnel of the organization; in this case among the instructors and assistant instructors as well as the students. We can assure you that in the Camp Greenleaf School of Roentgenology this spirit of coöperation is of the highest type.

The instructors have been selected because of their special fitness in the various subjects of the course, and they, in turn, have selected their assistants on the same basis. Each department has its own duties and responsibilities, and the instructor at the head sees to it that the work of his department is well done. The work of all is so correlated as to give the student officers the best foundation and preparation for the work they are called upon to do in the service. Little attention is paid to subjects that have no special bearing on the needs of the occasion.

The student officers on their part have always manifested a marked enthusiasm in their efforts to learn what is required of them, and we have been more than pleased with the results as shown by practical demonstration as well as by means of examinations held each week.

*Nineteenth Annual Meeting, American Roentgen Ray Society, September, 1918.

We would like to tell you more about the various phases of development of the school, but time will not permit. Then, too, it is more fitting that the history of this development should be recorded at a later time, for the process of development has not ceased. Even now we are contemplating extensive additions in order that the school may have a much greater capacity.

We believe that this school will have a far reaching and important influence in the future. For not only have we made roentgenologists, but we have been called upon also to instruct the medical officers of the various other specialties as to the manner in which they can make the best use of the roentgenologist.

Always we have made the plea for co-operation, and have done everything possible to maintain high ideals. In short, we are here among a large number of special schools all working for the same purpose—to make our medical officers more competent to care for those wounded in battle. There could be no more fitting place for such work than in this large camp, where order, discipline, enthusiasm and a great spirit of loyalty exist.

This meeting will add materially to our efforts here, and we are certain that you will all be glad to have come and to have given this help. We owe this privilege to the Commandant of this great camp, Colonel* Munson, whom I now have the honor to present to you.

ADDRESS OF WELCOME

BY BRIGADIER-GENERAL MUNSON

Commandant of Camp Greenleaf

CHICKAMAUGA PARK, GA.

Gentlemen of the American Roentgen Ray Society: Camp Greenleaf extends to you its most cordial welcome and hopes that your exercises here will be of the greatest profit. You are present on historic ground—historic ground for the achievements of the past, and future historic ground for present achievements—for we are making history here and not the least of the factors is the history in *x*-ray work which your Society is creating. Camp Greenleaf is the proper place for your meeting; for Camp Greenleaf is now the great medical center of America. It is at the present time the medical university of the profession of this country. There are here at the present time some 2700 officers of the Medical Department. That number is constantly increasing. A few days ago two hundred came in in a single day. There have matriculated at this University up to the present time, nearly 9000 officers, and as time goes on we hope and believe that the profession of America which passes into military service will largely, if not wholly, pass through this place.

You have here more than a selected personnel available for your further selection—you have here the facilities and the esprit which go with a great institution of this sort. How great an institution it is I may intimate by saying that we have at the present time fourteen different professional schools, which have approximately 500 student officers, about 150 of whom are matriculants who have not yet passed in the professional courses because they are taking the military course as a preliminary step.

The military work which precedes your *x*-ray course is the fundamental thing of the whole scheme. You are being transformed from civilian doctors, experts in

* Promoted to Brigadier-General after this address was delivered.

your line, into medical officers, experts in still broader lines, and made conversant with the difficulties of medical practice under the requirements of military service which must modify all your ideas, all your opportunities—perhaps even all your facilities. You must do things not the way, perhaps, that you would wish, but the way the military situation demands, for the military situation is paramount.

The number of medical officers who will come here in the future for training will, as I say, steadily increase. You have at the present time one of the most flourishing schools. In round numbers there are 58 officers matriculated and half a dozen or more taking the basic course, awaiting their opportunity. With these officers are being trained approximately two enlisted men to each officer with the view of assisting the officer, and taking much of the routine mechanics of your specialty off the hands of the medical officer to relieve him for other and higher duty. I believe this training of enlisted men, this training of assistants to the roentgen-ray officers, is by no means a small thing, even though a smaller part of your function.

In this work, at this medical university at Camp Greenleaf, the greatest medical university in America, gentlemen, the roentgen-ray school is serving all departments. Not only every branch of the division of surgery and the division of medicine, but even the dental division, comes under your purview and asks for your assistance. That assistance has been given most freely and most efficiently. The work here is one of team-work. No place like this is a one man's job. It represents efficiency, and that efficiency depends upon coördination; coordination depends upon willingness, zeal, endeavor, and ability; and these, gentlemen, we are cultivating in everybody here, in all the branches of the camp.

Now with regard to your own roentgen-ray school. We conceive here that we have, perhaps, the best roentgen-ray school in America, if not in the world. We conceive that we have here the best that the Roentgen Ray Society of America offers in the way of instructors; that it stands back of the school and that it guarantees its products; and we conceive that the certificate of graduation of this school at Camp Greenleaf is the highest evidence of professional efficiency in roentgen-ray work that can be given in the United States.

Now, gentlemen, this roentgen-ray work, this roentgen-ray school, is largely in the care of one man, and that man is the President of your Society. You claim him as a scientist. We perhaps know him not only as a scientist, but better as a soldier; for he has well demonstrated these qualities—the dual qualities of the soldier and scientist—in a most eminent degree.

Now, gentlemen, we extend to you, with the greatest of pleasure, all the facilities of Camp Greenleaf. This, we understand, is a business meeting, and not a meeting for entertainment. We have opportunities here not only for work and development in roentgen-ray work, but in food for thought and reflection in very many phases of the medical military work. You could with profit put in a week and not see it all. I have not seen it in all its full details yet. There are various training branches of greatest importance, and the magnitude of it all will be understood when I say that by the end of the week this camp will have approximated a strength of probably over 30,000 officers and men. Each part of the camp has its own particular purpose; for we are covering here every one of the organizations that the Medical Department has; and it probably has more organized formations than any other branch of the military service. Here we are trying to produce them all; and because of the efficiency of Major* Manges and the other chiefs, we think we are producing them creditably. So Camp Greenleaf welcomes you, and places at your disposal everything that it has.

*Promoted to Lieutenant-Colonel since this meeting was held.

ANNUAL REPORT OF ROENTGEN RAY DEPARTMENT ARMY MEDICAL SCHOOL, WASHINGTON, D. C., 1917-1918*

HOWARD E. ASHBURY, M.D.

Major, M. C., U. S. Army

THE Army Medical School is in close affiliation with the Surgeon General's Office and it is here that medical officers are trained for the Regular Army. In the Physical Examination Department, thousands of applicants for commissions in the Army are examined monthly.

The Commandant, Brigadier-General William H. Arthur, is Professor of Military Surgery, and President of the Faculty and the Medical Board of the School.

In addition to exercising its own peculiar function as a training school for officers the School laboratories are called upon by the Surgeon General's Office to carry out special investigations and report upon new methods for adoption by the Army.

The bacteriological, vaccine, chemical, and *x*-ray laboratories play important parts in this work. This is especially true of the Vaccine Laboratory, where the entire supply of typhoid vaccine is prepared for the troops. Col. Whitmore, who is in charge of the laboratories, has trained a large number of enlisted men as laboratory assistants in bacteriology and chemistry.

The officer in charge of the *X*-ray Department is the Professor of Roentgenology and a member of the faculty. The *x*-ray laboratory occupies a part of the first floor, rear, of the building, and a part of the sixth floor, and is divided into: (1) Laboratory for patients where cases are examined which are referred from the Army Medical School physical examination room, the Surgeon General's Office, the Attending Surgeon's office, and from among the officers and enlisted men and their families in and about Washington. (2) Laboratory for instruction, which adjoins the patients' laboratory. (3) Photographic laboratory.

At the outbreak of the war these three laboratories were together and the student officers received their practical instruction in the patients' laboratory one afternoon a week. But when the course of instruction was changed from one to three terms per annual session of about fourteen weeks each, and a class for enlisted men as manipulators started, it became necessary to rearrange the quarters so that daily classes could be held without interfering with the routine work of the department. This was accomplished by moving the photographic laboratory to the sixth floor, where three well lighted rooms were available. This additional space was fitted up with a Waite and Bartlett transformer and other apparatus that we had on hand, and a dark room and labyrinth installed—the work being done by the officers and enlisted men of the school and regarded as elementary instruction. We endeavored to follow the plans for base hospital operating and dark rooms as closely as possible.

The clinical *x*-ray laboratory was partitioned so that we were able to secure an office, an additional room for dental examination, and a control space for the large operating *x*-ray and fluoroscopic room. By removing a large labyrinth into the dark room, a plate loading space was secured which could supply the operators and feed exposed plates into the dark room. A smaller and less elaborate labyrinth was built to connect these rooms. The plate-examining room, which was quite large, was divided so that a waiting room was secured. This gave more privacy for plate study, which is really the most important part of any laboratory. Special view boxes with indirect lighting, and shelving above and below, were designed and built around the room and were found so satisfactory that

* Read before the nineteenth annual meeting of the American Roentgen Ray Society, Chattanooga, Tenn., September, 1918.

the plans were adopted by the Surgeon General's office for use in army laboratories. Plans for these boxes were drawn at the school and are on exhibition here. Plates are indexed and filed for easy reference and specially arranged for purposes of instruction.

Personnel.—Since the chief function of the Army Medical School is to train men for the army, our personnel has not been permanent, for as fast as an officer or man develops, he is sent out to engage in work in broader fields and others take his place. Of the men originally at the school in August, 1917, only two remain.

The personnel of commissioned men is as follows:

1 Major, M. C., Officer in Charge—Professor of Roentgenology.
1 Captain, M. C., Instructor in the Laboratory for Instruction.
1 Captain, M. C., Instructor in the Laboratory for Patients.
1 Captain, S. C., In charge of installations and repairs.

While the non-commissioned officers are:

1 Hospital Sergeant—in general charge.
1 Sergeant, 1st Cl.—Property.
1 Sergeant, Assistant Instructor.
1 Sergeant, Delco Engine Expert.
1 Sergeant, Photographic Laboratory.
12 Pvts. 1st Cl. — manipulators, electricians, draftsmen, photographers, dark room men, chauffeurs, etc.

Instruction.—The student candidates are selected from the applicants for the regular army who have successfully passed the entrance examinations.

The curriculum of the school consists of: Bacteriology, Medical Department Administration, Chemistry, Military Hygiene, Military Surgery, Military Medicine and Tropical Medicine, Sanitary Tactics, Ophthalmology, Operative Surgery on the Cadaver, Lectures by Special Professors and Roentgenology.

Successful candidates who secure a general average of 80% and + points are commissioned in the Regular Medical Corps.

It can readily be seen that our purpose cannot be to make these officers roentgenologists, so we aim to give them a healthy respect for this specialty, to help them to avoid the usual mistakes of the average surgeon and to enable them to intelligently pass on requisitions, etc., going through their hands to the Surgeon General's Office.

They have been given one hour a week lectures and one hour a week in practical laboratory instruction, demonstrating apparatus, the operation of machines, the localization of foreign bodies by the methods adopted by the Army, and the practical interpretation of roentgenograms, with particular reference to the diagnostic points in the pathology of the parts concerned. Special stress has been laid on the use of the newer types of apparatus adopted recently for use in the present war.

Three classes of student candidates and three sections of the Orthopedic Class have passed through the school:

Sections of Student-Candidates

3rd Class,	21st Session	—75 men
1st Class,	22nd "	—87 "
2nd Class,	22nd "	—85 "
3rd Class,	22nd "	—57 "
		304

Orthopedic Sections

1st Class—25	1 Naval; 6 Relieved; 1 Discharged (Phys.)
2nd Class—26	
3rd Class—15	
66	

By request of the Division of Orthopedic Surgery, of the Surgeon General's Office, the officers on duty in the Army Medical School, Orthopedic Section, are given the same general course as the student-candidates for the army and, in addition, special plate interpretation of bone pathology.

At the request of the Division of Internal Medicine of the Surgeon General's office, the officers who reported for duty on Tuberculosis Boards were given instruction in interpretation of roentgenograms of tuberculosis. This instruction covered two classes—two hours twice a week for a period of about three months, each officer averaging about eight hours' instruction. Eighty-eight officers secured this instruction. Patients referred for examination from the training camp at Fort Meyer and other camps near Washington were used for instruction and the clinical and *x*-ray evidence compared in the presence of the classes. An outline of the instruction follows:

Outline of Instruction for Student-Candidates

LECTURES

1. Electricity, Low and High Tension Current.
2. *X*-Ray Properties. *X*-Ray Tubes.
3. Apparatus for Use in: General Hospital; Base Hospital; Evacuation Hospital; Portable Outfits
4. Fluoroscopy Roentgenography.
5. Dangers and Precautions, Electric Shock.
6. Lantern Slide Demonstration of Positions and Technique.*
7. Bone Pathology.
8. Head and Teeth.
9. Urinary Tract.
10. Chest.
11. Gastro-Intestinal Tract.
12. Localization of Foreign Bodies.
13. Review.
14. Examination—Written.

LABORATORY

1. *X*-Ray Apparatus, Army Types.
2. Description and Operation of Gas Tubes.
3. Description and Operation of Coolidge Tubes.
4. Roentgenography; Making Roentgenograms.
5. Protection of Patient and Operator—Testing Protective Measures.
6. Interpretation of Normal Bone Plates.
7. Plate Interpretation: Bone Pathology
8. Plate Interpretation: Head and Teeth
9. Plate Interpretation: Urinary Tract.
10. Plate Interpretation: Chest.
11. Plate Interpretation: Gastro-Intestinal
12. Localization of Foreign Bodies.
13. Review.
14. Examination—Practical.

*See Book of Prints and Positions, Normal Anatomy.

Outline of Instruction for Enlisted Men

The need for enlisted *x*-ray technicians and manipulators in the Medical Department necessitated the establishment of a school of instruction, which was put into operation August 16, 1917. These men were selected from recruits who had had previous electrical experience, or a knowledge of photography. But a large number had no previous experience in *x*-ray work.

The outline of instruction is as follows:

LECTURES

1. *X*-Ray in General.
   Excitation Tubes in General.
   Tubes: Hydrogen, Gas, Coolidge.
2. Plates, Envelopes, Films, Screens, Cassettes.
   Exposure Effects.
   Developer.
   Fixing.
   Plate-Holder.
   Marking Plates.
3. Electricity: terms and principles.
   Dynamos—Motors.
   Electricity—Magnetism.
   Ohm's Law.
   Lenz's Law.
4. Coils.
   Choke Coils.
   Transformers.
   Interrupters.
   Rheostats.
   Auto-Transformer Control.
5. Exposure Factors: K, Voltage, Amperage, Time, Distance, Saturation Curve, Critical Curve.
6. Relation of Shadow to Radiation Tube Shift. Shadow Traverse.
7. Standard Positions.
   Stereoscopy.

8. Fluoroscopy.
9. Use of Transformer Chart—Trouble and Trouble Hunting.
 Wiring. Machines.
10. Troubles and Difficulties. Plates: Developer. Over and under exposure.
11. Lecture on Osteology.

LABORATORY

1. *X*-Ray Machines, General.
 Wiring, trace wiring. Make diagram.
2. Coils and Interrupter.
 Saturation Curve.
3. Transformer Chart.
4. Views of Arm Model Ex. 6—Relation of Shadow and Direction of Radiation.
5. Relation of Time of Exposure to Target.
6. Current and Time Relation.
7. Voltage Law. Ex. 9.
8. Making Plates of Normal Parts.
9. Keeping records and clerical work, (see exhibit).
10. Weekly written tests are customary. A number of the examination papers are on exhibition.

This instruction averages two hours' daily didactic instruction, and two hours' practical laboratory work on machines and in the dark-room.

Upon completion of the course, enlisted men are afforded practical experience by work in the Army Medical School Laboratory for Patients, Soldiers' Home, Providence Hospital, George Washington University Hospital, Georgetown University Hospital, Children's Hospital, Episcopal Hospital, and the Walter Reed Hospital, Washington, D. C.

Lists of qualified technicians and manipulators are sent to the Surgeon General's Office, *X*-Ray Division, for assignment to duty elsewhere. One sergeant who completed the course here, while on duty at the Soldiers' Home installed and operated the electro-therapeutic department. This sergeant is thoroughly conversant with the installation and the practical application of modern therapeutic apparatus and is now on duty in France.

Those qualifying who show special adaptability are retained at the school as assistants. Several have received commissions in the Sanitary Corps. Upon receiving their commissions they are ordered away from the school. One assistant instructor is now on duty at Camp Greenleaf School of Military Roentgenology. Others have been ordered to France in various capacities.

Mention should be made here of the special aim in training technicians and manipulators. These men are supposed, primarily, to be able to care for the *x*-ray apparatus, to make minor repairs, and to keep the machines running satisfactorily. A number of them thoroughly understand the electrical construction and are able to do almost every kind of repair work. These men are usually given assignments where their knowledge will be most useful; they are called technicians. Secondly, the men are instructed in making exposures of patients, developing the plates, and in general dark-room work. They are given a little osteology to enable them to intelligently make plates of the parts of the body requested by the surgeon. They are called manipulators, and they work under the immediate direction of the roentgenologist. In no way is it to be understood that they are meant to interpret roentgenograms, to give opinions on plates they have taken, or to do fluoroscopy. It is not expected that they shall in any way usurp the duties of the roentgenologist.

Certificates of Proficiency are given to men who are found qualified, technically and morally, to perform these special duties. Enlisted men found to be disqualified, after a fair trial in the class room, are transferred to other duties. The number of men who have passed is 174; number not qualified, 8; number transferred to other duty, 13; number discharged, 2 (one to complete a dental course and one having been court martialed); making a total of 197.

These manipulators and technicians are on duty in most of the cantonments and camps and the reports received have been, for the most part, favorable. A large number are now on duty in France. I feel sure they may be of the greatest assistance to the over-worked roentgenologist.

The question is asked, "What will become of the men after the war?" "Sufficient unto the day is the evil thereof." I am thoroughly convinced that the manipulator can produce satisfactory routine plates and that he can turn out a large quantity of work; also, that the roentgenologist who utilizes his services will be in a position to give more time to the medical side of his work, including fluoroscopy, therapy, and plate study. How often do we see the plates hurriedly gone over, because after spending the greater part of the day on purely mechanical things (which the manipulator can do) one has not the time to go into history, physical examinations, and careful plate study, all of which are so necessary to correct diagnoses. The roentgenologist has developed special skill in medical and surgical diagnosis, which, after all, is the consulting roentgenologist's proper sphere. This is proven by the almost universal demand for his opinion, not only in reference to diagnosis, but also to treatment. Does it not often fall to our lot to make the decision, pro or con, for an operation? Shall we accept this responsibility, or pass the buck and go on being technicians for the real doctors?

X-Ray Clinical Laboratory.—A medical officer roentgenologist is in attendance, seeing all patients and getting a short history directly bearing on the examination that is to be made. He personally makes all fluoroscopic examinations and notes in the history book the findings. He directs the manipulator in making plates in the positions necessary to show the pathology in question. Regulations controlling routine examinations with a standard table of positions and technique are adhered to.

Reports on examinations are made by the officer in charge and delivered by special messenger the day following the examination. Plates are filed numerically and those of special use for instruction are filed separately. Card indices of cases are filed alphabetically by pathological headings. An instruction index is used, which follows the classification adopted by the Conference for Standardization of Apparatus and Methods, held in New York in June, 1917.

A graphic chart is kept showing the rise and fall of the work done in the clinical laboratory. This chart shows at a glance the number of films and plates taken daily and monthly, and is of help in requisitioning supplies, particularly for the annual requisition, as it depicts the increase in the work during the year.

There were 2060 patients seen between September, 1917, and June 30, 1918. During the same period 3799 radiographs, and 5323 dental films were made.

Photographic Laboratory.—The photographic laboratory is in charge of a noncommissioned officer who had previously had experience in commercial photography. The work consists of taking photographs for the various departments of the school and things of interest to the medical department, of preparing lantern slides, and of making prints. Facilities are present for making enlargements and reductions and for copying drawings, tracings, and photographs for the preservation of records. There is, also, special apparatus for making microphotographs.

From September, 1917, to June 30, 1918, the following amount of work was done: 807 negatives, 2188 prints, and 1225 lantern slides made.

Special Activities.—It has been our endeavor to furnish special practical information concerning apparatus, material, and methods adopted for use in the army by the *X*-ray Division of the Surgeon General's Office. We claim no originality since most of our efforts have been directed toward the practical application of ideas originating elsewhere. The facilities of the department being at the disposal of the officers on duty in the *X*-ray Division of the Surgeon General's Office, most of the work has been done under their guidance and supervision and any credit that may be due should be placed there.

Aside from the routine reports on intensifying screens, photographic plates, *x*-ray accessories, apparatus and instruments, we have made studies concerning the protective value of lead glass, gloves, aprons, trochoscopic boxes, etc., supplied for use in the army. Following is a list of the special activities completed in the department during the year 1917–1918:

Index File: Pathology—for Instruction
Classification of Bone and Joint Diseases
Pathological and Anatomical Chart for Diagnosis of Bone and Joint Diseases
Description of *x*-ray Pathology of Bones and Joints
Technique for Determining the Size of the Heart from the Roentgenogram by use of the Planimeter
Heart Report
Interpretation of Roentgenograms: Tuberculosis
Method of making Strohl Setting on Portable Unit Table without U. S. Instrument, and also by an adjustable Strohl instrument—Coe
Hirtz Compass by Fluoroscopy without U. S. Adapter—Coe
Method of Finding Distance of Target from Filter on Top of Tube-case—Coe
Report on Para-amidophenol-hydrochloride
Report on Comparative Tests of Developers
Report on the Manufacture and Use of Thorium for Pyelography (Illus.)
Safety Zone for Operator in Fluoroscopic Work
Brief Explanation of Some Defects Noticed in Intensifying Screens—plates
Plans for Illuminating Boxes with Shelves
Portable Developing Box for Use with the Portable *X*-ray Unit—Coe
Scheme Showing Use of the Bedside Unit Operated from the Delco Engine by Making Contact with the Portable Transformer Table—Coe
Photograph Showing Use of Bedside Unit with the Portable Table—Coe
Photograph Showing Use of Portable Fluoroscope and Bedside Unit
Speed Coefficients and Intensifying Screens
Intensifying Screens and Single *versus* Double Screens
Plan for Setting up a Portable *X*-ray Unit.

ROENTGENOLOGICAL SERVICE IN A BRITISH EVACUATION HOSPITAL*

BY CAPT. WALTER C. HILL, M. C., U. S. ARMY

Roentgenologist, No. 9 (Lakeside, U. S. A.), General Hospital, B. E. F.

In THE British Army, the wounded man normally passes through an Advanced Dressing Station; a Casualty Clearing Station; an Evacuation Hospital; and, if permanently disabled or not fit for duty for some weeks, he goes to a Base Hospital in England.

The type of roentgen ray work in an Evacuation Hospital varies little from that at the Casualty Clearing Station, and during an offensive is identical with that of the Casualty Clearing Station, for many patients at such times come directly from the Advanced Dressing Station to the Evacuation Hospital.

The roentgen ray unit supply consists of induction coil, fluoroscopic table, tube stand, and gas tubes of different types, electricity being supplied from the lighting circuit or storage batteries. The roentgen ray laboratory is located in a room adjoining the operating theatre.

* Prepared for Presentation at the 19th Annual Meeting of the American Roentgen Ray Society, September, 1918.

The scope of work consists principally in localization of foreign bodies, examination of fractures, and of suspected cases of gas gangrene, and study of all types of intrathoracic conditions. Naturally, the amount and character of work varies with the character of the warfare. When there is no fighting, the type of work reverts to that of civil life, and in the Evacuation Hospital, there is little to do. But during a big offensive, the roentgenologist is worked to the limit of endurance and is fortunate if he obtains his eight hours' rest, for the majority of cases operated must first be roentgen-rayed. At these times, one pair of stretcher bearers is utilized to carry cases from the accumulation of patients in the corridors to the roentgen-ray room, and another pair to carry them from the roentgen-ray room to the operating theatre. The top of the roentgen-ray table is removed, and the stretchers placed on the frame, thus saving a considerable amount of time as well as inconvenience to the patient. With the equipment at hand, the roentgenologist must develop a technique that will allow him to examine the greatest possible number of patients, in order to keep a group of tables continuously occupied in the operating theatre, and further to accumulate a surplus of cases to be operated while he is off duty. I have found that the only possible way to accomplish this is to use the fluoroscope in practically all cases for localization of foreign bodies, and to a great extent in other types of work. One does not at all times have the perfect protection which my friend Pfahler has taught us to believe is necessary for our well being, but we surely have as much protection as the medical officer serving with a battalion at the front.

I feel that the roentgenologists coming to France should be well instructed in the use of the fluoroscope, and in working with different types of apparatus, for we shall not all have the good fortune to use one of the very satisfactory roentgen-ray units operating a Coolidge tube. The roentgenologist always holds a position of responsibility, but never of such great responsibility as he holds over here in connection with military surgery. A noted surgeon stated to me recently that he considered the roentgenologist one of the most important members of the war machine today. A portion of his time must be spent in the operating theatre in consultation with the surgeons, but his chief function lies in making quick and accurate examinations of great numbers of wounded. If for lack of time, a large fragment of shell has not been localized for removal and the operation is thus delayed for some hours, a gas gangrene may develop to the point where surgical interference will be futile. To the lack of early, adequate, surgical interference in an Evacuation Hospital can be attributed the majority of deaths from shell wounds.

The greatest number of cases seen by the war roentgenologist are those with shell or bomb fragments—sometimes one, sometimes hundreds to a case. As a rule the small fragments are not localized, unless, because of their anatomical position, they may cause trouble. These small fragments cause so little devitalization of the tissues along their track, that the tissues are able to control the slight amount of infection carried in by the foreign body. A fragment of shell, 1 cm. in diameter or larger, devitalizes to a considerable extent the tissues along its course, and furthermore, acts as a die, cutting and carrying on its distal surface a corresponding sized piece of all the clothes through which it passes, together with the accumulated bacteria. Therefore, the old axiom that "A bullet when it has ceased moving has ceased doing harm" certainly does not apply to these large shell fragments, for in most cases they commence doing harm only some hours after their entrance. They kill because of the amount of infected material they transport into the devitalized tissue.

The type of foreign body depends upon the character of the fighting. Occasionally we find large numbers of shrapnel balls. At other times, most of the cases examined contain rifle or machine gun bullets. It is quite remarkable how little damage a rifle bullet may do. A sniper was shot in the inner canthos of the right eye, and the bullet was found under the skin of the back of the neck on the right side. Careful search was required to detect the entrance wound. The eyelid was uninjured, the eye perfectly normal, and no ecchymosis present. The patient complained only of the sore spot in his neck.

A bullet may, as we know, travel great distances and also change its course after entering the body, so that an extensive screen examination is necessary to locate it. A British colleague in a neighboring hospital examined an officer who had been shot in the left groin, but the roentgen-ray examination disclosed no bullet in the abdomen or pelvis. The following day signs and symptoms of infarction of the left lung appeared. At autopsy, laceration of the external iliac vein was found, where the machine gun bullet had entered and from whence it had passed on through the circulation, lodging in a branch of the pulmonary artery.

The French give the following classification of gunshot wounds in cases reaching the Advanced Dressing Station:

Head	16.0 per cent.
Chest	10.0 per cent.
Spinal Column	2.6 per cent.
Abdomen	4.0 per cent.
Arm	14.0 per cent.
Forearm	8.0 per cent.
Hand	12.0 per cent.
Thigh	14.0 per cent.
Leg	12.0 per cent.
oot	6.0 per cent.
ultiple	20.0 per cent.

The percentages in cases coming to the Evacuation Hospital vary somewhat from the above, there being fewer head, chest, and abdominal cases. It will be seen that the greatest number of foreign bodies are found in the extremities, and therefore can be readily localized.

The great majority of foreign bodies in the head are found in the face. Less frequently are foreign bodies other than bullet or shrapnel balls discovered in the brain, for a shell fragment with sufficient force to pass through the steel helmet and skull prevents the patient from reaching the hospital. A relatively small percentage of chest wounds are penetrating, and these usually on the right side, few of the cases wounded in the left side reaching the hospital. Foreign bodies found in the lungs, heart, or mediastinum are almost invariably shell fragments, because bullets or shrapnel balls pass entirely through the chest or lodge in the opposite wall. For accurate localization of fragments within the chest, the most careful fluoroscopic examination is necessary to determine whether a foreign body lies in the lung, pericardium, heart, mediastinum, or in the chest wall; and if in the lung, to determine if possible in which lobe. The roentgenologist must give definite information, for at times it is extremely difficult for the surgeon to locate a foreign body in the chest, even with the ribs widely spread, allowing him to see as well as palpate. In injuries to the abdomen, the foreign bodies are usually found in the walls or in one of the solid viscera, as operative cases of abdominal perforation are cared for in the front areas.

The problem of fractures for the roentgenologist is quite the same as in civil practice. The majority of fractures coming to an Evacuation Hospital are compound, comminuted, or infected. In cases of gunshot fractures of the long bones, the screen method of examination is very satisfactory; a tracing being made from the screen for record and transfer with the patient. Especially is this method of value in busy times when patients are quickly transferred, one advantage being that the tracing is ready when the patient leaves the roentgen-ray room. In cases of suspected simple fractures and fractures of the skull and face, the plate method is more satisfactory.

The roentgenologist can be of great assistance in early diagnosis of gas gangrene before all the cardinal symptoms—such as swelling, discoloration, and crepitation—appear. In this connection, I have found the plate method quite indispensable. Very frequently one finds a single large globule of gas about a foreign body, and upon incision of the part, the pus escapes under pressure. However, these single large globules of gas are apparently formed by ordinary non-virulent types of gas-forming bacteria. Gas gangrene shows a typical picture—very small globules of gas may be seen radiating from the foreign body beneath the sheath of the adjacent involved muscle, and later, throughout all the soft tissues of the part. The roentgenograph is of great value, for the early diagnosis by this means enables the surgeon to limit his operation to thorough dissection of the muscle involved, whereas a few hours later, when all pathognomonic signs of gas gangrene are present, amputation is necessary; and where the trunk is involved surgical interference may be of no avail. I might say in this connection that if a deep wound is cleansed with peroxide, one may obtain a plate quite typical of gas gangrene, for it is remarkable the distance that oxygen bubbles will travel between the muscle sheaths. Frequently, there are cases of apparent early gas gangrene, in which the roentgen-ray examination shows no gas present in the tissue, the physical signs closely resembling gas gangrene having been produced by large interstitial hemorrhage or large clots.

The most interesting part of war roentgenology is the study of intrathoracic conditions. This is true of tuberculosis because there are many recrudescences of old tuberculous lesions due to the hardship and exposure of trench and dugout life. Other such conditions are hemothorax, pneumothorax, abscess of lung, empyema, etc. The stereoscopic plate method is naturally the ideal one for studying these conditions, and is essential for fine differentiation of tuberculous conditions. But war conditions are not ideal conditions, and one may have to depend to a great extent upon the fluoroscope.

I think it is worth while mentioning that I have also given two bismuth meals for stomach examination during my thirteen months' service in an Evacuation Hospital.

In conclusion, I wish to emphasize the fact that the work here is rather typical of all that done in advance of the Base Hospital, so that the roentgenologist who comes to France may have similar experiences. He must not expect ideal conditions for work, nor ideal apparatus with which to work, but must be prepared to do a great amount of work when it comes, by the most advantageous methods available at the time. And again, might I suggest to the teachers of war roentgenology the necessity of instructing their pupils in the manipulation of different types of apparatus, the problem of bone injuries, and the appearance of all intrathoracic conditions, as well as methods of localizing foreign bodies.

USE AND ABUSE OF ROENTGEN RAY TUBES *

BY C. N. MOORE

SCHENECTADY, N. Y.

I FEEL rather as though an apology was due for appearing before a body of trained roentgenologists to speak upon the subject of the use and abuse of roentgen ray tubes. My only excuse for doing so, is the belief that experience gained in the development, manufacture and testing of tubes, together with the examination of tubes returned for repairs, may enable me to be of some service by pointing out the conditions under which tubes were designed to operate. I will mention some of their limitations, and by means of sample tubes and a few simple experiments show some of the results of abuse. In the present emergency, it is highly desirable to conserve and utilize to the utmost degree the tubes which must be transported under such difficulties and for such distances. I hope that nothing I shall say will conflict with what you are being taught in the various schools for military roentgenology. My remarks will apply specifically to the hot cathode type of tube, but will apply in the main to all types.

Turning first to the all-tungsten target tube in the seven-inch bulb—a tube designed for diagnostic work, both roentgenographic and fluoroscopic, and for roentgenotherapy. It is intended to be operated under the following conditions: (1) With voltages as high as that corresponding to a ten-inch parallel spark gap between points, and with currents depending upon conditions to be explained later, and (2) upon apparatus delivering current to the tube. You are all perfectly familiar with the operation of this tube, but I wish to say a few words regarding the conditions just mentioned.

First, in regard to the question of the amount of energy that a tube will carry. In this case, energy may be considered as the product of the milliamperage times the potential (spark gap). Once the target design is fixed, the allowable energy input is determined principally by four things: (1) The target material, (2) the area of the focal spot, (3) the time during which the energy is applied, and (4) the temperature of the target at the time the energy is applied. Of the energy applied to the focal spot, approximately 99.8 per cent is converted into heat, so that the question of the allowable energy input is really a question of the rapidity with which heat can be removed from the focal spot and of the melting point of the target material. The metal tungsten is used today for the target face in practically all tubes. It has a melting point of 3300° C. If this temperature is exceeded, tungsten will melt. The filament in this incandescent lamp is made of tungsten. I am going to raise its temperature above 3300° C. by operating it at a voltage considerably in excess of that for which it was built. As I cut out resistance in series with the lamp, the tungsten becomes hotter and hotter, until finally, at this point where it is white hot, it melts. Probably the worst abuse of the roentgen ray tube is due to a lack of consideration of the fact that tungsten has this definite melting point. Present practice is resulting in repeated melting of the focal spot in many tubes. The molten tungsten vaporizes rapidly in an evacuated space, and deposits in a thin film over the active hemisphere, as is shown by this tube. This mirror-like metal deposit on the inside of the glass should not be confused with the violet coloration which always results when the particular kind of glass used in these bulbs is subjected to prolonged exposure to roentgen rays. This violet color is due to some change taking place within the glass itself and is perfectly harmless. The thin film of tungsten

* Read before the nineteenth annual meeting of The American Roentgen Ray Society, Chattanooga, Tenn., September, 1918.

exerts no appreciable filtering effect upon the roentgen ray, but it does disturb the electrical conditions within the tube. Experiments in the laboratory have shown that a grounded metal wire can be brought up into contact with a clear bulb when the tube is operating, whereas with a tube having a metal deposit inside, such a wire must be moved away a number of inches to avoid puncturing the tube. The metal of the tube stand is usually grounded and the large number of punctured bulbs similar to the one which I am showing you, would be greatly reduced if the practice of blackening bulbs were discontinued. Furthermore, I want to call your attention to the fact that this practice results in no appreciable gain. You may succeed in increasing your roentgen ray production a few per cent thereby, but this is hardly of interest. At the same time you have probably greatly reduced the life of your tube. Properly used, a tube will gradually acquire the deep violet color shown in this tube, which was returned for a trifling mechanical defect after two and a half years of constant use. If used in the same conservative manner, this tube should last many years more.

Just a few words in regard to the other factors involved in the question of allowable energy input. It is obvious that more energy may be applied to a large focal spot than to a small one without exceeding the allowable temperature. For a given size of focal spot, more energy may be applied for a short time than would be possible if the time of application were longer. And finally, for a given size of focal spot, more energy may be applied to a cold target without melting the focal spot than to one that is already hot, because in the case of the cold target, heat will flow away from the focal spot more rapidly.

What I have said so far has applied mainly to roentgenographic work. For continuous operations in roentgenotherapy, the limiting feature is not so much the target as the glass of the bulb. It is possible to get the body of the target so hot that heat radiated from it may cause gas to be driven out of the glass or may even melt the glass. Adequate cooling of the bulb is necessary to prevent this.

I have already stated that the present seven-inch tube with the solid tungsten target was designed to operate upon apparatus delivering rectified current to the tube. It is not designed to operate directly from the terminals of a high tension transformer without the interposition of a suitable rectifying device, or from the terminals of a coil without the use of valve tubes. Operation under these conditions constitutes one of the worst abuses with which we are familiar. Again it is a question of the temperature of the focal spot. Tungsten at a temperature of about 2000° C. begins to emit electrons at an appreciable rate. As a consequence, if a source of alternating potential is applied to the terminals of a tube with the focal spot or any point in the focal spot, at or above this temperature, inverse current will pass through the tube. This inverse current may focus on the glass in the cathode stem, causing cracking and the emission of gas, or it may focus on the glass of the bulb directly below the cathode. It is customary to speak of a tube being punctured by inverse at this point. What really happens is that the inverse current heats the glass locally so that it actually melts, or else sets up strains so that the glass cracks during this or some subsequent operation. After cracking, air rushes in and the electric current traveling along the air current gives the impression that a spark was the cause of the puncture. The presence of inverse is always indicated by green fluorescence at the cathode end of the tube. I am now going to do something which should never be done, I am going to run this tube directly from the terminals of a transformer with no other rectifying device. Within a few seconds from the start you will see green fluorescence appearing in the cathode arm. Now that the target is at a dull red temperature, the focal spot is hotter and you see the green fluorescence immediately upon closing the switch. The tube has not yet been injured, but if I should continue as I am about to do now, I shall undoubtedly ruin the tube. You see the inverse current focusing now on the glass below the cathode and a moment later so much gas has been evolved that I shall have to discontinue operation of the tube. Subsequent examination of the tube shows that, while cooling, the glass has cracked at the point where the inverse current focused upon it. The same thing would happen on our induction coil. It will also occur on the regular interrupterless machines if the rectifying switch is not set properly.

Turning now to the radiator type of tube which was developed for use in connection with the portable army outfits. This tube is adapted to diagnostic use only, and the allowable energy input is limited to that corresponding to 10 ma. at a five-inch parallel spark gap. For continuous operation in fluoroscopy, the current is limited to 5 ma. It is not suitable for therapy for the reason that it has not been designed to operate at the voltages used in such work and because it will not carry continuously more than one quarter of a kilowatt. The seven-inch tube with no copper in the anode will carry continuously about one kilowatt.

The radiator type tube is so designed that it will rectify its own current and can therefore be operated directly from the terminals of a high tension transformer or a coil. You are all familiar with the manner in which it is used on the portable outfits. It will operate equally well on outfits delivering rectified current, if the limits mentioned above are not exceeded.

I am now going to run a radiator tube on this apparatus taken from a portable outfit, with a current of 10 ma. to demonstrate the behavior of this tube under abuse. The longest roentgenographic exposure is probably not over forty seconds. You will observe from the milliammeter that the tube has remained fairly constant during this time. If, now, I continue running longer without adjusting the filament current, the milliamperage will gradually drop until at the end of two minutes it has reached 8 ma. This falling off in the milliamperage is due to the presence of gas driven out of the copper in the anode by heat. If I set the tube aside, the copper as it cools will reabsorb the gas and the tube will return to its original condition. Because of lack of time, however, I shall have to omit this part of the experiment. I am now going to abuse this tube. I will operate it at 10 ma. until it shows signs of distress. At the end of about four minutes the copper of the target has reached such a temperature that I shall have to discontinue to avoid melting it. Frequently before this point is reached, the tube will show green fluorescence throughout the bulb, owing to the fact that so much gas will have been evolved that further operation is unsafe.

A RÉSUMÉ OF THE ROENTGEN FINDINGS OF TWO HUNDRED AND FIVE CHEST EXAMINATIONS AT A BASE HOSPITAL IN FRANCE*

BY H. E. ALLISON

First Lieutenant, M. C., U. S. A.

FRANCE

DURING the past three months we have made 205 roentgen examinations of the chests of soldiers admitted to this hospital from various parts of the front with either definite or suspected pulmonary affections. Gunshot wounds of the chest, with their various complications, are not included in this paper. The occurrence of a fairly large percentage of normals is explained by the fact that all cases with a history suspicious of tuberculosis were roentgenographed regardless of their lack of objective symptoms and physical signs. As many of the cases were convalescing from influenza and bronchopneumonia, they were classified from a roentgenological standpoint as normal unless the condition was clearly defined on the plate.

Method.—Stereoscopic plates were made on all cases either in the x-ray room or at the bedside. When the condition of patients permitted, fluoroscopic examinations were also made.

Interpretation.—Interpretation was made without any knowledge of the patient's symptoms or results of his physical examination. From experience it is my belief that the roentgenologist will have a much lower percentage of error in diagnosis if he will confine himself to what he sees on his plate, rather than be biased by a history which may or may not be authentic, or to lay too great stress on symptoms which may be produced by some condition outside of the chest of which he has no knowledge.

In chests showing changes produced by tuberculosis I have classified as normal all cases showing changes which in the opinion of casual observers are anatomical rather than clinical. Under anatomical tuberculosis I have included: (1) Increase in root shadows. (2) Calcified tubercles. (3) Peribronchial involvement—unless gross and circumscribed or accompanied by mottling. (4) Lessened opacity in one apex as compared with the opposite one, which is generally due either to unequal muscular development or apical pleurisy.

Classification.—In the following table I have included complications found under both conditions, consequently the number of conditions is somewhat in excess of the number of cases examined.

CONDITIONS FOUND

Normal	40
Pulmonary tuberculosis (Parenchymal)	46
Pulmonary tuberculosis (Gross peribronchial)	5
Influenza	58
Pneumonia (Lobar)	12
Pneumonia (Broncho)	13
Empyema	6
Pleural effusion (Serous)	12
Intralobar effusion	3
Lung abscess (Acute)	1
Cardiac hypertrophy	22
Aortic aneurysm	1
Total	219

Of the six empyemas found, four accompanied unresolved pneumonia. In two, the pneumonia had entirely disappeared. Of the twelve serous pleural effusions five were found complicating a definite tuberculosis. In seven cases no lung lesion could be found. All three of the intralobar effusions accompanied a definite pulmonary

*Prepared for the 19th Annual Meeting of the American Roentgen Ray Society, September, 1918.

tuberculosis. The acute lung abscess was postoperative. Of the twenty-two cases of cardiac hypertrophy, eight were found accompanying lobar pneumonia; two accompanying bronchopneumonia; and ten were dependent on valvular disease.

Pulmonary Tuberculosis. — Neither the roentgenologist nor the clinician in army service has the time to give to prolonged study and observation necessary, at times, to determine the activity of a pulmonary tuberculosis. The information the clinician desires from the roentgenologist is: (1) Is tuberculosis present? (2) If so, its character, distribution, and probable activity or non-activity. This information, quickly and accurately given, is of immense value in enabling the clinician to quickly distribute and evacuate his cases.

The definitely active cases are sent before an examining board so that if found unfit for duty they can be returned to the states without unnecessary delay. The borderline cases, where the activity of the process is questioned, may be sent to special hospitals farther back from the front for a period of observation. The definitely non-tuberculous lung conditions such as influenza, resolving pneumonia, etc., are sent directly to convalescent camps.

Whether or not the earliest changes of pulmonary tuberculosis can be demonstrated on the roentgen plate is still a mooted question. Certainly no scientific proof that they cannot be so demonstrated has as yet been advanced. The cardinal points in the roentgen appearance of tuberculosis are: Generally upper lobe, occasionally middle lobe, and practically never lower lobe involvement. Increased bronchial markings leading to the lesion, and parenchymal mottling have all been too clearly emphasized to warrant more than passing mention. The point which I believe needs special emphasis is that peribronchial tuberculosis alone without parenchymal mottling is practically never of clinical significance unless it is gross in amount, clearly circumscribed, and located in the upper lobes. This has been abundantly proved by Heise, Cole, Brown, and others.

Influenza.—The influenza we have encountered in France has been of an unusually severe type. From a standpoint of symptoms and physical signs it has ofttimes been impossible to distinguish from tuberculosis. Where bronchopneumonia existed as a complication, blood-streaked sputum, and occasionally, frank hemoptysis persisted over a period of several weeks. Where influenza exists uncomplicated by pneumonia the roentgen appearance is quite typical and easily recognized. It consists of markedly increased bronchial markings throughout the lungs, practically always bilateral and usually more marked at the bases, diminishing in intensity from the bottom up. The hilus shadow is usually increased and the pleural unaffected. When bronchopneumonia exists as a complication the diagnosis is more difficult, but as the pneumonia is usually middle or lower lobe in origin (a region where tuberculosis is rare) they can usually be differentiated. The most difficult problem is to differentiate an influenza infection with an apical bronchopneumonia from an apical tuberculosis. The mottling produced by the two conditions is so very much alike that often we must resort to the time honored custom of watchful waiting to decide which condition is present. The only helpful point I have been able to observe is that in tuberculosis the increase in bronchial markings is usually confined to the affected portion of the lung, while in influenza with bronchopneumonia the bronchial markings are usually increased throughout both lungs. In a certain percentage of cases repeated sets of plates over a period of weeks and even months will have to be made before the diagnosis can be cleared up. We have found the roentgen pictures of influenza quite typical for as long a time as three months after an acute attack.

Lobar Pneumonia. — The roentgen characteristics of lobar pneumonia have been so thoroughly described in the past that I have nothing to add except to call attention to the fact that lobar pneumonia extending outward from the root of the lung has been quite commonly observed, not only in my short series of cases but in many larger series as well. It is extremely liable to be confused with acute lung abscess, due to its location, and to the fact that the consolidation is so sharply circumscribed instead of gradually shading into the normal lung valuation as is common in lobar pneumonia.

The other conditions observed have in no way varied from previous descriptions of them.

Résumé

1. Parenchymal tuberculosis is generally a clinical disease unless slight in amount and definitely calcified.

2. Peribronchial tuberculosis is not of clinical significance unless sharply localized, circumscribed, or accompanied by mottling of the parenchyma.

3. Uncomplicated influenza gives a typical roentgen appearance.

4. Stereoscopic chest plates furnish invaluable assistance in a Base or an Evacuation Hospital where rapid and accurate distribution and evacuation of cases is necessary.

I wish to express my gratitude to Lieut. Col. Joseph A. Blake for permission to present this résumé and to the Medical Staff of the Hospital for the hearty coöperation they have given in enabling me to follow the cases clinically.

MIDWINTER MEETING OF ROENTGENOLOGISTS

The Fifth Eastern Midwinter Meeting of Roentgenologists will be held at the Hotel Traymore, Atlantic City, Friday evening and Saturday, January 24th and 25th, 1919.

While the plan which has been so successful in previous meetings will be closely followed it is desired that the discussion topics be more limited. For instance, that in place of a general topic "Bone Lesions," several subtopics be chosen, such as "Difficulties of Diagnosis Between Osteomyelitis and Sarcoma." What are the early signs of malignancy in pre-existing bone cyst? Is diagnosis possible between tuberculous arthritis and that caused by other specific infections? That is, the limitation rather than generalization of discussion.

The staging of a successful meeting at this time is of course beset with unusual difficulties, and other demands upon the correspondent's time render it almost beyond accomplishment. Every possible assistance is therefore solicited along three lines: (A) Furnishing addresses of men who should attend. (B) Suggestions as to program and topics. (C) (Especially important.) Volunteers who will agree to discuss specified topics.

We believe that you value these meetings. Show that you do by giving us a lift over this hard place.

David R. Bowen, M.D.,
Correspondent.

235 So. 15th St.
Philadelphia.

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Fraternal Greetings

Letters from French Roentgenologists to Members of the American Roentgen Ray Society on the Occasion of the Nineteenth Annual Meeting, September, 1918

From Major R. Ledoux-Lebard, Chief of Radiologic Service, Hospital Descartes, Tours, France

Gentlemen:

Words fail me to thank you adequately for your kind invitation to be present at this meeting of your society and for the great honor of being elected an honorary member. You may well believe me if I state that nothing could have given me a greater pleasure than to be sitting among you today and to become personally acquainted with all the eminent roentgenologists who compose this society and have so extensively contributed to the development of our specialty.

But at this crucial moment of the war, when my masters, my colleagues and my assistants are all giving the best of their efforts to the aid of the wounded and to the support of our great cause, I have felt that I could not leave France and my work here, and that I had to give to my country my share of effort—however small and inefficient it may be.

As I have the honor of being among those chosen to continue over here in France the instruction of American war radiologists who, with your armies, come to our aid, I am constantly in mental communion with all of you and this coöperation with your wonderful work has given me, and still daily gives me, the greatest joy I have felt since the war began. I am only too well acquainted with my own limitations but I hope that they may be to some extent overlooked in consideration of the sincerity of my endeavor to impart to the men entrusted to my care the love of our still rising specialty and whatever small knowledge of war radiology I may have acquired. And let me tell you this: They are a fine lot of men, all of them, with the true spirit in them!

Let me hope that you will not resent my not having accepted this time your invitation which I appreciate to its full value and for which I cannot sufficiently express my gratitude. If, some day, in one of these coming years, I have the privilege of being asked again among you, it would be my most intense joy to come and to thank you, as well as to express my admiration, for the splendid work that you have achieved here and for the extraordinary task surmounted, against almost incredible difficulties, by the men who have come over to France.

(Signed) R. LEDOUX-LEBARD.

From Major Haret, Director of the Radiologic Service of the French Armies and the Civil Jurisdiction

GENTLEMEN:

My friend, Lieutenant Colonel Case, Chief of the Radiological Service of the American Expeditionary Forces, has paid me the great honor of requesting me to be the spokesman for the French Radiological Service.

In our rôle as specialists, rather firm bonds had already united us before the beginning of the terrible drama which has been enacted for the past four years on our northern and eastern frontiers. The number of our American confrères had been growing each year in the midst of the Radiological Society of France; we had been reading and commenting with the greatest interest on the innumerable contributions developed in your laboratories.

Across the ocean, a current of reciprocal sympathy had been established upon a scientific foundation. One could hardly open a book, read a thesis, or look through an article in a journal without seeing mentioned there, with credit, the efforts of as many American as French specialists; and this was only one of the slight evidences of the many bonds which united our minds as well as our hearts.

But it was destined that this union should become even more firm. Two peoples of the same mentality were bound to be interested in the same ideals. Therefore, from the very first days of this frightful war, we were able to detect a movement gradually developing within you which was certain before long to range you by our sides.

Barely a year has gone by since you determined to enter into the struggle, and behold the resplendent appearance today of our sister republic!

Your formidable power has come to the help of France. Your men, your wealth, your science—everything has been offered to us. In every sphere your activity is manifest. You are not content with merely bringing up engines of destruction against our common enemy. You add to them the most highly developed means for the treatment of the heroes who are pouring out their blood for this sublime cause. My duties in the French Service for Military Hygiene have given me an opportunity to see the entire extent of the aid which you have brought us in the radiological field. Indeed this branch of roentgen diagnosis is perhaps the one which has been most developed since the beginning of hostilities. The number of roentgenological posts has multiplied a hundredfold since August 1914. Indeed no surgeon would consent to be without the roentgenological examination unless actually in the field. In the past year especially, the improvements have been tremendous, both as regards material and organization. It may be stated that every wounded man is examined systematically, from the very beginning of his treatment, by means of the x-rays.

It is therefore with a most profound joy that we have observed the intimate relation which exists between your roentgenological service and ours, convinced that it would bear important fruits. Indeed we have already begun to gather these fruits. American roentgenologists have already been chosen for several offensive attacks. We have perfected our methods together; we have continually improved our material, actually borrowing from one another various ingenious novelties. This is a labor, pursued with the most complete harmony, for the purpose of relieving the wounded.

Permit me, my dear colleagues, to tender you at the beginning of your meeting the heartfelt greetings of the French Radiological Service. We shall never forget the magnificent spirit with which you have helped us during these terrible trials. And when the day of victory shall shine forth, united in joy as we have already been in suffering, the French radiologists will be proud to share with the radiologists of America the laurels which they will have earned in common at the beds of the wounded, in an intimate union of right and justice.

Long live the American Roentgen Ray Society!

(Signed) HARET.

From Dr. A. Béclère, of The Academy of Medicine of Paris, Former President of The Society of Medical Radiology of France

TO THE AMERICAN ROENTGEN RAY SOCIETY:

As an honorary member of the American Roentgen Ray Society I am happy and proud of the honor which you have paid me. My only regret is not to be able, at this annual meeting, to express my gratitude to you in person. The war has suspended the meetings of the French Society of Medical Radiology, since all the members have been mobilized and are scattered, some in the ambulant laboratories of the army zone; others in the fixed laboratories of the rear zone. For this reason they have not been able to give their dean the formal mission of transmitting the friendly greetings of our society. It is therefore in my own name that I am writing to you. I feel, however, that I am the spokesman, not only of my colleagues of the Society of Medical Radiology of France, but also of all French radiologists without exception.

In this reunion of exclusively medical and scientific men I shall say only a few words in accord with the elevated ideals that you are following.

To our medical eyes, in war as in peace, the wounded and the sick appear merely as suffering human beings, that is to say as sacred beings; and without asking them on which "side of the fence" they are fighting, we compel ourselves, to our utmost, to bring our help to all of them.

To our scientific eyes, all human knowledge appears like a collective edifice, always in process of construction, but never finished, to which innumerable workers of all times and of all countries have brought their little stones. In the field which we are cultivating, that of medical radiology, to how great a number of investigators are we not indebted for our knowledge and our actual power?

It was in France, at the end of the 18th century, that Abbé Nollet, with the aid of the newly invented pneumatic pump, first rarefied the atmosphere inside a glass tube, and passed through it the discharge from a static machine, which was also a recent invention.

This "electric egg" as he called it contained in germ a whole series of surprises then entirely unsuspected. From that egg developed successively: In Germany the discovery of the cathode rays by *Hittorf;* in England their profound study by *Crookes;* then in Germany the discovery of the x-rays by *Roentgen;* and almost immediately afterwards in France, the discovery of the rays of uranium by *Henri Becquerel*, soon followed by the discovery of the marvellous radium by *Pierre Curie* and *Madame Curie*. Finally, in the United States, a discovery by your celebrated *Edison* became the point of departure for a revolution which was actually accomplished in medical radiology, of which the *Coolidge tube* is the wonderful result. It is not merely a change in instruments. New horizons are being opened in the field of radiodiagnosis, on account of the remarkable ease of technique; and even more is offered in the field of radiotherapy, because of the production on a large scale of more penetrating rays, some even as penetrating as certain of the gamma rays of radium. We have reason to hope for therapeutic successes much more numerous, more rapid, and more extraordinary than those obtained up to the present.

From the "electric egg" of the Abbé Nollet to the Coolidge tube, what a course has been traversed—at the cost of what efforts, of what struggles; and, although I have limited myself to the mention of only a few names, how numerous and to what a number of different countries belong the scholars who are responsible for this progress, the common heritage of humanity.

The physicians to whom we owe the perfection of radiodiagnosis and of radiotherapy are even more numerous. They are scattered over even a greater number of countries. I shall not attempt to mention even the most famous of them, even limiting myself in the enumeration of the American physicians whose part has been so great in the progress of medical radiology. Permit me, however, to pay my respects to one of the first pioneers in this new field, one whose treatise published at the very beginning of this century taught me very much; a man to whom I have been bound by a firm friendship for the past sixteen years—Doctor Francis H. Williams of Boston.

Thus the progress of Science and of Medicine is the result of a collective endeavor, of an international effort. As has been said, science has no country.

But in the words of our immortal Pasteur we hasten to add, and you will no doubt repeat with us, "if Science has no country, at least *men of science* should have one."

To the natural sentiment of love which every man feels for his native land is added, for you and for us, a just feeling of common pride, since the soldiers of our two lands are fighting side by side for the same ideal; and are heroically pursuing a contest whose issue (certain, now, thanks to your arrival) will be the legitimate triumph of right over might.

This fraternity of arms has of necessity again sealed the brotherly union of medical radiologists, American and French. My keenest wish is that in the future this union may become ever firmer and more intimate.

Full of admiration and of gratitude towards the great American republic and its illustrious president, I offer you from the depths of my heart the following sentiments:

Long live the United States of America!

Long live the American physicians!

Long live the American Roentgen Ray Society!

(Signed) A. Béclere

Major of the 1st Class, Chief of the Central Service of Radiology, of the Military Government of Pons

Editorial Correction

Concerning article on "Roentgen Ray Protective Materials" by W. S. Gorton, Ph.D., appearing in the October, 1918, number of The American Journal of Roentgenology:

Note—Experiments made since the article "Roentgen Ray Protective Materials" was written have shown that the large part of the effect therein attributed to a very soft x-radiation from the lead glass, when subjected to x-rays, is in reality due to a luminescence of the glass.

ROENTGENOLOGISTS ASSIGNED TO MILITARY SERVICE

OVERSEAS

Alleman, Geo. Ellsworth, Lt.	Evacuation Hospital No. 8
Allen, Lewis G., Lt.	
Allison, R. G., Lt.	
Angell, F. C., Lt.	" " " 6
Annadown, Paul V., Lt.	Base Hospital No. 7
Antell, Leon, Lt.	
Aronson, Barnett, Lt.	Evacuation Hospital No. 9
Ash, Ray C., Lt.	Base Hospital No. 61
Aspray, Jos., Capt.	Mobile Hospital No. 102
Aull, John, Lt.	Base Hospital No. 11
Bachmann, M. H., Lt.	" " " 52
Bailey, Clyde L., Lt.	" " " 42
Baird, Jos. C., Lt.	
Baun, Wm. D., Lt.	Evacuation Hospital No. 26
Beard, A. H., Lt.	Base Hospital No. 26
Beardsley, F. A., Lt.	
Beatty, John R., Capt.	Evacuation Hospital No. 22
Beaudet, E. A.. Lt.	
Beitsch, Wm. F., Capt.	
Bell, Alfred L. L., Lt.	Base Hospital No. 90
Bell, Fred H., Lt.	
Beller, Raymond C., Lt.	" " " 32
Bendick, Arthur J., Capt.	" " " 3
Benson, A. L., Lt.	
Bernstein, Benj. M., Lt.	" " " 71
Birkelo, Carl C., Lt.	" " " 69
Blackburn, A. B., Lt.	
Blythe, Vernon, Capt.	" " " 69
Bonoff, Karl M., Lt.	" " " 114
Boone, W. H., Lt.	" " " 103
Borzell, F. F., Capt.	" " " 38
Bowie, E. R., Lt.	" " " 24
Bowman, Wm. B., Capt.	" " " 114
Box, Thos. T., Lt.	" " " 43
Bradford, Duke C., Lt.	Evacuation Hospital No. 24
Bragg, Jesse L., Capt.	" " " 34
Branower, Jacob, Lt.	Base Hospital No. 131
Breese, Floyd P., Lt.	" " " 87
Bridenbaugh, J. H., Lt.	
Broemser, Milton A., Lt.	" " " 88
Bromer, R. S., Capt.	" " " 34
Brons, Wm. C., Lt.	Evacuation Hospital No. 49
Brown, Robert D., Capt.	Base Hospital No. 102
Bruorton, Oscar L., Lt.	
Bryant, Frank A., Lt.	
Buchanan, Edwin P., Lt.	
Buckner, Wm. F., Lt.	" " " 93
Burg, Walter A., Lt.	Evacuation Hospital No. 17
Burns, Ira D., Lt.	
Burkholder, John L., Capt.	Base Hospital No. 24
Burnett, H. W., Lt.	Evacuation Hospital No. 16
Butler, Frank E., Lt.	Base Hospital No. 94
Byrnes, John P., Lt.	
Cabot, Vernes S., Lt.	Evacuation Hospital No. 9
Cade, W. H., Lt.	
Campbell, Raymond F., Lt.	
Cantrell, Thos. D., Lt.	Base Hospital No. 11
Carney, Harold E., Capt.	
Carroll, P. M., Lt.	" " " 44
Case, Iverson C., Lt.	
Case, James T., Lt. Col.	Headquarters, A. E. F.
Caylor, Claude C., Lt.	Base Hospital No. 41
Chester, Walter S., Lt.	" " " 59
Chidester, Hugh, Lt.	" " " 67
Christensen, J. R., Lt.	Evacuation Hospital No. 15
Christie, A. C., Lt. Col.	Headquarters A. E. F.

Clair, Jean B., Lt.	Base Hospital No. 76
Clark, James J., Lt.	" " " 74
Climan, Max, Lt.	" " " 60
Clinton, R. S., Lt.	Evacuation Hospital No. 4
Coffin, W. K., Lt.	" " " 28
Cohen, Leon Sclis, Lt.	
Colcher, Abraham E., Lt.	" " " 36
Cole, Lewis G., Maj.	General Hospital No. 1
Coleman, Oscar E., Lt.	" " " 4
Conley, Bernard M., Capt.	Base Hospital No. 54
Cook, Orrin S., Lt.	" " " 47
Corniea, Albert D., Lt.	" " " 67
Corvese, Anthony, Lt.	
Covington, James M., Capt.	" " " 35
Crosby, Leonard G., Capt.	" " " 29
Currin, F. W., Lt.	
Davidson, S. C., Lt.	
Davis, Albert B., Major	" " " 76
Davis, Ernest L., Major	" " " 91
Davis, Fred W., Capt.	" " " 85
Davis, R. A., Lt.	" " " 37
Davis, S. G., Lt.	
Deming, Ralph, Lt.	" " " 62
Deer, John S., Lt.	" " " 43
Deweese, E. R., Lt.	" " " 55
Dewey, Lorenzo S., Lt.	
Dickinson, Ezra P., Lt.	" " " 95
Diveley, Rex L., Lt.	" " " 28
Drury, Roy F., Lt.	" " " 52
Elias, F. J., Lt.	" " " 18
Ellsworth, S. W., Capt.	" " " 116
Engel, Wm., Lt.	
Engesather, John A. D., Lt.	" " " 63
Epperson, Paul E., Lt.	" " " 158
Epstein, Irving, Lt.	
Evans, John, Lt.	" " " 42
Ewing, Leslie H., Lt.	" " " 68
Fagone, Peter G., Lt.	
Favour, Richmond, Jr., Lt.	
Fletcher, Frederick P., Lt.	" " " 62
Flynn, James M., Capt.	" " " 19
Ford, Charles, Capt.	" " " 77
Frankhauser, Agnew F., Lt.	
Frost, Earl J., Lt.	Base Hospital No. 72
Feldman, Maurice, Lt.	
Ferguson, Everett R., Lt.	" " " 95
Fetter, Earl W., Lt.	" " " 64
Firebaugh, T. C., Capt.	" " " 157
Fitzgerald, Chas. A., Lt.	Evacuation Hospital No. 25
Garnjobst, J. H., Lt.	Base Hospital No. 98
Geyer, C. W., Capt.	" " " 86
Gillis, James P., Lt.	
Gilmore, W. H., Capt.	Mobile Hospital No. 103
Girvin, Richard B., Lt.	Base Hospital No. 53
Given, M. A., Lt.	Evacuation Hospital No. 14
Glenn, Wm. S., Jr., Lt.	Base Hospital No. 116
Goin, L. S., Lt.	" " " 116
Gold, Louis, Lt.	General Hospital No. 1
Goss, Harold M., Lt.	Evacuation Hospital No. 21
Goss, Harry L., Lt.	Base Hospital No. 127
Grant, Arthur S., Lt.	Evacuation Hospital No. 26
Grimm, H. W., Lt.	
Gaillard, Samuel S., Lt.	

Hall, Herbert W., Lt.	
Hand, J. D., Lt.	
Harris, Charlton S., Lt.	
Harris, Clarence P., Lt.	
Hawes, Geo. F., Lt.	
Heatley, J. E., Lt.	
Hecker, Wm. Capt.	Base Hospital No. 107
Henschen, Gustave E., Lt.	
Hermann, Wm. G., Lt.	
Herrmann, Carl B., Lt.	Evacuation Hospital No. 24
Hickey, Preston M., Major	Headquarters, A. E. F.
Hodges, Fred M., Capt.	Base Hospital No. 45
Hoffmeier, F. N., Lt.	Evacuation Hospital No. 17
Holeton, A. J., Lt.	" " " 29
Holmes, Ralph W., Capt.	" " " 12
Hood, Philip G., Capt.	Base Hospital No. 106
Hook, Sam W., Lt.	" " " 88
Horowitz, Jos., Lt.	
Horrigan, Arthur J., Capt.	" " " 53
Hotchkiss, Walter K., Lt.	" " " 72
Howard, J. C., Lt.	" " " 51
Howard, Wm. P., Lt.	" " " 33
Hudnutt, Orrin D., Lt.	" " " 31
Hull, Logan E., Lt.	
Hurlbut, S. P., Lt.	
Ingalls, Stanley S., Lt.	" " " 161
Ingber, Irving S., Lt.	" " " 159
Jaches, L., Major	Replacement Unit No. 1
Jacobs, Alexander W., Lt.	Base Hospital No. 85
James, Jesse, Lt.	" " " 98
Janes, B. F., Lt.	
Jenkins, Wm. F., Lt.	" " " 89
Jenkinson, E. L., Lt.	
Johannes, E. W., Lt.	
Johannessen, Carl J., Lt.	
Johns, M. W., Capt.	Base Hospital No. 48
Jones, Harry O., Lt.	Replacement Unit A.
Judkins, C. L. M., Lt.	
Kaminski, Zeno L., Lt.	Base Hospital No. 69
Kann, U. S., Capt.	Evacuation Hospital No. 16
Kariher, H. C., Lt.	
Kaufman, Julius, Lt.	" " " 30
Kelley, Jacob S., Lt.	" " " 10
Ketcherside, Harry, Lt.	
Kirk, Chas. H., Lt.	" " " 12
Kirkham, Judd, Lt.	Base Hospital No. 29
Kirwin, Thos. J., Lt.	Evacuation Hospital No. 5
Kitterman, Peter G., Lt.	Base Hospital No. 78
Knapp, John C., Lt.	" " " 40
Kortwright, Warren P., Lt.	" " " 35
Krupp, David D., Lt.	" " " 92
Lambert, John H., Capt.	" " " 7
Landes, W. L. S., Lt.	
Laughlin, Thos. F., Lt.	" " " 70
Law, Frederick M., Major	" " " 115
Law, Wm. P., Lt.	" " " 56
Leach, Austin F., Lt.	" " " 92
Lebendig, Abraham, Lt.	" " " 86
Ledbury, J. W., Lt.	
Levey, Simon A., Lt.	Evacuation Hospital No. 21
Lindsey, John H., Capt.	
Little, D. E., Lt.	" " " 33
Livingood, John E., Lt.	
Lockwood, Ira E., Lt.	" " " 1
Long, J. P., Lt.	
Lowe, A. L., Capt.	
Lupton, Earl Lane, Lt.	Base Hospital No. 47
MacRae, John B., Capt.	" " " 54
McCall, A. C., Lt.	" " " 65
McCampbell, Herbert H., Capt.	Mobile Surgical Unit
McCaskey, Francis H., Lt.	
McCullough, Clarence J., Lt.	Evacuation Hospital No. 31

McCullough, T. L., Lt.	
McEwen, H. B., Lt.	Evacuation Hospital No. 13
McGrath, Earl F., Lt.	Base Hospital No. 79
McHenry, R. K., Lt.	
McKenna, John J., Capt.	
McMillan, Thos. M., Lt.	" " " 58
McNamee, E. P., Lt.	
Mackay, Wm. H. G., Lt.	" " " 66
Mackey, D. E., Lt.	" " " 115
Magruder, L. F., Lt.	" " " 41
Malone, F. F., Lt.	
Marsh, Chester A., Lt.	Evacuation Hospital No. 27
Mason, J. B., Capt.	Base Hospital No. 108
Mashburn, N. C., Lt.	
Maver, Wm. W., Lt.	" " " 1
Menees, Thos. O., Lt.	" " " 13
Mensch, Max, Lt.	
Merritt, E. A., Major	
Metz, A. R., Lt.	" " " 13
Meyer, Keith T., Lt.	
Meyer, M. F., Lt.	" " " 91
Mick, W. H., Capt.	Evacuation Hospital No. 2
Miller, Byron Y., Lt.	Base Hospital No. 77
Miller, Chas. M., Lt.	" " " 80
Miller, Fred McK., Lt.	Evacuation Hospital No. 23
Miller, J. E., Lt.	
Miller, Jas. L., Lt.	Base Hospital No. 83
Moir, Chas. L., Lt.	" ". " 14
Monnich, Walter A., Lt.	
Moon, Alexander C., Lt.	
Moore, A. B., Lt.	" " " 26
Morrow, Robt. J., Lt.	" " " 89
Mulligan, Peter B., Lt.	
Nichols, Bernard H., Lt.	" " " 55
Odea, Patrick, Lt.	Replacement Unit A
Ogburn, H. H., Lt.	Base Hospital No. 65
O'Reilly, Thos. W., Capt.	Evacuation Hospital No. 7
Osmond, John D., Capt.	" " " 26
Ostrowsky, Herman, Lt.	Base Hospital No. 90
Owen, Arthur K., Capt.	
Owen, Gilbert V., Capt.	" " " 35
Palmer, Dorwin L., Lt.	" " " 46
Palmer, Lester J., Capt.	" " " 58
Parson, Russell C., Lt.	Evacuation Hospital No. 13
Paul, Burton E., Lt.	
Pedersen, H. C., Lt.	Base Hospital No. 131
Pence, John R., Lt.	" " " 82
Perkins, Roy S., Lt.	" " " 51
Perry, Gentz, Capt.	" " " 87
Peters, Chester M., Lt.	
Pierce, Willard R., Lt.	
Pindall, Earl L., Lt.	
Poole, Chas. Henry, Lt.	
Portmann, Ursus V., Capt.	" " " 99
Post, Jos. W., Lt.	
Powers, R. A., Lt.	" " " 104
Prince, N. C., Capt.	Mobile Surgical Unit
Ray, W. B. G., Capt.	Base Hospital No. 27
Rayle, Albert A., Lt.	" " " 99
Rea, M. O., Lt.	" " " 102
Reed, Chas. B., Capt.	
Reed, L. V. H., Lt.	Evacuation Hospital No. 19
Reeds, W. A., Lt.	Base Hospital No. 109
Reid, Robt. W., Lt.	" " " 25
Rendich, Richard A., Capt.	" " " 37
Rhudy, B. E., Lt.	
Rhyne, S. A., Lt.	" " " 46
Roberts, Douglas J., Lt.	" " " 57
Roen, Paul B., Lt.	
Rogers, A. E., Lt.	Evacuation Hospital No. 16
Roland, M. M., Lt.	" " " 18
Ross, H. M., Lt.	
Rowe, Edw. W., Capt.	Base Hospital No. 49
Rowell, Edward E., Capt.	" " " 44
Royal, Warren M., Lt.	Replacement

Rudasill, Chas. L., Lt.	
Ruff, F. R., Lt.	
Ruggles, Howard, Capt.	Base Hospital No. 30
Rush, Weaver A., Capt.	" " " 81
Ryan, James A., Lt.	" " " 40
Salter, Oscar E., Lt.	
Sansing, Campbell, Lt.	" " " 71
Sargent, Wm. H., Capt.	
Saylin, Jos., Lt.	" " " 78
Sharpe, Abraham M., Lt.	Evacuation Hospital No. 32
Shearer, John S., Major	Headquarters, A. E. F.
Sheldon, Francis B., Lt.	Base Hospital No. 56
Shellito, J. C., Lt.	
Sheppard, Cyril E., Lt.	" " " 82
Sherman, Herbert De G., Lt.	Mobile Surgical Unit
Shreffler, A. R., Lt.	
Siebeneichen, Hugo A., Lt.	Base Hospital No. 110
Sinclair, Fayette A., Lt.	" " " 49
Singer, John J., Capt.	
Skinner, E. H., Capt.	" " " 28
Smart, Chester L., Lt.	
Smith, Elmer M., Lt.	
Smith, Eugene A., Capt.	" " " 22
Snider, Sam H., Lt.	" " " 28
Snow, Henry, Jr., Lt.	" " " 96
Spangler, Davis, Lt.	
Squires, Jas. W., Capt.	" " Yale Unit
Steiner, Jos. M., Capt.	" " No. 15
Stephens, Jamie D., Lt.	
Sterne, Henry P., Lt.	" " " 75
Stevens, Neil C., Lt.	Evacuation Hospital No. 23
Stewart, James E., Lt.	
Stewart, R. A., Lt.	
Stofer, E. S., Lt.	Base Hospital No. 14
Strahl, Milton I., Lt.	" " " 48
Strait, Bernard S., Lt.	Evacuation Hospital No. 19
Sturr, R. P., Lt.	
Swan, Guy H., Lt.	Base Hospital No. 38
Swanson, J. T., Lt.	
Tabb, John L., Lt.	
Teperson, H., Irving, Lt.	Evacuation Hospital No. 11
Thames, Eugene, Lt.	Base Hospital No. 81
Thatcher, Geo. I., Capt.	" " " 60
Thewlis, Malford W., Lt.	

Thomas, E. P., Lt.	Base Hospital No. 3
Thompson, A. W., Lieut.	" " " 23
Thompson, Harold B., Lt.	" " " 50
Thompson, Jas. C., Lt.	Replacement
Tompkins, Chas. R., Lt.	Evacuation Hospital No. 28
Tracy, J. Ross, Lt.	
Troxler, W. E., Lt.	Base Hospital No. 50
Turlington, H. C., Lt.	
Tyson, Ralph M., Lt.	" " " 38
Underhill, Chas. S., Lt.	Replacement
Van Korb, Wm., Capt.	Evacuation Hospital No. 27
Van Sweringen, Walter, Capt.	Base Hospital No. 84
Wahl, Edward W., Lt.	
Wainscott, Clyde E., Lt.	
Walker, Wallis, Lt.	Evacuation Hospital No. 11
Waller, Constantine P., Lt.	Base Hospital No. 128
Ward, James, Capt.	" " " 105
Watts, Wm. B., Lt.	
Weaver, Louis S., Lt.	Evacuation Hospital No. 14
Webb, J. A. H., Lt.	Base Hospital No. 61
Wellman, Graham O., Lt.	Evacuation Hospital No. 20
Wentworth, A. J., Lt.	Base Hospital No. 80
Wentz, M. C., Lt.	
Whitaker, Ben T., Lt.	" " " 63
Whitehead, L. J., Lt.	" " " 19
Wiatt, Robert G., Lt.	" " " 70
Wilcox, Clark A., Lt.	" " " 160
Wiley, Louis R., Lt.	Evacuation Hospital No. 9
Wilkinson, Boyd E., Lt.	" " " 15
Williams, James Neal, Lt.	Base Hospital No. 22
Wilson, E. T., Lt.	
Wiltrout, Irving G., Lt.	" " " 83
Witter, Calvin B., Lt.	Evacuation Hospital No. 20
Woisard, Jos. I., Lt.	Base Hospital No. 93
Woodall, Chas. W., Capt.	" " " 42
Wooding, Charles Edward	Evacuation Hospital No. 35
Woods, C. E., Lt.	Unit "I"
Woolsey, H. U., Lt.	Base Hospital No. 84
Wrenn, Frank, Lt.	
Wronker, Harry, Lt.	" " " 79
Wyatt, Jos. Harrison, Lt.	Mobile Hospital No. 100
Zimmerman, Geo. A., Lt.	Evacuation Hospital No. 49
Zulick, J. D., Capt.	Base Hospital No. 20

UNITED STATES

Alguire, Alden, Capt.	General Hospital No. 13
Anthony, Jos. E., Lt.	Base Hospital, Brownsville, Texas
Ashbury, Howard E., Major	Army Medical School, Washington, D. C.
Baetjer, F. H., Major	Johns Hopkins University
Baumgarten, Roy C., Lt.	Base Hospital, Camp Travis, Texas
Belden, Webster W., Lt.	General Hospital No. 10
Bethea, W. R., Capt.	Camp Shelby, Hattiesburg, Miss.
Blaine, Edw. S., Capt.	Camp Greenleaf, Ga.
Boice, Ralph H., Lt.	Camp Stuart, Va.
Bowers, S. C., Capt.	Camp Custer, Mich.
Brown, Percy, Major	General Hospital No. 10
Brown, Samuel, Lt.	Chillicothe, Ohio
Calloway, Fas. T., Lt.	Camp Gordon, Atlanta, Ga.
Carter, R. A., Lt.	Base Hospital, Ft. Sill, Okla.
Chandler, O. B., Capt.	Camp Dodge, Ia.
Childs, Donald S., Capt.	General Hospital No. 12
Cook, Albert G., Lt.	Ft. Omaha, Nebraska
Cooper, George H., Lt.	Base Hospital, Ft. Riley
Cooper, Jesse R., Lt.	Camp Merritt, N. J.
Copeland, Norman, Lt.	" Cody, N. M.

Cornman, Leighton R., Capt.	Camp Grant, Ill.
Cummings, E. S., Lt.	Fort Riley, Kans.
Damron, J. E., Lt.	Payne Field, West Point, Miss.
Davis, Charles J., Capt.	General Hospital No. 11
Dean, Horace B., Lt.	Linda Vista, Cal.
Dewey, James E., Lt.	Mobile Unit No. 101
Diemer, F. E., Capt.	American Lake, Wash.
Dunham, H. K., Capt.	General Hospital No. 19
Eckles, Samuel H., Lt.	Camp Hancock
Edwards, J. Bennett A., Capt.	" Dix
Eide, Alfred T., Lt.	General Hospital No. 22
Ferguson, Albert B., Lt.	" " " 4
Fickessen, W. R., Capt.	" " " 16
Finney, Guy A., Lt.	Base Hospital, Camp Jackson
Fishel, C. R., Lt.	Ft. Snelling, Minn.
Fitzpatrick, C. M., Lt.	Ft. Des Moines, Ia.
Gariss, Jos. L., Capt.	Camp Sherman, Ohio.
George, A. W., Major	" Devens, Mass.
Goldstein, Theo. P., Lt.	" Morrison, Va.
Greaves, Harrison A., Capt.	Hazelhurst Fld., Mineola, L. I.

Griggs, John B., Capt.	General Hospital No. 19
Guthrie, Michael B., Lt.	Camp Doniphan, Okla.
Harris, S. B., Lt.	Ft. Oglethorpe, Ga.
Hawkins, E. L., Lt.	Camp Sevier
Hawks, John D., Lt.	" Custer
Herendeen, Ralph E., Lt.	Bellevue Medical College, N. Y.
Herrmann, E. R., Lt.	Ft. Thomas, Ky.
Hirsch, J. Harry, Lt.	Walter Reed Gen. Hospital
Honeij, James A., Lt.	Army Hospital, New Haven, Conn.
Hoyt, Benjamin F., Capt.	Camp Johnson, Fla.
Johnson, Russell M., Lt.	" Humphreys, Va.
Johnson, Stuart C., Capt.	" Taylor, Ky.
Johnston, Geo. C., Lt. Col.	Surgeon General's Office
Jones, Z. G., Lt.	Fort Sam Houston, Texas
Kaigha, Chas. B., Lt.	General Hospital No. 8
Kail, Carl, Lt.	Hot Springs, N. C.
Kelley, Jas. F., Lt.	Camp Grant
Kennison, Wm. H., Lt.	Ft. Slocum, N. Y.
Kirklin, Byrl R., Lt.	Fort Bayard
Koloord, Theodore, Lt.	Camp Upton
Lanier, Leon, M., Lt.	" Pike, Ark.
Levering, J. Walter, Lt.	Oglethorpe
Le Wald, L. T., Major	New York, instructor
Liss, I. Edward, Lt.	General Hospital No. 16
Lutz, J. Fletcher, Major	" " " 2
MacRae, Raymond D., Lt.	Camp Lewis
McDeed, Winfield G., Capt.	" Lee
McKinney, J. T., Lt.	Emb. Hospital, Newport News, Va.
McLean, Guy M., Lt.	Ft. Monroe, Va.
Manges, Willis F., Lt. Col.	Camp Greenleaf, Ga.
Margulies, A. C., Lt.	General Hospital No. 9
Marshall, H. L., Capt.	Camp Meade
Merrill, Benj. E., Lt.	Post Hospital, Ft. Sill, Okla.
Ming, Chas. M., Lt.	Ancon Hospital, Ancon Canal Zone
Moffatt, F. J., Lt.	Camp Dodge
Moore, Jas. M., Lt.	" Lewis
Morgenlauder, Aaron M., Lt.	General Hospital No. 9
Newcomet, Wm. F., Capt.	Camp Gordon
Nims, Chas. H., Lt.	Alexandria, La.
Noble, Robert P., Lt.	Base Hospital, Camp Kelly, Texas
Nutt, G. S., Lt.	Base Hospital No. 97
Oechsli, A. B., Lt.	Jefferson Barracks
Palmer, Myron B., Capt.	Surgeon General's Office
Parker, Jesse O., Lt.	Camp MacArthur, Texas
Peden, Jos. C., Lt.	Base Hospital, Camp Zachary Taylor
Peters, Chas. E., Lt.	Camp Fremont, Cal.
Philips, Herman B., Lt.	" Mills
Podlasky, Harry, Lt.	General Hospital No. 1

Pomeranz, M. M., Lt.	Camp Lee
Postlethwaite, Frank McC., Lt.	" Douglas, Arizona
Powell, Eugene V., Capt.	
Priest, W. M., Lt.	" Sherman
Robinson, R. V., Capt.	" Pike, Ark.
Roepke, H. F., Lt.	" Greenleaf, Ga.
Rogers, Lewis L., Lt.	" " "
Ronayne, F. J., Capt.	General Hospital No. 20
Ryder, O. A., Lt.	U. S. War Dispensary
Samuel, Ernest C., Cont. Surgeon	Jackson Barracks, La.
Selby, John H., Major	Walter Reed General Hospital
Shanor, Chas. K., Lt.	Cornell University
Shawhan, Rexin C., Lt.	Camp Upton
Schimmelpgennig, Robt. D., Lt.	Coast Defense of Boston
Schneider, Henry K., Lt.	Post Hospital, Plattsburg Barracks
Simpson, Harry M., Lt.	Walter Reed General Hospital
Sprague, F. A., Capt.	Louisville, Ky.
Startz, Irving S., Lt.	Edgewood Arsenal, Md.
Stewart, John D., Lt.	Fort Oglethorpe
Stewart, Wm. H., Major	Ft. Des Moines
Sullivan, Michael F., Lt.	Fort McPherson, General Hospital No. 6
Swanberg, Harold, Lt.	Camp Greenleaf, Ga.
Sybenga, J. J., Lt.	General Hospital No. 3
Taylor, F. W. Howard, Lt.	Cornell Medical College
Thomas, Ray B., Lt.	Camp McClellan
Thompson, J. C., Lt.	General Hospital No. 17
Townsend, Leroy S., Capt.	Army Medical School
Tripler, Samuel, Lt.	Fort Ontario
Turner, L. L., Lt.	Base Hospital, Camp Eustis
Valensi, Albert, Lt.	General Hospital 24
Wang, Stanley L., Lt.	" " 21
Watters, Chas., Capt.	Camp Greenleaf, Ga.
Weitzner, Samuel F., Lt.	" Logan
West, Frederic B., Lt.	" Meade
West, Theodore S., Capt.	" Greene, N. C.
Wheat, A. F., Major	" Wheeler, Ga.
Wheatley, Frank E., Lt.	Oglethorpe
Wheatley, Louis F., Capt.	General Hospital No. 21
Whisler, Frederick M., Capt.	Camp Greenleaf, Ga.
Wilkins, Henry F., Lt.	Corpus Christi, Texas
Wise, Francis R., Lt.	Base Hospital, Ft. Logan H. Roots
Wolfe, H. D., Lt.	Camp Wadsworth
Wolfe, J. R. V., Capt.	" Upton
Young, Daniel W., Capt.	General Hospital No. 18, Waynesville, N. C.
Zimmerman, Harold	Letterman General Hospital, California

TRANSLATIONS & ABSTRACTS

Laborde, Simone. Le Radium et les Blessures de Guerre. (*Revue Interalliée*, 1918.)

Dr. Simone Laborde has applied radium to many different kinds of vicious scars with good results. The cicatrices were largely due to retractions, and adhesions. Application of radium for 20 hours about five times, with an interval of two weeks, very frequently brought total return of mobility and relaxation of adherent tendons and muscles, and restored the function to compressed nerves. About two-thirds of the cases of painful neuritis were ameliorated or cured, and the same number of cases of atonic, slowly-healing wounds were cured with dressings saturated with radio-active water. Painful stumps were also very often benefited by treatments of rather long duration.

Peer Lund.

Masmonteil, F. Roentgen Examination of the Diaphysial Fractures of the Forearm. (*J. de Radio. et d'électrol.*, No. 12, December, 1917.)

For examining a patient roentgenoscopically or roentgenographically in case of diaphysial fractures of the forearm, one must not be satisfied to examine merely the seat of fracture but the whole of the forearm including the upper and lower radio-ulnar articulation where often one may find important injuries. The roentgenograms must be taken with the forearm in two different positions. The principal one is the antero-posterior position with the forearm supinated. The other one, less important, a lateral view.

Peer Lund.

Levine, Isaac and Joseph, Barnett. Morphologic Appearance of Cancer Clinically Cured by Radium and Roentgen Ray. (*J. Am. M. Ass.*, No. 13, Sept. 29, 1917.)

A clinical cure of cancer can be considered to be the gross destruction of the primary tumor with disappearance of symptoms and the well-being continued for a sufficiently marked time to preclude the spontaneous remission of the disease. The clinical effect of radiation on malignant tumors was always thought to be accompanied by distinct morphologic changes, destruction of the tumor cells and connective tissue formation. The authors claim, after the microscopical observations and experimental studies, that while during the treatment with radium and x-rays the rays do not produce any marked change in the morphological appearance of the tumor, the proliferating power and thus also the clinical malignancy of the cancer cells are very deeply impaired. The proliferating power is markedly inhibited and there is produced a sterilization of the cancer cells. The degeneration of the cells and the connective tissue formation are the later stages in the life cycle of the cancer cells. In an untreated cell of a malignant tumor there is a rejuvenation before this later phase of life is reached, but the radiation arrests this proliferation and the natural degeneration occurs. Therefore the morphologic appearance of a radiated cell is not an absolute criterion of therapeutic effect of the rays. Only positive findings are indicative of results, while negative findings do not preclude that there was some influence caused by the rays.

Peer Lund.

Pauchet, Victor. Dilatation of the Duodenum. (*Arch. d'électric. méd.*, No. 428, May, 1918.)

In the course of abdominal operations, the surgeon often finds a dilatation of the duodenum, coincident with an intestinal kink of the last loop of the ileum and a dilatation of this loop.

In the x-ray picture the duodenum appears enlarged; in spite of intense peristaltic movement it empties only with difficulty. The last loop of the small intestine empties only after fifteen to thirty hours. This duodenal and iliac stasis appear to be due to a ptosis of the cæcum and the ileum, forming a kink (Arbuthnot Lane) with a traction on the mesentery and the mesentery vessels. As a result of this, there is a stasis and chronic toxemia and a general infection of the portal system.

The medical treatment consists of an abdominal support and abdominal exercises, and so forth. The surgical treatment would be ileosigmoidostomy with or without right cholostomy.

The patient with a chronic obstruction of the duodenum gets an acute dilatation of the stomach and duodenum with very grave symptoms. The acidosis of the stomach provokes a continuous aerophagia with acute distention of the stomach. This distention by accentuating the mesenteric kink causes duodenal blockage.

BARKER, LEWELLYS F. Oral Sepsis and the Digestive Apparatus. (*South. M. J.*, Vol. XI, No. 7, July, 1918, p. 481.)

The forms of oral sepsis most often responsible for disorders of the digestive apparatus consist of two groups: (1) alveolar infections secondary to diseases of the dental pulp; and (2) gingivitis, pyorrhea alveolaris, and infections around impacted and unerupted teeth. The first group includes: (a) acute peri-odontitis (apical, interradial or lateral) in which the tooth becomes tender, especially at night, and feels longer and looser than it should, so that mastication becomes painful, often resulting in an acute alveolar abscess (gum boil), in an alveolar parulis (or flat swelling under the periosteum), or in a chronic alveolar abscess, with a sinus, of the gum or face; and (b) proliferative peri-odontitis, that leads to granulons (apical, interradial or lateral), usually starting as a result of the devitalization of a tooth and imperfect treatment of the root canal, and causing no symptoms referable to the tooth or gums recognizable by the patient. It was the application of roentgenological technique to dead teeth that revealed the frequency of this condition, which is referred to often as "blind abscess." Any person who has devitalized teeth in his mouth does well to have them *x*-rayed at intervals in order that a proliferating peri-odontitis shall not be overlooked. From the second group of oral infections much toxic matter may be directly absorbed. Inspection of the mouth, palpation of the gums, and roentgenographic examinations make the diagnosis clear.

The varieties of disturbance of the digestive apparatus associated with these forms of oral sepsis are (1) gastritis and gastroenteritis, (2) achylia gastrica, (3) pylorospasm (concerning which the evidence is not yet extensive), and (4) a toxic hepatopathy. It seems probable that some cases of (5) gastric and duodenal ulcer are secondary to oral sepsis. There is still doubt as to whether (6) appendicitis and (7) cholecystitis may occasionally be due to metastatic infection from a primary oral focus.

Let us be somewhat sceptical and not attribute everything to oral sepsis. Yet we know that bad teeth may do much harm by causing trouble in other parts of the body. I do not think a tooth should be sacrificed unless the indications are clear for its removal. On the other hand, do not try to save teeth that can not be made aseptic, for there is real danger that they may injure the rest of the body.

BARKER, LEWELLYS F. Discussion—Symposium on Oral Sepsis. (*South. M. J., Nashville*, Vol. XI, Sept., 1918, p. 614.)

There is no point that is more generally overlooked by the general practitioner at present than the significance of oral sepsis in relation to other diseases. Cases of arthritis and cases of anemia have gone on for months without any attention at all having been paid to the teeth, and in which an examination of the teeth revealed serious sepsis of the mouth. Until the primary focus of infection has been removed but little result may be achieved by therapeutic efforts.

The renal complications of oral sepsis should have been emphasized. Nephritis is certainly not infrequently secondary to oral sepsis. It seems likely that a considerable amount of the arterial sclerosis and hypertension that develops in middle and later life has a relation to chronic oral sepsis. There are certain rundown conditions that turn out to be due to unrecognized oral sepsis.

In children the primary focus is more often in the tonsils or in the adenoids; in older people, more often in the teeth, the paranasal sinuses, or the gall-bladder.

Oral infection without distinct symptoms should be especially looked after, and the infection removed to prevent development of more serious disease. This is more important than to recognize oral infection after the heart valves have become involved or the joints have become crippled by arthritis; prevention is easier than cure.

With reference to their personal dental work, physicians should not permit the devitalizing of a tooth so that a bridge or crown may be put on, for now it is possible to attach bridges to live teeth.

B. DARLING.

Graves, M. L. Oral Sepsis and the Anemias. (*South. M. J.*, Vol. XI, No. 7, July, 1918, p. 484.)

Anemia constitutes but one of the clinical manifestations of infection, whether it originates in the mouth or elsewhere. It is a fairly constant symptom in all the grave infections and, to a more moderate extent, in the less severe ones. Cases, absolutely negative after careful examination and presenting mouth infections of a very bad character, have impressed me with the growing probability of the oral cavity being at least a nidus for or the portal of entrance of the infective agent producing pernicious anemia. Anemias of the secondary type, including streptococcal and pneumococcal and other infections of the blood, resulting in anemias, have often shown the mouth as the probable cause of infection.

I am not aware that the pathology or pathogenesis of leukemia has ever been determined, but considering the two principal etiological suggestions of (a) malignant neoplasm and (b) infection, my personal observation inclines me to look to agencies of infection as the probable cause. It may be urged that other sources are quite possible, but one cannot ignore the open sesame of the mouth infection.

Gibbes, J. Heyward. Oral Sepsis and Arthritis. (*South. M. J., Nashville*, Vol. XI, July, 1918, p. 489.)

Pyogenic bacteria are responsible for many forms of endocarditis, for gastric and intestinal inflammations, for the group of joint diseases, formerly designated as arthritis deformans, etc. A streptococcus or other type of infecting agent has been substituted for "uric acid diathesis." The treatment is now etiologic instead of symptomatic, and it is possible to prevent the development of many disabling diseases.

The mouth is the portal by which the largest number of disease germs enter the body.

There is a great group of diseases which can be properly investigated only through the *x*-ray. Films should be made of all devitalized teeth. *X*-ray inspection should also be made of apparently sound teeth as the viability of a tooth does not mean that the tissues about the neck of the root are normal. Proper interpretation of dental roentgenograms is a delicate question, and discrimination is required in deciding for or against the sacrifice of a tooth. Medical men are inclined to be radical in indicating extraction but dentists are inclined to treat teeth unquestionably diseased.

The roentgen ray often discloses a degree of infection and alveolar destruction that would pass unsuspected upon inspection alone. The roentgen ray is the method of precision in gingival and dental examinations.

But no one portal of entry for infecting microörganisms should be allowed to obscure the importance of investigating all possible sources of infection.

Beck, Harvey G. The Relation of Chronic Infection to Thyroid Deficiency. (*South. M. J., Nashville*, Vol. XI, July, 1918, p. 492.)

Glandular insufficiency is of common occurrence and frequently overlooked and chronic infections are almost invariably associated with glandular syndromes. That acute or chronic infectious processes have an etiological significance in either hyper- or hypo-functioning of the thyroid has been demonstrated clinically. The removal of chronically inflamed tonsils, gall-bladders, and appendices has been advocated as the first step in the treatment of Graves' disease, and frequently results in cure. Rheumatism shows a special tendency to involvement of the thyroid. Thyroid intoxication occurs in young women patients with focal infection in the form of alveolar abscesses, tonsillitis, and sinusitis; thyroid enlargement has been observed coincident with chronic gingivitis. In one case goitre symptoms were relieved after removal of abscessed teeth; in another, goitre, arthritis, and pyorrhea followed tonsillectomy, from which recovery followed treatment for the pyorrhea and extraction of an abscessed incisor.

The frequency with which oral sepsis and inflammation of the gall-bladder and appendix are associated indicates more than a casual relation. The administration of thyroid usually relieves the symptoms referable to thyroid deficiency but does not remove the source. Surgical measures must frequently be employed. With a clinical picture of hypothyroidism, the possibility of chronic infection should be suspected and diligent search made for foci, especially in the mouth, gall-bladder, and appendix.

B. Darling.

Wilson, Robert, Jr. Discussion Symposium on Oral Sepsis. (*South. M. J., Nashville*, Vol. XI, Sept., 1918, p. 610.)

Perhaps it is due to the enthusiasm of those of us who have been too hasty in advising the extraction of teeth which should not have been extracted, that many members of both the medical and the dental professions have been slow in accepting the truth about oral sepsis. The importance of curetting the cavity after the extraction of a tooth should be emphasized. The physician, himself, in consultation with the dentist and the roentgenologist should reach a decision as to whether or not the tooth should be extracted.

Richardson, Edward H. Discussion—Symposium on Oral Sepsis. (*South. M. J., Nashville*, Vol. XI, Sept., 1918, p. 611.)

Chronic infections have to be considered seriously in their relationship to the disturbances of the endocrine glands. There are certain possible explanations as to how a chronic infection may bring about a thyroid deficiency. One is that there is an absorption of toxins from the focus of infection (with a specific injurious effect on the parenchyma of the thyroid). A second possible explanation is that the chronic absorption of toxins from the focus of infection might bring about chronic inhibition of the thyroid gland through the central nervous system. A third possible explanation might be that chronic foci of infection disturb the normal balance which is believed to exist between the different units of the endocrine system, and there may be inhibition of the thyroid gland through hyperactivity of another unit. A fourth explanation is that it is a metabolic phenomenon.

Granger, A. Improved Model of the Granger Localizer. (*Journal of Roentgenology*, Vol. I, No. 2, August, 1918, p. 127.)

Granger's device belongs to the general type of the pierced-screen, parallax combination, in which, briefly, a transparent—to *x*-ray—base, *A*, placed underneath the patient, contains an easily recognized opening, *B*, and carries an upright standard, *C*. On this standard is carried a pointer, *D*, and a fluorescent screen which has in its center a pencil hole, *E*. In the general type the screen is adjustable up and down, and the pointer both up and down and to and fro. *B* and *E* are in a vertical line and *D* is in a plane with that line.

In Granger's device, upright *C* is attached to an independent base which may be easily attached to or removed from the base *A*. *A* has a scale with zero at *B*, and *C* has a scale with zero at *A*. *D* and *E* are adjustable in the vertical plane through sleeves. The opening, *B*, is one inch square and the base, *A*, carries a grid of six 1/8-inch brass bars. Three of these are imbedded in the base from end to end, two forming the right and left margins of the opening, *B*, while the third bisects it. The three cross bars of the grid are so placed that two form the near and far margins of the opening, *B*, and again the third bar bisects it. The grid therefore occupies the opening, *B*, while the three long bars extend to either side.

The center of *B* is marked by a 1/32-inch hole through the center of the grid. The shadow cast is that of a six-bar grid, the three uprights of which extend from the near and far sides. The instrument is used on any transparent—to *x*-ray—top table, having a protected movable tube underneath.

In use base, *A*, is adjusted underneath the patient so that the shadow of the foreign body overlies the center of the shadow of the grid. The screen is then adjusted so that the pencil hole, *E*, also overlies the foreign-body shadow, and the skin is marked at this point. The shadow of pointer, *D*, will be seen to overlie or approximate the shadow of the middle upright of the grid. The tube is now shifted so that the foreign-body shadow follows the middle cross bar of the grid from its middle to its intersection with one of the outer bars—say the right. Now, with the tube remaining fixed, pointer *D* is moved up or down until its shadow overlies or approximates this outer bar as it did the middle one in the first position. The pointer is now advanced to produce a second skin mark and the required measurements are read off on the scales. In other parallax instruments one has to shift pointer and tube until a position is found where the shadow of the pointer indicates the shadow of the foreign body with any tube position. With Granger's improvement, this operation is reduced to one easily determined motion. Rapidity and accuracy are promoted.

D. R. Bowen.

E. W. Caldwell

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A DESCRIPTION OF THE CALDWELL STEREOFLUOROSCOPE

BY LIVINGSTON MIDDLEDITCH, JR.

Captain, Sanitary Corps, U. S. A.

THE Caldwell stereofluoroscope is so arranged as to make possible stereoscopic vision by the alternate excitation of two *x*-ray tubes and by the selective presentation of the screen images to the observer's eyes. F_1 and F_2 in Fig. 1 are the focal spots of the two tubes alternately excited, B is the body under examination, and E_1 and E_2 are the observer's two eyes.

The two tubes are flashed in turn, F_1 giving off rays when F_2 is inactive, and vice versa. These short flashes produce different images on the screen owing to the displacement of the two tubes from each other. The images are present at alternate, very brief intervals and they overlap on the screen so that the resultant appearance is a confusing mixture of the two stereoscopic images. A shutter is placed just in front of the eyes, so arranged that during the instant that F_1 is excited E_1 can see the screen and E_2 cannot, and during the instant F_2 is excited E_2 can see the screen and E_1 cannot. This shutter, alternately permitting the eyes to see the screen in synchronism with the flashes of the two tubes, serves as a selector of the two stereoscopic images, which are displaced in point of time but not in point of space. Thus each eye sees only the one image that is intended to reach it for stereoscopic vision. The period of lag of fluorescence in the crystals of the screen is well within the period of persistence of an image in the eye, so that the observer is conscious only of a continuous image similar to that produced by the successive images of a moving picture. Here, however, sixty images appear to the eye in each second, and in the motion picture only sixteen.

The general arrangement of the machine as shown in Fig. 2 (the photographs illustrate an early model, none of the later design being available) is as follows: (1) is the transformer which supplies power to both tubes; (2) is the box containing the tubes and diaphragms; (3) is the table frame, with bakelite stretcher top omitted; (4) is the screen mount; with shutter and viewing holes at (5); and (6) is the apron in which the operator stands and from which he controls the movements of the tube and screen and the electrical operation of the tubes. The tubes and screen are always maintained at constant distance from each other but they may be shifted into any position up and down, to bring the screen close to the part being examined, or laterally and lengthwise of the table. The stretcher top carrying the patient may also be shifted lengthwise on the table, so the adjustment of the machine to the part under examination is a very easy matter. Fig. 3 shows the machine in use.

Screen and Shutter.—The fluoroscopic screen is made circular in shape and a small size is provided as well as the regular large size to enable it to be brought down close to certain parts inaccessible with the large screen. Both screens are mounted in deep bakelite casings which may readily be kept sterile and serve to protect the screens from blood and disinfecting solutions. The upper surface of the screen is, of course, covered over by lead glass which serves as a protection from the *x*-rays.

The shutter, from the standpoint of design and construction, is the most difficult feature of the whole machine.

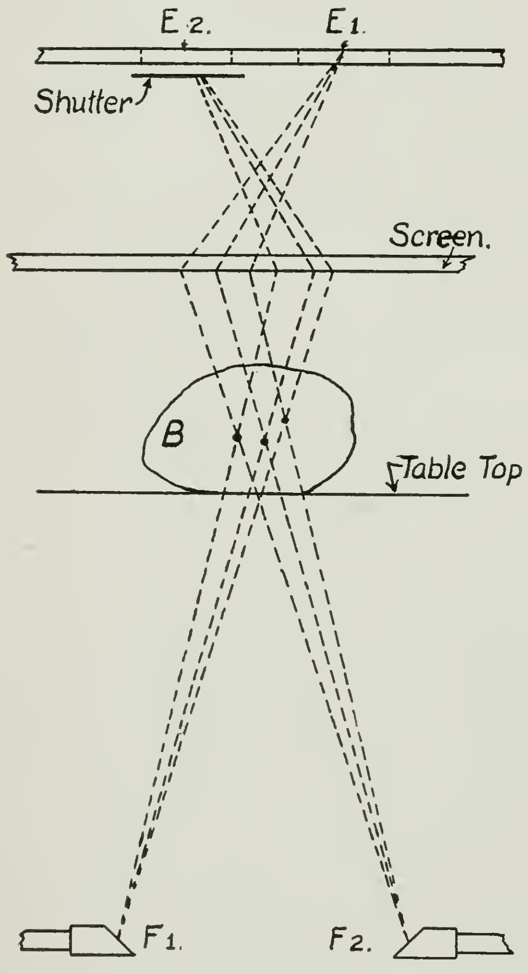


Fig. 1. Arrangement of Tubes, Screen and Shutter.

It must synchronize absolutely with the illumination of the screen, which is produced by successive alternations of the supply current to the transformer as described later. If the machine is being operated on 50-cycle current, there will be fifty impulses through each tube every second and the shutter must run absolutely synchronous if stereoscopic vision is to be possible. The shutter, which is quite similar to a moving picture shutter, has three wings which serve to cut off the vision through the eye holes and three open segments which allow the light to pass. Fig. 4 shows the shutter in relation to the eye holes.

The driving of the shutter is accomplished by making it the rotor of a motor, the field windings surrounding it and placed just beneath the face plate. The electrical details of this motor need not be gone into further than to say that it is a salient-pole type of synchronous motor similar in principle to those used to drive the high tension rectifiers of *x*-ray machines. The problem of starting and running on a single phase line has not yet been satisfactorily solved. Meanwhile the shutter is operated on two phase current from a small auxiliary converter. While it is theoretically possible to obtain two phase current from single phase by properly balancing two circuits containing respectively an inductance and a condenser, the difficulties encountered have made it too delicate and temperamental a balance for practical work up to the present time. Major Caldwell was very much interested in this matter of phase-splitting and hoped to eliminate the auxiliary two phase convertor. The great difficulty with all synchronous motors of this type is that they have very little torque to hold them in synchronism; and no torque for starting unless an auxiliary split-phase starting winding is provided. It is hoped to obtain a motor that will be easily started from a single phase line, that will hold synchronism well without oscillation or "hunting," and if possible, to operate over such a

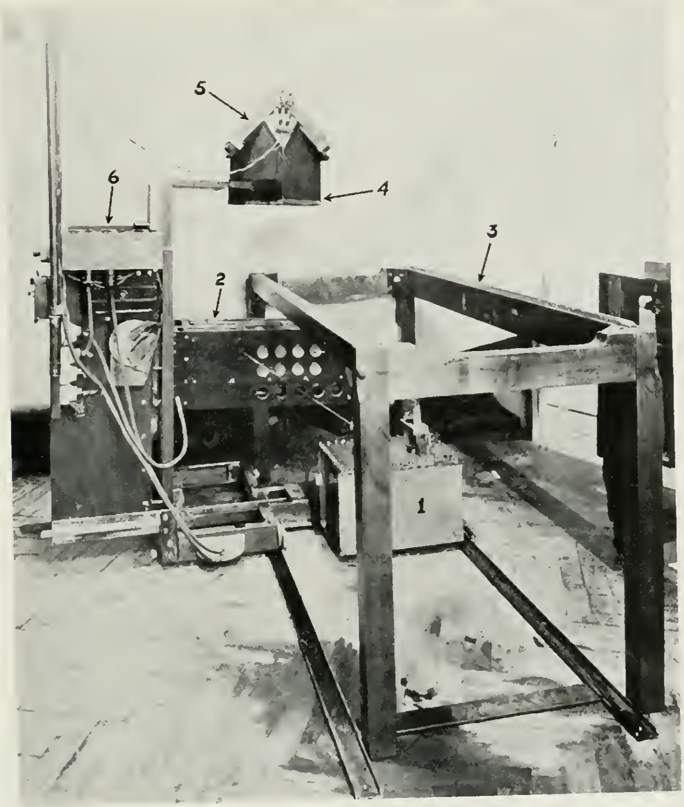


FIG. 2. GENERAL VIEW OF THE APPARATUS. TABLE TOP REMOVED.

FIG. 3. STEREOFLUOROSCOPE IN USE. TUBES AND SCREEN MAY BE SHIFTED IN THREE DIRECTIONS.

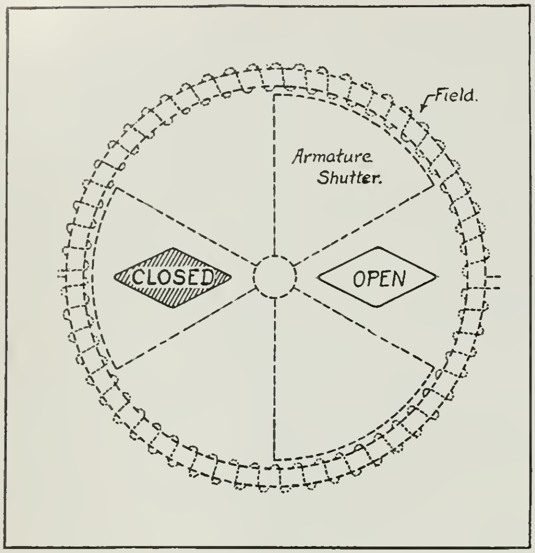


Fig. 4. Plan of Shutter and Its Relation to the Viewing Apertures.

range of frequencies as will be encountered in the military service abroad.

Tubes and Diaphragm.—For the production of a good stereoscopic screen image it is essential that the radiation from one tube be very closely the same as that from the other tube, both as to penetration and intensity. The gas tube presented great difficulties in the stereofluoroscope, since it was almost impossible to obtain two tubes that would give equivalent radiation and would continue to do so. The Coolidge tube, which is under control as to current and penetration, offered a very satisfactory solution of this difficulty.

Two self-rectifying Coolidge tubes are used, but owing to space considerations they are smaller than the ordinary size of self-rectifying tube as used on the U. S. Army Portable Unit and Bedside Unit. No mechanical rectifier is needed in the operation of these tubes and a source of considerable trouble is eliminated. These tubes are so connected that one will allow current to pass on one direction of the alternating voltage from the transformer and the other tube will allow it to pass on the wave in the other direction. By this connection the tubes are made to flash alternately, and there is eliminated the objectionable high inverse voltage which is present in the operation of a single self-rectifying tube. The filaments are lighted by two transformers, included in the case with the high tension transformer, and means are provided to balance them to give the same current on each tube, and when balanced to increase or decrease both tubes alike.

The tube box is provided with a double diamond shaped diaphragm controlling the

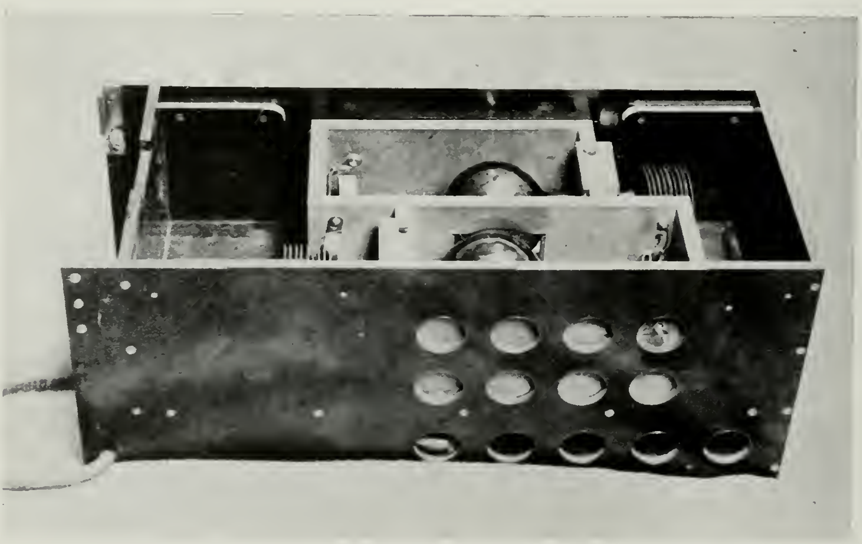


Fig. 5. Tube Box, Showing Special Coolidge Tubes. Diaphragm Removed.

rays from both tubes by a single handle, since they do not require individual control. The diaphragm control is in the operator's left hand as shown in Fig. 3. The tube box, with the diaphragm removed, is shown in Fig. 5. The box is constructed of lead-loaded bakelite.

Electrical System.—The electrical system is shown in approximate diagram in Fig. 6. It is fundamentally a simple apparatus and the electrical circuits are likewise simple. The main line is assumed to give alternating current, and it supplies the main primary, the filament, and the shutter circuits. In case the available supply were D. C. a rotary converter would be used

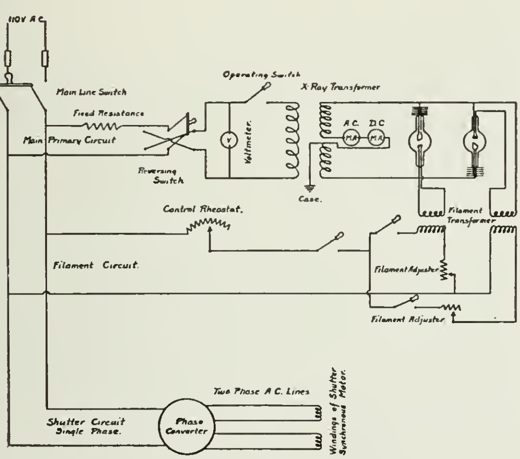


Fig. 6. Diagram of Electrical System of the Stereofluoroscope.

with an extra pair of slip rings to give the desired two phase current for the shutter and the phase converter would be eliminated. The remaining circuits, however, would be unaffected except that all current would have to pass through the rotary. The main primary circuit includes simply a fixed resistance, a reversing switch and the operating switch. The filament circuit includes a rheostat control lever (in the operator's right hand, Fig. 3), this rheostat controlling the current through both tubes. Adjustment resistances are used, as shown, to balance the current through the tubes individually. Note that the tubes are connected to the high tension lines oppositely, and that the two filament transformers are needed for insulation purposes. A single transformer could not be employed to light both filaments in this connection.

Control.—When resistance is included in the primary circuit of a transformer an increased current demand results in a lower voltage from the secondary. This feature is inherent in all rheostat controlled x-ray machines and is decidedly a disadvantage in roentgenography. As applied to the stereofluoroscope with a fixed resistance of the proper size it makes a very simple and practical method of control. In using a high gap for fluoroscopy very little current is needed for good screen illumination; and in using a less penetrating ray for greater contrast in the image between soft and dense parts, a larger current becomes necessary. By moving the control lever the current and voltage are changed oppositely, but so that the resultant screen brightness is nearly constant. Fig. 7 shows such a relation between current and voltage. This makes

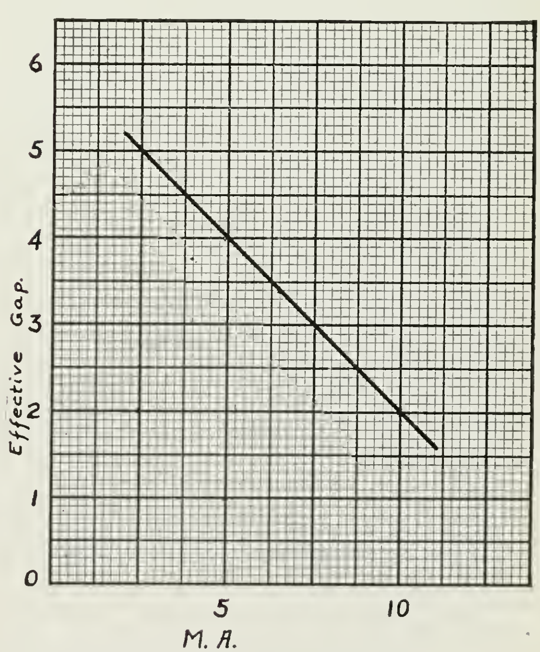


Fig. 7. Chart Showing Relation of Voltage to Tube Current.

an exceedingly convenient control for fluoroscopic work and renders available a range of penetrations for getting the greatest possible information out of the fluoroscopic examination and to give the best stereoscopic image in a particular case.

Meters.—The following meters are used. A. C. voltmeter; A. C. milliammeter; D. C. milliammeter. The A. C. voltmeter is connected across the primary lead wires of the step-up transformer and by measuring the voltage maintained at the primary it serves as an index of the secondary voltage applied to the tubes. It is in this case a reliable guide since the difference between maximum and minimum current is not so great as on a large *x*-ray transformer where such a meter is not of very much service.

The two milliammeters read respectively the sum and difference of the currents flowing in the two directions through the secondary of the transformer. Both meters are inserted at the grounded mid-point of the secondary in order that they will be safe to touch and may be placed conveniently near the operator. The tubes being in proper balance the direct current meter should read 0 m. a. If the needle swings to the right, the tube to the right is drawing an excessive current by the amount indicated; and if it swings to the left, the left tube is drawing the most current. So long as the tubes draw the same current, no matter how much or how little that current might be, this meter will indicate zero. The A. C. milliammeter gives an indication of the total current and serves in that way as an operating guide. It may be remarked that if the two tubes are balanced as regards current they will be operating on the same working voltage, but if they are not balanced in current they will not be balanced in voltage, the tube with the heavier current receiving the lower voltage. The meter board detached from the machine is shown in Fig. 8.

Pseudoscopic Image.—If the shutter is thrown into synchronism in the wrong position the image on the screen which should be presented to the right eye will be presented to the left and vice versa. The resultant image in space will now appear above the screen instead of below it, and will be pseudoscopic instead of stereoscopic. The image will undergo a transposition symmetrically with respect to the screen. It then becomes possible to insert a pointer to the interior of the image and to measure the actual distances between different landmarks. Or, if the pointer be connected to a pantographic apparatus, it becomes possible to trace the image and produce a cross sectional drawing of the part being examined. The change between the pseudoscopic and stereoscopic images is readily made by means of a reversing switch in the main primary circuit.

Fig. 8. Meter Panel Detached from the Machine. Showing primary voltmeter, secondary a-c. milliammeter, and secondary d-c. (load balancing) milliammeter.

Usefulness of the Stereofluoroscope. — Nothing has been said herein concerning the actual use of the machine and its application to problems of the x-ray examination, to diagnosis, or to the localization of projectiles. It is unwise at the present time to give much more than a description of the apparatus since sufficient operating experience is not at hand upon which to base further study. Major Caldwell himself took the attitude that only by long and continued use under actual working conditions could a rational opinion of its usefulness be formed, and until this is done judgment may best be withheld. One of the machines has recently been shipped, and will be put overseas to the test of real service.

THE RATIONALE OF RADIOTHERAPY IN UTERINE HEMORRHAGE

The roentgen-ray destroys the Graafian follicle, which in turn controls menstruation, and hence menstruation can be controlled by the use of the *x-ray*. Similarly, abnormal uterine bleedings can be controlled, as the majority of them arise from disturbances in the menstrual mechanism, and not to local mechanical causes.

Radium also possesses a local cauterizing effect on the uterine cavity. In women of the late child-bearing period radiotherapy is the procedure of choice. In girls radiotherapy should be used as a late procedure. The induction of an artificial menopause for economic reasons is possible. Whether it is justifiable or not is a matter for discussion.

In fibromyomata associated with bleeding, the same result, amenorrhea, follows, as it does in uterine bleeding, from a grossly normal uterus. The fibromyomatous mass shrinks as a result of the radiotherapy to a marked degree, often to an extent that permits the mass to escape palpation. Unless the fibromyomata cause symptoms, they should remain untreated. Radiotherapy is the treatment par excellence, when hemorrhage is the only symptom, because it reduces the condition to the symptomless class. Since the amenorrhea should be permanent, radiotherapy is particularly ind cated for women of thirty-eight years or over, while it should be restricted more and more as the age is lower. Where mechanical symptoms predominate they are best treated mechanically, *i. e.*, by operations.

The uterine bleeding as treated in eight girls was controlled with varying success in all cases. In three the menses became almost normal; in five an amenorrhea of varying duration was induced. In one instance there were severe hot flushes for a period covering nine months.

Radium appears to exert the same influence as x-ray therapy. The advantage of radium over the x-ray is that one treatment carried over twenty-four hours usually suffices for results. With the x-ray, the treatment is spread over six to ten weeks. Uterine hemorrhage from any cause may be stopped by the intrauterine application of radium. Hemorrhage from disturbed menstruation with or without fibromyoma may be controlled by the x-ray. Practically all fibromyomata will shrink to a satisfactory degree after radiotherapy, while no harm results.

All cases of hemorrhage from a grossly normal uterus in women of thirty-eight or over should be treated by radiotherapy after carcinoma has been ruled out by a diagnostic curettage. In younger women radiotherapy should be used only as a late resort. For uterine hemorrhage associated with fibromyomata of the uterus, radiotherapy is indicated, if symptoms from mechanical causes are absent and the woman is over thirty-seven years of age. —J. A. Corscaden, *American Journal of Obstetrics*, February, 1918.

THE STEREOSCOPE IN ROENTGENOGRAPHY *

BY EUGENE W. CALDWELL, B.S., M.D.

IT IS well known to all of us that the roentgenogram is only a shadow picture, and that for this reason we sometimes have difficulty in interpreting it correctly. We are accustomed to drawings and photographs which give us a fair idea of perspective, and most of the so-called errors of the *x*-ray are due to our failure to regard the roentgenograph not as a photograph or drawing, but as a shadow picture or silhouette. It is true that roentgenographs used in diagnosis differ from the black and white silhouette because the *x*-rays penetrate more or less readily every part of the human body and therefore give us shadows which vary in intensity according to the varying thickness (and opacity to *x*-rays) of the different structures through which they pass.

The shading thus produced gives us an impression of perspective which may be accurate enough to show the cylindrical form of some of the bones, but it gives us little or no idea of the distances between different parts in a direction perpendicular to the plane of the plate. In order to show all of the space relations it is therefore customary to make two roentgenograms in which the plane of the plate and the general direction of the rays are arranged at an angle of ninety degrees from each other.

For examination of fractures of the long bones, and for localization of foreign bodies which lie very near the surface, this method is sufficiently accurate. It is easily carried out, and in such cases is probably the most practical procedure. There are, however, certain parts of the body, as the shoulder and hip-joint, where for obvious reasons we can obtain a roentgenogram only when the rays pass approximately in the sagittal direction, and a second roentgenogram from a position at right angles from the first is practically impossible. For the localization of foreign bodies lying far below the surface, and which cannot be brought close to the plate, the above method is not sufficiently accurate, unless the direction of the rays which cast the shadow of the foreign body in each roentgenogram is as nearly as possible perpendicular to the plane of the plate. This condition may be obtained by first ascertaining the position of the foreign body with the fluoroscope, then arranging the photographic plates and the source of the roentgen-ray in correct positions. Several very ingenious appliances have been designed for accurately carrying out this technique.

It is obvious, however, that if a foreign body can be plainly shown on the fluoroscopic screen in two positions, the localization thus obtained is so satisfactory as to make roentgenograms unnecessary. In practice, we find that many cases of foreign bodies which the fluoroscope fails to show sufficiently well for such localization, or perhaps does not show at all, may be readily shown by the roentgenograms.

It is evident, therefore, that any process which will lend perspective to our plates, especially to those which show foreign bodies or injuries in the shoulder and hip-joint, will have a fine field of usefulness.

Our normal appreciation of the space relations of the things we see is a complex process, and is dependent upon a large number of factors which I shall not undertake to discuss in this paper. The most important of these factors are: First, the fact that the size of the image on the retina varies with the distance of the object; secondly, the fact that our two eyes see from slightly different points of view. Therefore we have two pictures from which the brain by an obscure process of triangulation unconsciously estimates the varying distances of different objects.

* This paper was probably read before a New York medical society about 1906. But we are unable to find a record of its publication.—EDITOR.

In the ordinary photograph, or drawing, the image on each eye is practically the same as if the object were viewed with one eye; that is, the picture presented to each eye is the same. If, however, we have two photographs made from points of view differing by a few inches, or approximately the distance between the two eyes, and view them in such a way that the two pictures are presented to the two eyes separately, we obtain this effect of triangulation, and the impression of perspective is much heightened. This principle is employed in the ordinary Brewster stereoscope and in the small stereoscopic views of Indian temples and ruins of Egypt familiar to all of us.

Soon after the roentgen-ray came into use Professor Elihu Thomson suggested that a pair of roentgenographs in which the two pictures which are made with a tube displaced about the distance between the two eyes when viewed in a stereoscope, would give us the effect of perspective. Early in 1896, Thomson reported some experiments of this nature in the *Electrical Review*, and since that time a large number of experimenters have made improvements in the apparatus for making and viewing roentgenographs of this sort.

In the ordinary Brewster stereoscope the size of the pictures is limited to about 2½ inches in width, or a little more than the distance between the pupils of the eyes. By far the great majority of our roentgenographs must be much larger than this, and we must either reduce them to the size suited to the ordinary Brewster stereoscope, or employ some other means of viewing them stereoscopically.

Early in 1897 Dr. Mackenzie Davidson of London devised a special means for conveniently making the stereoscopic roentgenograms, employing the Wheatstone stereoscope for viewing them. With the Wheatstone stereoscope we may use pictures of any size used in roentgenography. In this instrument the two pictures are placed opposite each other, and are viewed in two mirrors placed between them at right angles to each other in such a way that the right eye sees the reflection of one picture and the left eye the reflection of the other.

In viewing stereoscopic pictures it is supposed that the distance of the reflected beam of light from the eye to the picture should be about the same as the distance between the source of the x-ray and the plate when the plates were made. Theoretically this condition would seem important, but in practice it is found that the distance from the eye to the plate may be varied within wide limits. It is of course essential that the two plates should be adjusted to the same level so that the images would coincide at every point. In most of the Wheatstone stereoscopes, means are supplied for adjusting the plates until this condition is obtained. In order to assist in leveling up the pictures it is very valuable to place over the plate when the exposures are being made a ribbon of wire or metal which casts a shadow on the plate, of which the edge is parallel to the direction to the movements of the tube in the two exposures.

In viewing stereoscopic pictures the impression of perspective, which is due almost entirely to the fact that having the two points of view and the variations in the size of the images of the different parts according to the distances from the observer, is practically absent in the roentgenogram, and gives us no help. We may readily reverse the position of the two plates and thus obtain a pseudo-stereoscopic effect, and make the parts which were more distant in one position appear even nearer in the other.

In making exposures for a pair of stereoscopic roentgenograms it is necessary that the movements of the tube be in a line parallel to the base line of the plates, as was before suggested, and that there be no change in the position of the subject during the two exposures. In Mackenzie Davidson's apparatus for making stereoscopic exposures the tube is held in a holder attached to a beam supported above the plate in a direction parallel to its base. The object to be examined is supported upon a box with a sheep-skin top, which material offers very little obstruction to the *x*-rays. The two plates may then be slipped under the sheep skin, removed and replaced without disturbing the position of the subject. The envelopes in which the *x*-ray plates are ordinarily enclosed are considerably larger than the plates themselves. Therefore we cannot depend upon the side of the plates for a base line. In roentgenograms we have no horizon, and it is therefore difficult to obtain this base line without some artificial means. Mackenzie Davidson accomplishes this very important feat by stretching across the sheep skin a wire parallel to the beam supporting the tube. The method of using this apparatus is very simple. The plate is inserted under the sheep-skin top of the box. The exposure is made. This is removed and replaced by another plate, the tube holder moving along a horizontal bar the desired distance. The second exposure is made in the same way. The displacement of the tube in the two exposures depends, of course, upon its distance from the photographic plate and to some extent upon the thickness of the parts to be roentgenographed. If the movement is too small the stereoscopic view is flat and lacks perspective; if it is too large we get an exaggerated impression of distances and a very tiring effect upon the eyes. In practice, however, a considerable range in the amount of this movement may be made without loss of the stereoscopic effect. The source of the *x*-ray is then about 12 inches from the plate and the best results will be obtained when the tube is moved through a horizontal distance of about 2½ inches. If the distance between the tube and plate is increased the distance of the movement should be correspondingly increased, but if the object to be roentgenographed is very thick and the distances between the different parts are great, a smaller horizontal movement should be made than in the case where the object is small and every part of it lies close to the plate. The work of Thomson and Mackenzie Davidson is the foundation of all that has been done in stereoscopic roentgenography. Davidson's method of making the exposures has been universally employed, with various improvements and modifications, and the Davidson Stereoscope for viewing the roentgenograms has been more extensively employed in this country than any other design. Dr. L. A. Weigel of Rochester, Dr. A. B. Johnson of New York, Dr. Hultz of Grand Rapids, Michigan, and others have added valuable improvements to the technique of the apparatus.

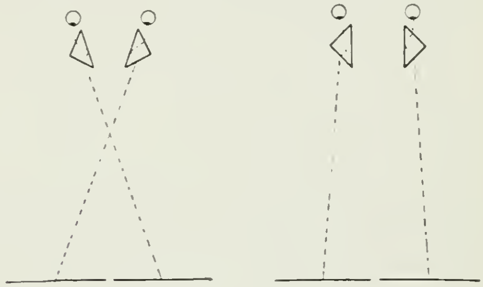
The stereoscopes of Weigel and Johnson are both constructed on the Wheatstone plan and are fitted with many conveniences which adapt them for use with roentgenographic negatives. Johnson's stereoscope is provided with a bellows between the two mirrors and the roentgenographic negatives, to exclude diffused light, and to enable the negatives to be examined in a lighted room.

The difficulty and some tedious technique of making stereoscopic roentgenograms and the clumsiness and variety of adjustment necessary for viewing them in the Wheatstone stereoscope have prevented this method from coming into general use. It is obvious that if two stereoscopic roentgenograms can be permanently mounted together, as by the ordinary stereoscopic photograph, it would save many difficulties of leveling and adjusting and would materially help toward bringing the art into everyday practice.

Dr. Walter of Hamburg has described in the *Fortschritte auf dem Gebiete der Roentgenstrahlen* for October, 1902, a number of stereoscopes which accomplish this result. The first of these is a mirror stereoscope, which is like a large Wheatstone stereoscope with two additional mirrors which reflect the light so that the two pictures may be placed in the same plane. Doctor Walter has pointed out that in all mirror stereoscopes there is a reflection from the surface of the glass as well as from the silver at the back of the mirrors which causes some blurring of the images. The mirror stereoscope of Walter's is really a modification of the Helmholtz stereoscope which was designed for viewing distant objects with a general appreciation of distance. Doctor Cowl of Berlin has shown that if the two outside mirrors of this arrangement be so placed that they may be rotated by a vertical axis to bring the pictures into alignment, a much smaller device than that of Walter's may be used. In Doctor Cowl's stereoscope the mirrors are about $1^1/_8$ inches square and are placed very close to the eye.

The writer has found that the blurring of the images by reflection from the surface of the glass may be entirely obviated by substituting for mirrors right-angle reflecting prisms. When the prisms are used the beam of light enters and emerges from the glass in a very nearly perpendicular direction. There is little reflection, and it is in such a direction as not to enter the eye. Walter in the article mentioned describes also a prism stereoscope for viewing large pictures. He has suggested turning the prisms on a vertical axis to see the crossing of the images and reversal of the picture. He points out the fact that with this prism stereoscope there is a distribution of the rays by the prisms and color effects are produced. This he says may be obviated by the use of achromatic prisms, which are difficult to obtain and very expensive. He concludes by stating that the best form of stereoscope is that which he calls his lens stereoscope. This is really a combination of a camera and the ordinary Brewster stereoscope. By the camera lens the images of the pair of roentgenograms to be examined and which are of proper size for the Brewster stereoscope, are produced. Behind the lens of the camera are placed the two lenses of the ordinary Brewster stereoscope. The separate image is thus presented to each eye as though the eye were viewing the plates through a telescope. Walter has pointed out the fact that in this instrument it is necessary to use in the camera a lens of wide aperture and very short focus. Such a lens as Walter suggests is quite expensive, but is a very useful piece of photographic apparatus. Although very effective this lens stereoscope of Walter is much too expensive as well as too complicated to come into general use.

For some time I have been using a prism stereoscope, the principle of which I supposed was new, but recently I have found that this arrangement of prisms for viewing stereoscopic pictures is very old.



Indeed I have been unable to find out with whom it originated, and whom to credit for it.

The prisms in this apparatus are standard right angle 25 millimeter prisms. They are arranged to be rotated at a vertical axis. The direction of the beam of light through the prisms is such that it suffers total reflection, and we therefore see a mirror picture of the roentgenogram. Another effect of this reflection is that the dispersion of the beam of light as it enters the prism is corrected as it emerges. Chromatic effects are therefore obviated and it is unnecessary to use achromatic prisms. This instrument is smaller than an opera glass, and the adjustment of the angles of the prisms is made in a way somewhat similar to the focusing of an opera glass. The advantages of the instrument are its small size and its comparatively low price. With 25 millimeter prisms one may view stereoscopic pictures of any size up to 12 x 24 inches at a distance of two to three feet. Pictures larger than this cannot be conveniently mounted side by side, and I am inclined to think that they can be viewed in the Wheatstone stereoscope with more satisfaction.

I have found it very convenient to make two stereoscopic negatives on the same plate. This method obviates all difficulty of adjusting the two pictures to the same level, and prevents the possibility of a pair of them being separated. Obviously it also saves time and trouble in every stage of making the negative.

SUPPLEMENTARY NOTE

SINCE the foregoing article was written, changes have been made in the general design of the prism stereoscope but the optical principles are unaltered.

Each prism is mounted on a pivot which, in turn, is mounted on a plate. The necessary angular relation is obtained by swiveling the prisms on their pivots and the necessary inter-pupilary distance is obtained by symmetrically separating the plates.

It is plain that both these motions must be symmetrical and that the swiveling and separating must be movements independent of each other. The mechanism by which these motions are accomplished is illustrated in Fig. 1, which shows an under view of the apparatus. The separation of the prisms is accomplished by the lower shaft and, by virtue of its engagement with the right and left threads, the prism bases are symmetrically separated by the knurled head at the left. The angular relation of the prisms is obtained by rotation of the upper shaft in the illustration. The same knurled head is utilized by simply shifting it into engagement with the squared upper shaft. The prism bases are directly connected to the squared upper shaft through levers which contribute angular motion to the prisms themselves. A study of the picture will show that rotary motion of this upper shaft will result in swiveling the prisms equal amounts. As the worm wheels are slidably mounted on the upper shaft, rotation of the latter affects only the angular relation of the prisms, conversely the same slidable motion makes the angular position of the prisms independent of any rotation of the lower shaft.

Two star spring washers, one on each prism pivot, afford enough friction to hold each prism in any angular relation to which it may be adjusted.

A general view of the prisms and their relation to each other is shown in Fig. 2. Fig. 3 shows the apparatus equipped with suitable mounting and blinders. —[HANCHETT]

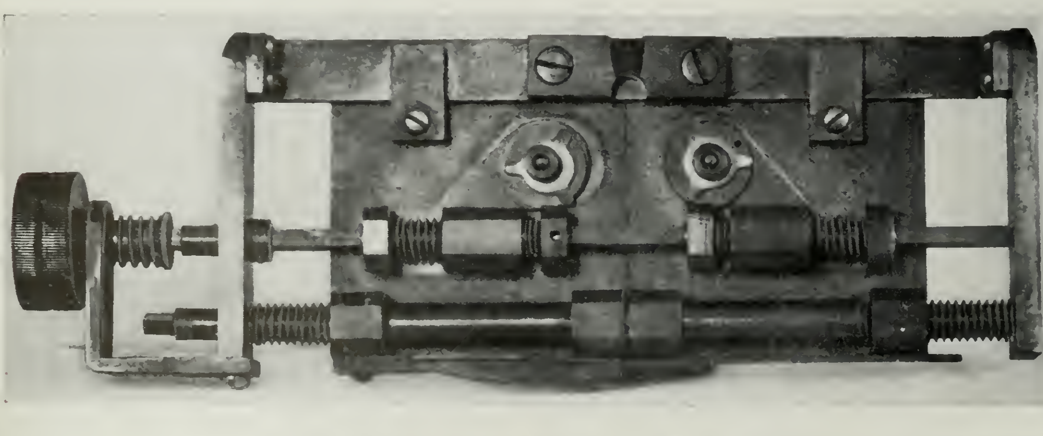


FIG. 1. UNDER VIEW OF THE CALDWELL PRISM STEREOSCOPE.

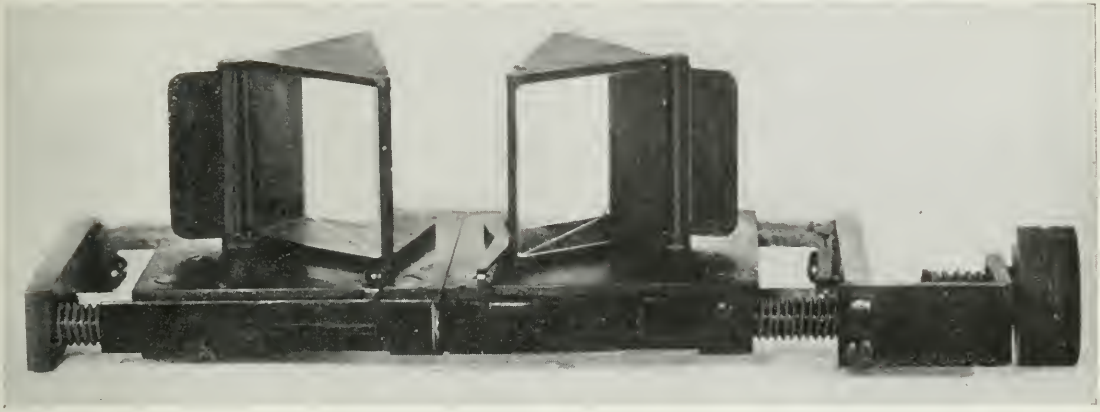


Fig. 2. General View of Prisms and Their Relations to Each Other.

Fig. 3. Apparatus Equipped with Suitable Mounting and Blinders.

CALDWELL TILT TABLE FOR FLUOROSCOPY

BY GEORGE HANCHETT, M.E.

NEW YORK

THE object of this apparatus is to combine in one the advantages of the vertical and horizontal fluoroscopes with the additional advantage of supporting the patient at any angle, from the vertical position to the Trendelenburg.

The general view of the table is shown in Fig. 1. It comprises a rectangular frame long enough to support the subject and is pivoted at its middle on a base like a cheval mirror.

This tilting motion is performed by a worm wheel and sector which is connected by a train of spur gears to a small motor. The motor is electrically connected to run in either direction by holding closed an appropriate button. The electric circuits are provided with limit switches which stop the motor in the extreme positions of travel. It will be seen that the table is locked in any position in which it is stopped, for the worm sector is not a reversible combination.

The fluoroscopic screen is pivoted by a double-hinged joint to the main rectangular frame of the apparatus. The movement of this screen by the side of the large rectangular frame is affected through a worm wheel and chain combination, so that it can be racked up and down the length of the frame.

The roentgen-ray tube is contained in a box equipped with sheet lead shutters. This box is mounted on a track directly beneath the celluloid screen. By simply putting pressure upon it the track permits the tube box to slide longitudinally with reference to the main frame. It is also slidable transversely with reference to the main frame by tilting a vertical lever from side to side. As the tube and screen can be moved independent to each other, though following the main frame, it is obvious that they can be placed in any position with reference to the main frame without disturbing any other adjustment.

It remains to control suitably the radiation proceeding from the tube box. This is done by two pairs of lead shutters mounted on the tube box itself at right angles to each other. The shutters are manipulated in pairs by a system of pulleys. The axes of these pulleys comprise shafts upon which the pulleys are slidably mounted, so that the position of the shutter is entirely dependent upon the rotary motion of the shafts and not at all upon motion that may result from movements of the tube box. These shafts, which are two in number, one for each pair of shutters, are connected to flexible Bourdon wires and rotary knobs mounted on the same side handle that forms the lever which controls the position of the tube box. The electrical connections which supply the high tension current are attached to the extreme ends of the table. These show plainly in all figures, particularly in Figs. 2 and 3. It is at once apparent that as the table moves, the connections must readily follow. To permit this they are connected to the table from permanent positions by means of flexible cords, the slack of which is taken up with an automatic take-up somewhat similar to the Hartshorne shade roller. These take-up reels are made of fiber and are displayed in Figs. 5 and 6. Fig. 5 shows the assembled take-up. This is mounted on a pin on which it can swivel and be located at any convenient point. Fig. 6 shows the details of the take-up mechanism, consisting of a reel actuated by a large spiral spring. This serves to keep the connecting cords taut at all times.

The method of using the table is largely apparent from the foregoing description of its construction and the accompanying photographs, but perhaps it may be well to review the method directly.

The subject stands on the platform at the bottom of the apparatus and leans

FIG. I. CALDWELL TILT TABLE.
celluloid back, the mechanism for the support of the fluorescent

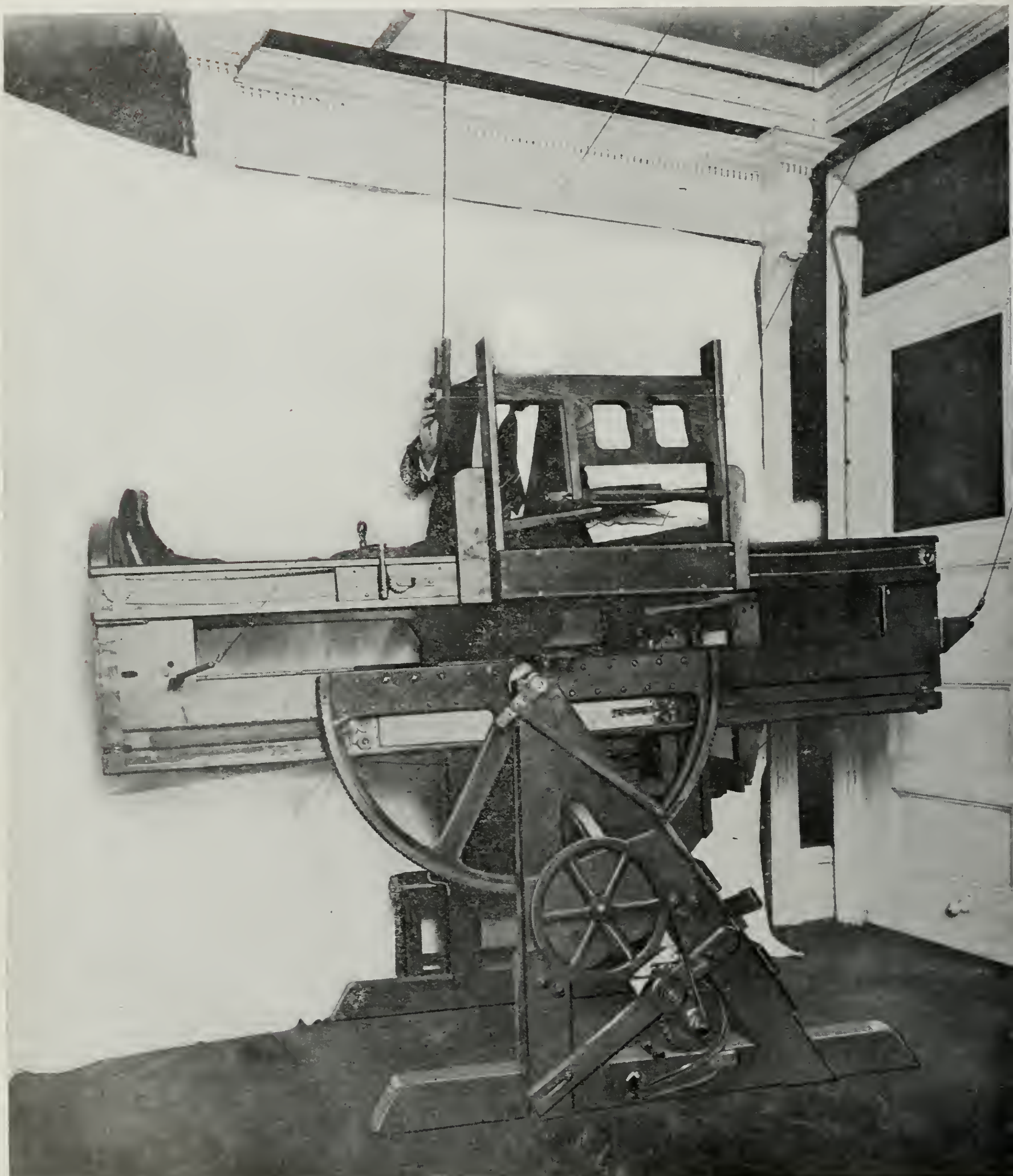


FIG. 2.

The table in the horizontal position. Attention is directed to the worm gears and the motor.

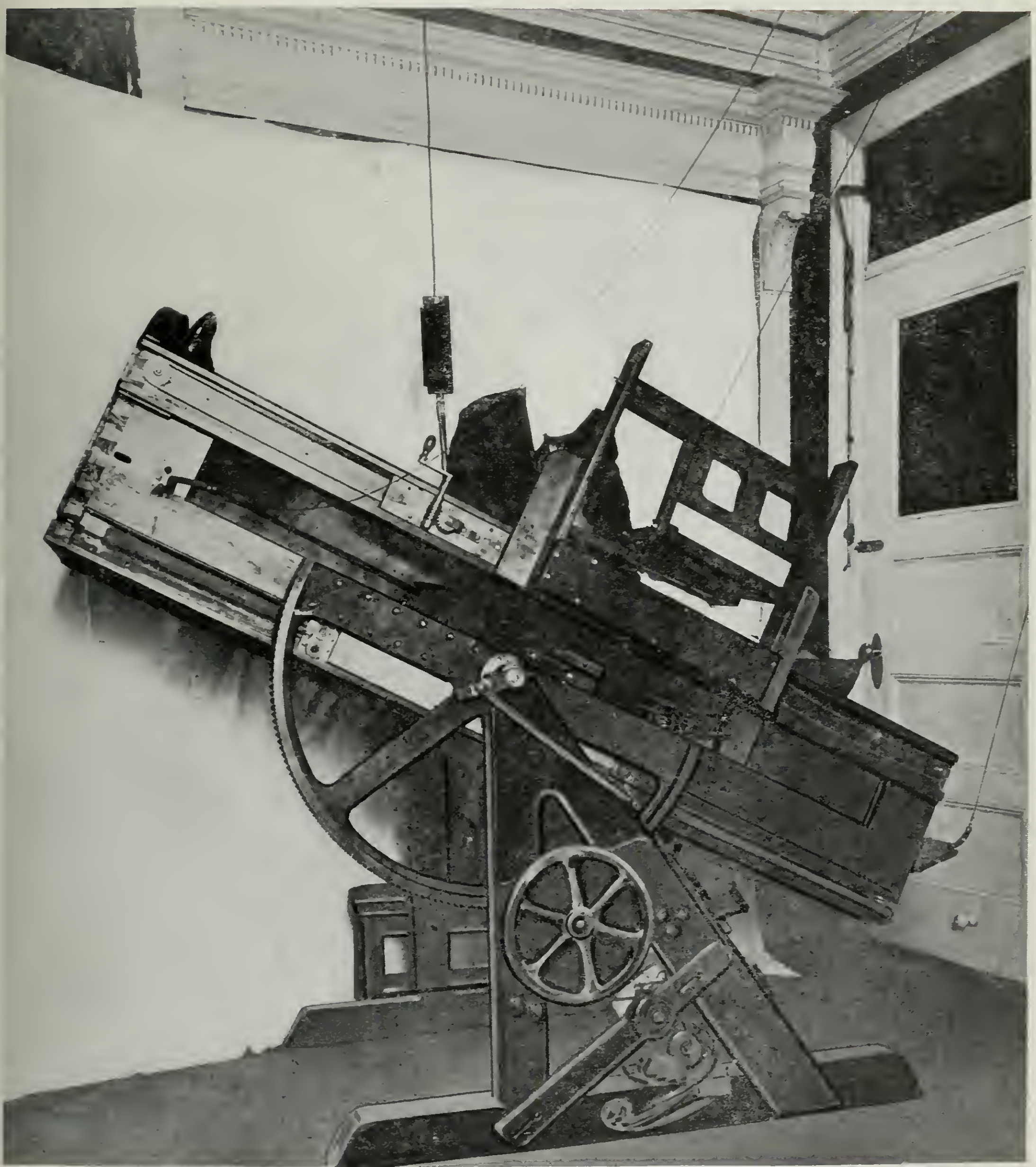


Fig. 3.

The patient in partial Trendelenburg position. Attention is directed to the high tension terminals.

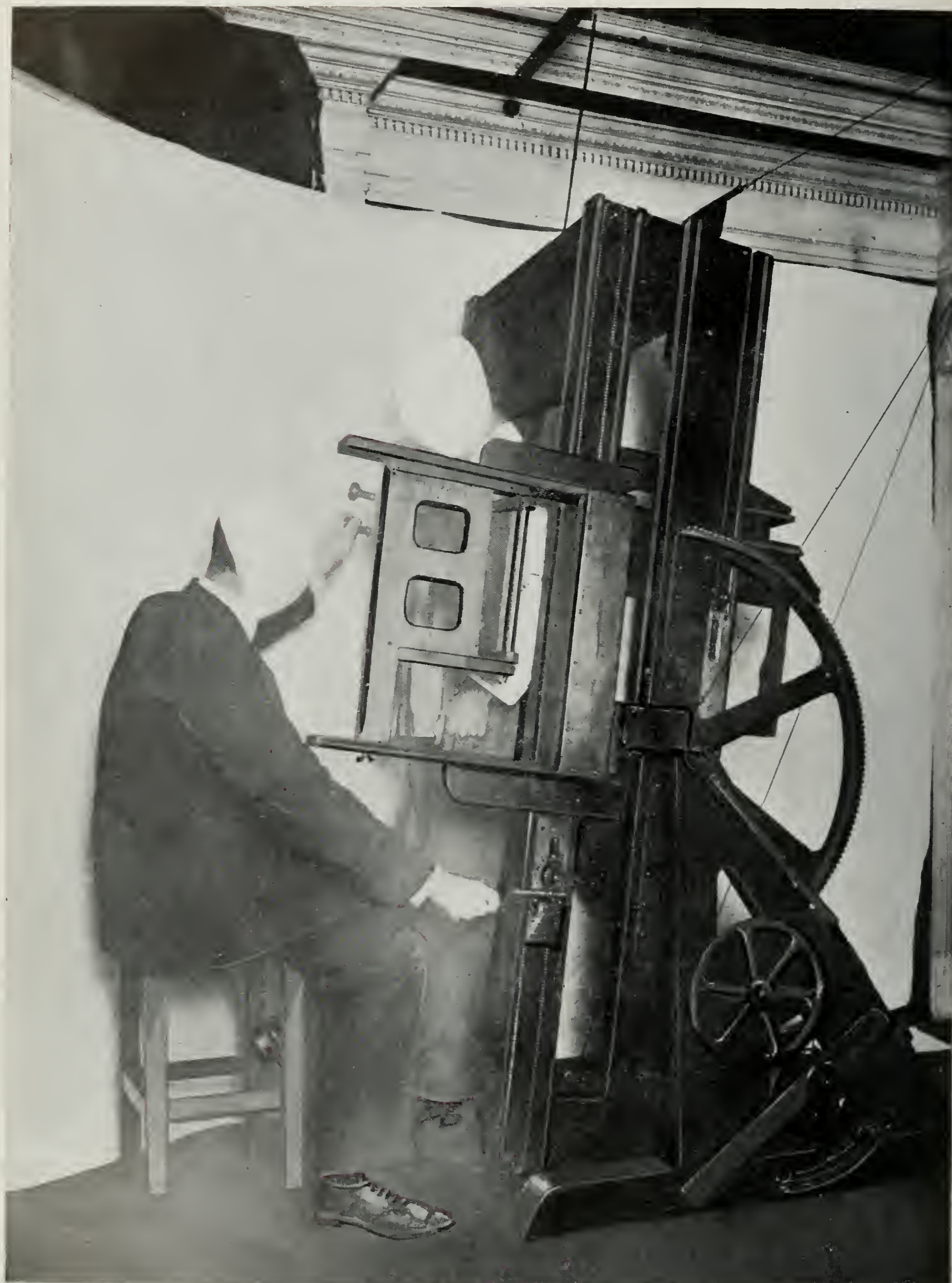


FIG. 4.

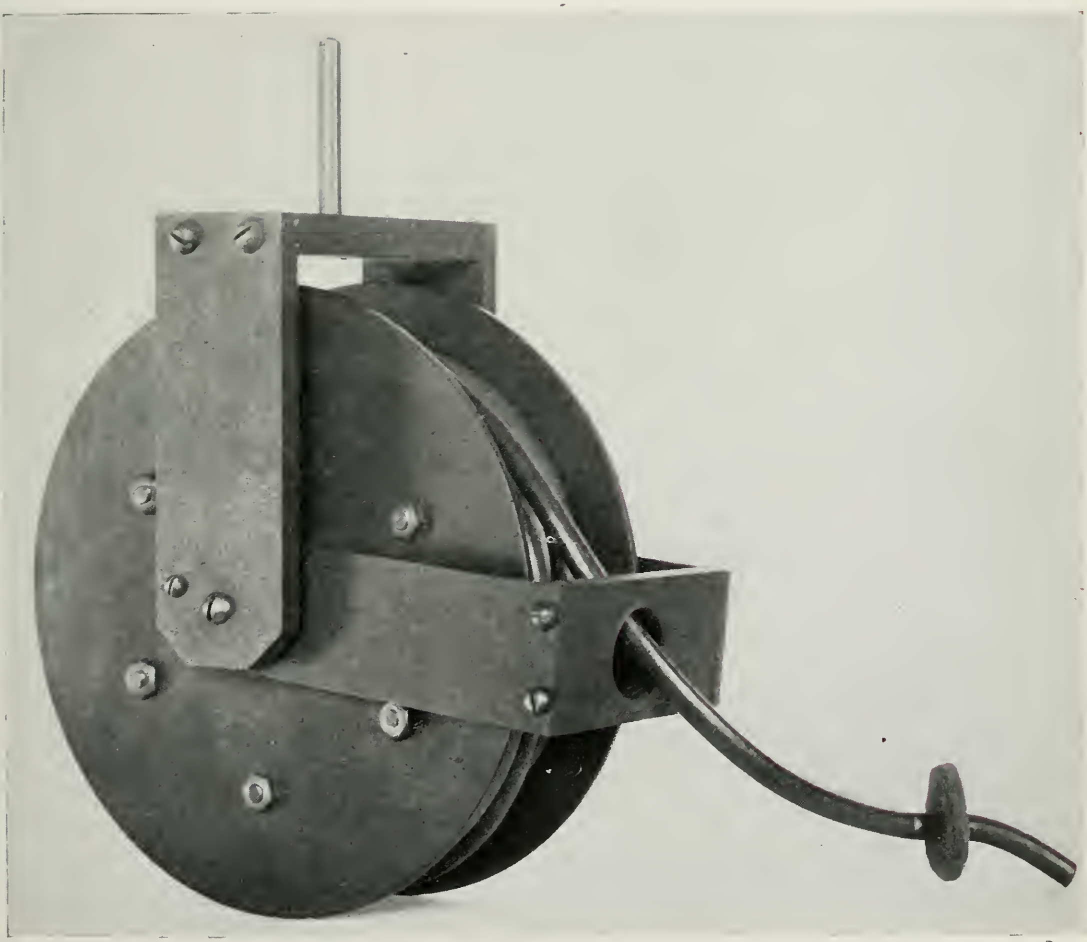


FIG. 5.
The take-up reel.

against the celluloid screen. The patient may be secured to the table by straps. An electric button is pressed which starts the motor, and the whole table may be tilted to any position as shown in Figs. 2 and 3. The fluorescent screen is moved to the proper position by means of a crank and worm wheel which appear at the left of the apparatus. The handle which appears at the right of the apparatus controls the movements of the tube box, while the knobs control the shutters.

Fig. 6.

Details of the take-up mechanism.

VACUUM VALVE TUBE*

BY EUGENE W. CALDWELL, B.S., M.D.

THIS valve tube is provided with a cathode which is so arranged to co-act with an operating regulating device as to automatically regulate the vacuum of the valve tube during operation.

The diagrams here shown illustrate the tube. Fig. 1 is a vertical section. Fig. 2 is a diagram showing a somewhat modified form of circuit connected to the tube. Fig. 3 shows still a different form of circuit.

As shown, the cathode terminal is the lower end of the tube in all the figures. The cathode itself is composed of a number of electrically connected aluminum strips.

The effectiveness and efficiency of this valve action is promoted by the use of a cathode having a large effective diameter or capacity, and a highly desirable regulating action is secured by arranging the gas generating material or salt in a separate regulating chamber having a suitable regulating diaphragm between it and the cathode chamber of the valve tube. When the tube is in normal operating position, the gas generating material in this regulating chamber is more or less in contact with the regulating diaphragm so as to cause the evolution of gas and consequent regulating action whenever the tube gets into the regulating condition. This causes heating effects on the regulating diaphragm or other exposed parts of the regulating chamber so that the tube is promptly restored to its normal critical condition in which such regulating action is eminent but no longer actually takes place. The valve tube, for some purposes, may with advantage also be provided with a plurality of separated anodes so that they may simultaneously be connected to different sources of potential which may be out of phase with each other, so as to combine in a single tube the current impulses from these different sources of electricity.

With a vacuum tube of this character having a main cathode chamber about two and three-quarter inches in internal diameter and about six inches in length, the valve action was very pronounced and the

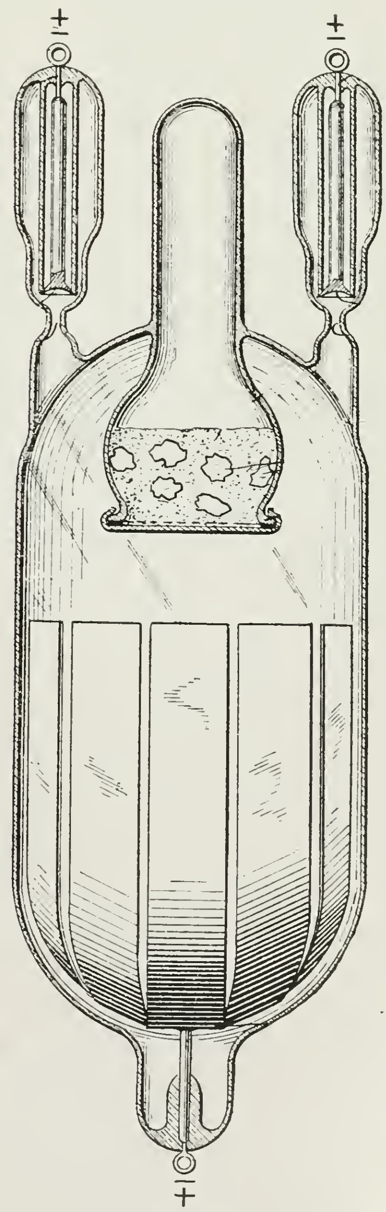


FIG. 1.

* This article was compiled from notes, sketches, and other references [EDITOR].

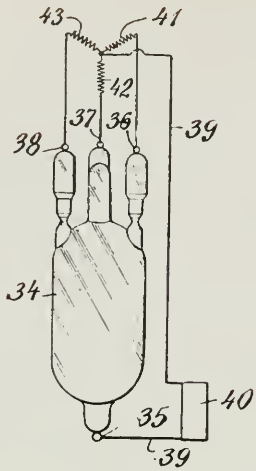


Fig. 2.

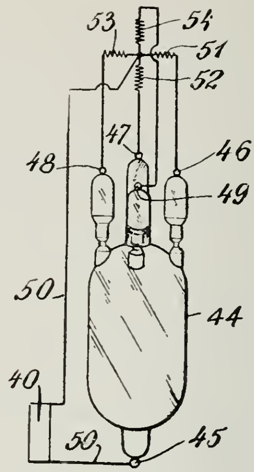


Fig. 3.

direct resistance of the tube was found to be very low, so as to give the tube a correspondingly high working efficiency. The potential required to break down the starting resistance in the direction of the normal operation of the tube was in the neighborhood of 1,000 volts, while a potential of about 30,000 to 40,000 volts was required to overcome the starting resistance of the tube in the reverse direction. By using multiple separated anodes in such valve tubes, each anode may be connected to a separate source of polyphase high potential electricity, so as to allow periodic current impulses to pass through the tube in the desired direction and superimpose through a single tube current impulses from a number of branches of a polyphase circuit. Fig. 2 diagrammatically shows such an arrangement, tube 34 being provided with the cathode terminal 35 and three separated anode terminals 36, 37, and 38, each connected to one of the branches 41, 42, and 43 of a three-phase high potential circuit with the neutral point connected to the working circuit 39, by which the working device 40, such as an *x*-ray apparatus, for example, is connected to the cathode terminal 35.

Fig. 3 diagrammatically shows a four-phase arrangement in which tube 44 is provided with the cathode terminal 45 and the terminals 46, 47, 48, and 49 connected to the separated anodes within the tube, which are not shown. A four-phase high potential circuit of any description may have its branches 51, 52, 53, and 54 each connected to one of the anode terminals, while the mid or neutral point of the four-phase circuit may be connected to the working circuit 50, including a similar utilizing device as 40.

SKIAGRAPHY OF THE ACCESSORY SINUSES OF THE NOSE*

BY EUGENE W. CALDWELL, B.S., M.D.

NEW YORK

THE use of the roentgen ray as an aid to diagnosis in certain diseases of the accessory sinuses of the nose was brought to my attention a little over two years ago by Dr. Coakley, of New York, and Dr. Ard, of Newark. Dr. Ard had just returned from the clinic of Dr. Killion at Freiberg, and had brought with him some excellent plates, in which the outlines of frontal and maxillary sinuses and the ethmoid cells were distinctly shown. On one of these plates there was an increased density of shadow over one of the frontal sinuses, which was believed to indicate pus in the cavity.

There is, in different individuals, such wide variation in the size of the frontal sinuses, in the number and position of their septa, and occasionally such a great lack of symmetry, that the use of the roentgen-ray in this region would be fully justified even if it could give us no other information than the anatomical details just mentioned.

Therefore, at the suggestion of Dr. Coakley, I at once began making roentgenographs of cases from his clinic at the University and Bellevue Hospital Medical College. To this clinic and to the anatomical department of the college I am indebted for splendid material for a series of experiments which were directed toward securing a good technique for making roentgenographs of such cases, and for determining their practical utility to the rhinologist.

This work was carried on at the Edward N. Gibbs Memorial *X*-Ray Laboratory, which is the Roentgen Ray department of the college.

By comparing the frontal sinuses of several cadavers with the roentgenographs made of them, it was readily shown that the extent of the sinuses and the location of their septa could be determined by the roentgen-ray with sufficient accuracy for the purpose of the surgeon. The indications given by the roentgen-ray of diseased conditions in the sinuses of patients from the clinic were confirmed in many cases by operation and by other means, but it seemed desirable to make further experiments to determine why the roentgen-ray indicated such conditions and how much reliance could be placed in these conditions. Some experiments with this end in view were therefore carried out by Dr. Chisholm and myself.

It seemed probable that the increased density of the shadows of diseased sinuses was due chiefly to an increase in the amount of fluid in the cavity, either in a swollen and edematous lining membrane or a collection of exudate or pus. Radiographs of specimens of pus and exudates from various sources show that their opacity to roentgen-rays was practically the same as that of a normal saline solution, or of pure water. This was determined by radiographing at the same time equal volumes of the various fluids in little thin celluloid dishes of exactly the same size and shape.

A piece of mucous membrane from a cadaver was cut in half. One piece was kept moist by placing it in a sealed jar while the other piece was dried. The radiograph of the two pieces showed that the water in the moist specimen cast a shadow many times as dense as that cast by the solids of the dry specimen.

We then made radiographs of some heads of cadavers before and after filling parts of the sinus cavities with water or with pieces of moist mucous membrane introduced through trephine openings. It was easy to detect the added liquid and membrane in the radiograph, but the

* Read by invitation before the Seventh Annual Meeting of the American Roentgen Ray Society at Niagara Falls, N. Y., August 29 to 31, 1906. Reprinted from the *American Quarterly of Roentgenology*, January, 1907.

rather large trephine openings were objectionable and it was found very difficult to keep the liquid from leaking out of the cavities. Dr. Coakley then made the very practical suggestion that we use moist gelatin instead of water or membrane for filling the cavities, and the demonstration was then repeated with more refinement in detail. Control radiographs were first made to show that the opacity to roentgen-ray of the moist gelatin was practically the same as that of the water or pus or edematous membrane.

Radiographs of the heads of some fresh cadavers were made. Then the scalp was turned down over the frontal bone until the supraorbital ridges were exposed. By means of tracings from the first radiographs, the frontal sinuses and their septa were outlined in ink on the frontal bones of the cadavers. Then by using a small drill, directed downward and backward from points above the superior limit of the sinus, we were able to enter unerringly the different cavities formed by the septa. By means of a small syringe needle introduced through the drill holes, we were able to show that these cavities contained no fluid. We then injected into some of the cavities gelatin which was just warm enough to flow through the syringe needle, and which solidified immediately after. The scalp was then replaced and more radiographs of the head were made. In these radiographs the empty cavities could be readily distinguished from those filled with gelatin.

These experiments convinced us that the roentgen-ray indication of fluid in the sinuses was fairly reliable,—a fact which had been recognized by our German colleagues before we began our experiments.

In order to use the roentgen-ray successfully for exploring the accessory sinuses of the nose, it is necessary to obtain radiographs of very good quality. Such radiographs are not easy to make. They call for the best possible appliances, and an amount of attention to petty details of technique which the busy clinician is unable or unwilling to give, and of which he has usually not the vaguest idea.

Owing to the thickness and opacity of the skull and brain, it is necessary to make long exposures, and to use rays of rather high penetration. The use of rays of too high penetration, however, results in a lack of contrast in the negative. Rays of low penetration act more energetically upon the scalp, and longer exposures are necessary with them, in order to obtain sufficient effect upon the photographic plate. Unnecessarily long exposures must be avoided, because they increase the liability of blurred pictures due to movements of the subject, and also because they increase the danger of harmful effects of the rays, both upon the scalp and upon the deeper structures.

The necessity for long exposures, and sometimes for repeated exposure, together with failure to secure the proper degree of penetration and sufficient distance between tube and scalp, sometimes cause roentgen-ray alopecia, and even roentgen-ray dermatitis over the back of the head. Not only these unfortunate accidents, but also the disclosures of Dr. Edsall, of Philadelphia, and others, as to the profound effect of roentgen-rays upon all living cells, remind us of the importance of working with especial caution and certainty in this region. Indeed, I think it is unwise to expose the same individual during a period of three weeks, for a longer time than is necessary to obtain two or three radiographs in the antero-posterior position.

The danger of roentgen-ray alopecia and dermatitis may be considerably reduced by interposing between the tube and the patient some sort of protective ray filter. For this purpose, I use a sheet of aluminum, $^{1}/_{50}$ of an inch thick, very close to the tube, and work with the target of the tube 18 inches from the center of the plate. No accidents have occurred in my practice under these conditions.

It is, of course, necessary to use some screening device to cut off as much as

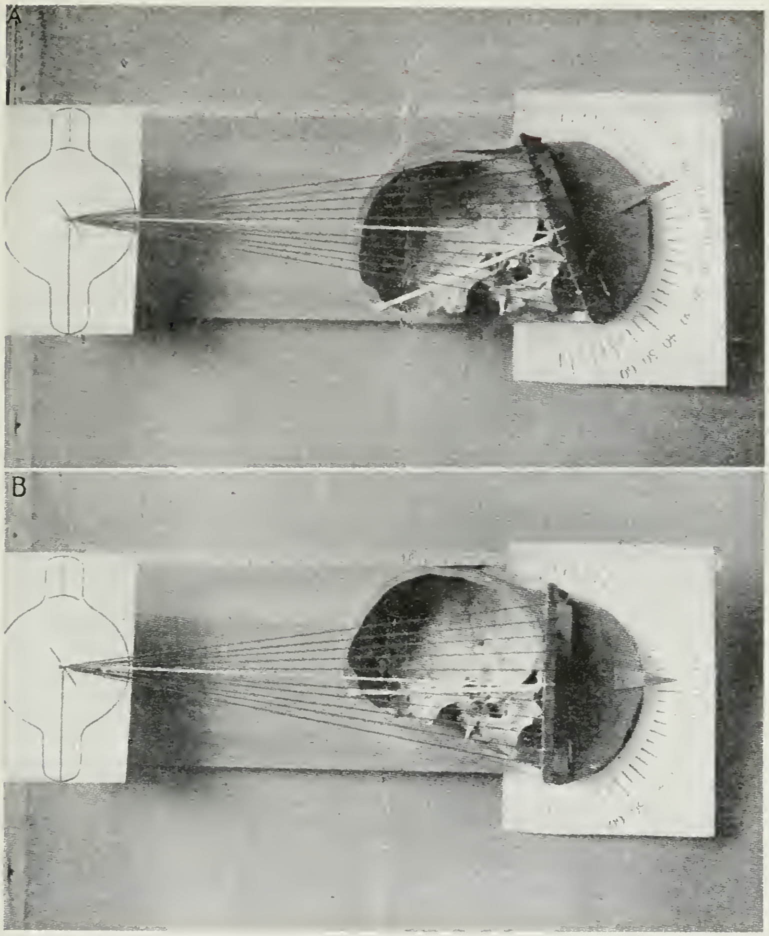


Fig. 1.

possible the rays originating from the glass walls of the tube. For this reason, most operators use the Albers-Schoenberg compression screen, or some modification of it. These appliances, although exceedingly clumsy, are perhaps the best for the purpose which the market affords.

The usual procedure is to place the patient in a recumbent position, face downward, with his forehead and nose resting upon the plate holder, and to adjust the tubular part of the compression apparatus over the back of the head. The usual length of exposure in Germany is two to three minutes, but it is quite possible, with good apparatus, to obtain brilliant negatives with exposures of ten to twenty-five seconds.

The length of exposure, and the degree of penetration depend somewhat upon the thickness of the skull, which varies greatly in different individuals. For determining the degree of penetration of the ray, and for estimating the length of exposure necessary in a given case, I like to observe the degree of fluorescence produced on a barium platinum-cyanide screen by the roentgen-rays which pass through the skull of the subject at the time the exposure is made. This is one reason why I do not use the Albers-Schoenberg apparatus. I work with my patient lying face up on a canvas stretcher. I place the tube and diaphragm under the stretcher, support the plate over the face, place a fluorescent screen over the plate, darken the room, and watch the effect of the rays on the screen. Two advantages of this method will be apparent at once. The patient is more comfortable, and hence less likely to move during the exposure, and then, if the penetration of the tube changes and becomes too high or too low, it will become apparent at once to the operator, and the exposure may be terminated without delay.

The appearance of a radiograph of the face and its usefulness in diagnosis depend much upon the position of the tube and the direction of the rays with reference to the base of the skull. We must avoid superimposing the shadow of the horizontal plate of the frontal bone upon that of the frontal sinus, or the shadows of the petrous bones upon those of the maxillary sinuses, or the shadow of the basilar process of the occipital bone upon that of the ethmoid cells. Any of these undesirable results and some others as well may occur if the exposure is made in a careless manner. The necessity for a standard distance and position of tube is, therefore, apparent.

The direction of the rays with reference to the plane of the photographic plate is comparatively unimportant, and since we must bring the plate as close as possible to the face, this direction will be determined by the prominence of nose and forehead, and therefore subject to considerable variation with different individuals.

The distance of the source of roentgen-ray (the target of the tube) from the face and the plate is, however, of some importance, partly because upon it depends the amount of divergence of the rays which give us the shadow picture. Considerations of safety to the patient and length of exposure are, however, the chief factors which determine this distance. I find that 18 inches answers all the requirements for safety and that this distance does not necessitate longer exposure than about 20 seconds for the antero-posterior projection and 10 seconds for the transverse projection.

In order to secure a standard position for the source of rays we may select one of the diverging rays which produce the picture and measure the angle which it makes with a plane corresponding approximately to the base of the skull. The ray I have selected for this purpose is the ray which passes through the skull in the mesial plane and pierces the center of the glabella. This ray I have called for convenience the principal ray. A suitable plane which can be readily located by external landmarks is the one which passes through the centers of the external auricular orifices and the center of the glabella. To save time I shall call this plane the basal plane and the angle between it and the principal ray, the principal angle. With a fixed distance between the target of the tube and the glabella the general direction of the rays may be expressed by the measurement in degrees of the principal angle.

From measurements of a number of skulls which had been split in the median plane, and from a number of radiographs of skulls and heads at different measured angles I have found that, with the target 18 inches from the plate at the glabella, the best results are obtained when the principal ray makes an angle of from twenty-three to twenty-eight degrees with the basal plane. I have therefore adopted twenty-five degrees as the standard angle for the principal ray, and the basal plane, or the standard principal angle. With this distance of tube and direction of ray, the shadow of the edge of the horizontal plate of the frontal bone, where it joins the wings of the sphenoid, appears as a transverse line passing across the orbit about one-half inch below the supra-orbital ridges. The appearance, in a symmetrical picture, of this shadow in the position mentioned is a fair indication that the principal angle is approximately correct. I regret to say that some of the plates I shall show here were made before the importance of this angle was appreciated, and before we had accurate means for adjusting it.

A few degrees variation from this standard direction is unimportant, but accuracy and uniformity are desirable. In order to obtain a fair degree of accuracy, I have arranged my tube with an indicator of transparent celluloid which locates the principal ray, and a scale graduated in degrees, which shows the angle between the principal ray and the perpendicular.

I have also a little instrument which measures approximately the angle of the basal plane with the perpendicular (see Fig. 2). This device carries a conical plug, which fits into the external auricular orifice, and a ruled celluloid strip which can be adjusted so that the ruled line passes over the center of the glabella and therefore lies in the basal plane. A scale, graduated in degrees, to which is attached a spirit level, may be turned until the zero point on the scale is perpendicular. In this position, one of the little pointers indicates the angle of the basal plane with the perpendicular, and the second pointer, placed twenty-five degrees away, indicates on the scale the correct angle for adjusting the tube holder.

With the Albers-Schoenberg apparatus, the same result may be obtained approximately by placing the tubular diaphragm in such a direction that its axis lies in the plane passing through the glabella, and about three-quarters of an inch below the parietal eminences on each side. It is understood, of course, that in making the anteroposterior projection the principal ray, or the axis of the Albers-Schoenberg cylinder, lies in the median plane of the body.

The radiograph of the head in the transverse direction is comparatively easy to make, and is of little importance. It gives an idea of the depth of the frontal sinus, and a knowledge of this depth is sometimes useful in interpreting the shadows on a so-called "front view" plate. The outline of the sphenoidal cells may be shown in the lateral projection, but I am told that this is of little use to the surgeon. I therefore make this plate with especial reference to the frontal sinus. The plate is supported parallel to the median plane, and the ray passing through the center of the glabella

FIG. 2.

is perpendicular to the plate. The sphenoidal cells may be best shown by passing the perpendicular ray through the middle of the line joining the external auricular orifice and the external angular process.

It is well known that photographic prints of roentgen-ray plates fail to show the detail of the original negative. This is especially true of plates of the skull. In these sinus plates, the print is particularly disappointing, and we rely solely upon the negative. Contact copies on glass are difficult to make, and they seldom show as much as the original negative.

The examination of these negatives is facilitated by having a dark mat around the part of the picture we want to see. I therefore make these radiographs on plates eight by ten inches, and have devised a method of giving them a very dense black border, which is as follows: After the exposure is made, I cover the plate with a piece of cardboard the exact size of the plate holder. This cardboard carries at its center a sheet of lead of sufficient size to cover the useful part of the picture, and carries also the words "right" and "left" with the plate number in lead letters and figures. An exposure to roentgen-ray of about three seconds through this cardboard and lead, produces in the developed plate a dense black border around the useful part of the picture, which has been protected by the lead plate, and leaves the indicating words and figures on the plate in the proper position. The appearance of the black border in the developing tray is found to assist materially in examining the plate by ruby light to determine the stage of development.

CANCELLATION OF APPEAL FOR SCRAP PLATINUM

THE Platinum Section and the Section of Medical Industry, War Industries Board, desire to express appreciation of the hearty response made by physicians, dentists and others when the call for scrap platinum was made.

As the Governmental demand for platinum in the making of explosives, etc., has been tremendously decreased by the curtailed war program, it is requested that no further scrap platinum be tendered to the Government through the channels indicated in our communication of September 17, 1918.

(Signed)

Charles H. Conner, Chief,
Platinum Section.

Lieut. Col. F. F. Simpson, M.C., U.S.A.,
Chief of Section of Medical Industry.

EUGENE WILSON CALDWELL

1870-1918

EUGENE WILSON CALDWELL, scientist, physician, Nestor of American roentgenology, died June 20, 1918, in the most fruitful period of his life, as the result of injuries received while experimenting with the roentgen ray in the early days of his professional career.

He was the son of W. W. Caldwell and Camilla Kellogg Caldwell. He was born at Savannah, Mo., in 1870. A few years later the family moved to Concordia, Kansas, where they still reside.

As a child, he never cared for the ordinary pastimes of children. On the contrary his interest was always centered in scientific apparatus, and in descriptions of mechanical devices. At the age of eight years he dismantled his mother's new sewing machine, but promptly reassembled it. At the age of ten he constructed an induction coil which, in later life, was one of his proudest possessions. When he was seventeen, he entered the University of Kansas in the electrical engineering department. Shortly after his arrival there he visited the various laboratories and the University museum to see whether all of the apparatus, which he had seen illustrated in his catalogues, really existed. In his second year he was appointed assistant in the laboratory of physics. He took little or no interest in athletics.

While a student at the University he became associated with Professor Lucien I. Blake in submarine telephony experiments, which were first conducted at Woodshole, Mass., and, later, at Sandy Hook Lightship. Together they solved the secret. Professor Blake ungrudgingly gave his assistant full credit for valuable aid. The first message was transmitted between Sandy Hook lightship and Sandy Hook. The instrument at that time was known as the "Hydrophone."

Shortly after his graduation from the University of Kansas, in 1892, he came to New York and on account of his work in submarine telephony he became associated with the New York Telephone Company.

In the early days of roentgenology, it was exploited by photographers, instrument dealers, etc. A photographer who had not met with much success in his business venture offered his apparatus for sale. This was bought by Caldwell in the fall of 1898. The equipment consisted of an oil immersion coil, a General Electric tube and several other accessories. The outfit was demonstrated to him during the day. Possession was taken that same evening and when he tried out the apparatus he found that the coil had been burned out in the interim. He spent that night in repairing his coil, and was rewarded by seeing two patients the next day. Early in his career in roentgenology he recognized it as a medical specialty. Accordingly he began his medical education with a special course in anatomy at Columbia University. This was followed by a medical course and he was graduated from the University and Bellevue Hospital Medical College in 1905.

The Edward N. Gibbs Memorial *X*-ray Laboratory was established in 1901 with Caldwell as director. This post he retained until 1908.

For long years he maintained a shop in connection with his office, so that he might give full play to his mechanical genius. In it were made most of the instruments which were used in his office. These included many of the accessories, from a simple tube stand to a stereofluoroscope. He devised the Caldwell electrolytic interrupter, an induction coil, various types of *x*-ray tubes and a self-regulating valve tube. Early in his career he saw the advantage of the osmosis regulator and we find a description of it in a letter written to the Edison Company, dated 1899.

He is best remembered for his contribution to medical literature on the roentgen examination of the accessory nasal sinuses, and for a book which he wrote in collaboration with Dr. Wm. A. Pusey entitled "Roentgen Rays in Therapeutics and Diagnosis."

He was one of the first roentgenologists to join the old Medical Reserve Corps. He retained his membership when the Corps was reorganized at the beginning of the war, and was commissioned as captain in the Medical Reserve Corps, U. S. A. Later, he was advanced to the rank of major.

He was visiting physician to the Roentgen Department of the Presbyterian Hospital. He was also consulting roentgenologist to the New York Orthopædic Hospital and the German Hospital.

He was an Associate in Roentgenology, College of Physicians and Surgeons, Columbia University. He was a member of the New York Electric Society, American Institute of Electrical Engineers, Roentgen Society of London, American Roentgen Ray Society, New York Roentgen Ray Society, Philadelphia Roentgen Ray Society, American Medical Association, N. Y. Academy of Medicine, Phi Kappa Psi, Sigma Psi, and Nu Sigma Nu fraternities.

He was married to Elizabeth Perkins in 1913, who survives him.

AEROPHAGIA

Piedrahita says that the repeated movements of swallowing, the belching of gases, followed by transient relief, and the gurgling sound heard on auscultation of the cardia, aid in revealing aerophagia as the cause of certain disturbances in the stomach, heart and air passages. If the eructation is done facing the flame of a candle, the flame does not waver as it does when fermentation gases are expelled. Three unusually inveterate cases are described in men from 50 to 64 years old, whose incessant but unsuspected aerophagia had caused dilation of the stomach with consequent displacement of other organs, with symptoms that had annoyed them for twenty years. The men were enlightened as to their unconscious swallowing of air as they swallowed their saliva, and were instructed how to avoid it. The most effectual means for this is to place a cork between the teeth for fifteen minutes at a time, especially after meals. With a cork between the teeth it is impossible to swallow, and the men soon conquered their aerophagia habit and with it subsided all their symptoms. Piedrahita says that this habit of swallowing air is often an actual tic, and it seems to be responsible for 10 to 15 per cent. of the cases of digestive disturbances encountered at Bogota. This dilatation of the stomach stretches its walls and smooths out the folds which shelter the secreting glands, and, besides this, the pressure on surrounding organs may induce dyspnea, intracranial oppression and sensory phenomena, unconsciousness and dizziness. He advises carrying a cork in the pocket and putting it between the teeth when the impulse comes to swallow. If there is a tendency to hyperacidity, he supplements this with alkalines and sedatives to soothe the irritated glands in the stomach. By these means excessive production of saliva is prevented, which aids further in checking the swallowing of air.—(*Repertorio de Medicina y Cirugia*, *Bogota*, June, 1918, p. 461.) (Ref. *Jour. Am. Med. Assn.*, Vol. 71, No. 11.)

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EUGENE WILSON CALDWELL

Again are we called to mourn the loss of a pioneer in roentgenology. Most truly a sacrifice to the pursuit of knowledge and its application to human needs, Dr. Caldwell was one of the first in this country to recognize the prospective value of Roentgen's discovery. He entered this field of investigation with unusual preparation and with a whole-hearted enthusiasm characteristic of the true spirit of scientific research. Neither difficulty nor expense, neither weariness nor danger could ever deter him from carrying on his experimental work in order to achieve the end in view.

To give a complete list of his contributions to the real advancement of roentgenology in this country would be impossible in the space available. In fact, it would, to a large degree, be a history of the development of this work in the United States. Beginning with the redesign of induction coils, following with improvements in interrupters, for many years he continued to develop apparatus, which formed the basis for much of the important equipment now in use, even though not adopted in the exact form of his original development. Dr. Caldwell possessed in a rare degree that prerequisite for research and invention sometimes designated "scientific imagination." There was always in his mind the idea of improvement. He never allowed himself to use the term "good enough," and this applied not only to his mechanical and electrical design, but also to his care in the study of diagnostic problems. His geometrical sense, his intuitive grasp of the problems of function in the human mechanism was fully as remarkable as his genius in basic science and in invention.

Perhaps no one has contributed more to the rational use of fluoroscopy than Dr. Caldwell, and stereoscopic work engaged his attention at an early date. Anticipating military needs, he, at his own expense, developed a stereoscopic fluoroscope for trial. The favorable impression made by the preliminary model led to orders from the Surgeon General to perfect this apparatus. To this task he devoted his last days while suffering intensely, in fact, never free from pain. Almost from his deathbed, on June 17th, he went over many details and urged a close friend to see that the work should be completed.

While his friends, who knew of his sufferings during the latter years of his life, feel a relief that death has intervened to bring him peace, yet they can only regret the misfortune of his untimely end, far within his threescore years and ten. Many are the problems which had originated in his mind, that he had discussed with a few of his intimate friends, but whose solution must be delayed for lack of one possessing his peculiar training, experience and judgment to continue the work. The roentgenologists and scientists of our country may be proud of this record, and it may be held as an inspiring example to those who desire to contribute to future advancement.

JOHN S. SHEARER.

To many who, perhaps, knew him less intimately, the light of the personality of Eugene Wilson Caldwell was dim in comparison with his brilliancy as a scientist. Accentuating this was a natural reticence concerning matters not essentially germane to his professional activity; consequently only those closest to him could realize the profundity of his sensibility to the beauties of nature and the finer arts of man. Particularly was he a lover of life as revealed in its simple and fundamental surroundings—the domestic life of living creatures. He often expressed a yearning for an oasis in the journey of labor, where he might pause long enough to enjoy these things. Of the fine arts he was strongly appreciative; his knowledge of the textiles of the East was authoritative.

Major Caldwell took especial delight in his intercourse with his friends, and he thoroughly enjoyed the deep and lasting associations which only his personality could create and develop. He was an amazingly accurate judge of human nature; therefore an able and just critic. The encouragement of his praise has many times proven a potent stimulation to others in their work. His advice was never sought in vain.

The acute sense of humor with which he was blessed helped to mitigate the suffering of his later years and to protect an active mind from the influence of corporal anguish. The familiar shaking of his body in silent laughter was never stayed by physical distress.

Those who cherish the welfare of American roentgenology will regret the loss of Eugene Caldwell. Those who learned to know him heart and soul will ever mourn it.

PERCY BROWN.

Major Eugene W. Caldwell was a member of the old Medical Reserve Corps of the United States Army, having been commissioned as a captain in that Corps long before the war. Upon the entrance of the United States into the war, he accepted a commission as captain in the Medical Officers Reserve Corps and, soon after, was ordered to active duty and assigned to station in New York City for the definite work of perfecting a stereofluoroscope for the use of the Medical Department of the Army. He was promoted to the grade of Major in the Medical Reserve Corps on May 11, 1918.

During the last year of his life Major Caldwell worked almost continuously, in spite of great physical suffering, to bring to completion what is undoubtedly his greatest achievement, the stereofluoroscope. Even during his last illness, while confined to bed, and in the midst of great pain, he was able to give such advice as to bring this apparatus to a high state of practical efficiency. The first stereofluoroscope is now ready for shipment to France.

It was a great satisfaction to Major Caldwell, and is now a source of pride and comfort to his many friends, that he was able to bring this important work to completion. It is confidently believed that the stereofluoroscope will be of exceedingly great value in roentgenology, and especially in roentgenology as applied to conditions in military hospitals. But however valuable it may become, it is only one of the many contributions made by Major Caldwell to the advancement of roentgenology, in which he was a pioneer. The Army today owes him a great debt—directly, for the in the methods of instruction to be followed and apparatus to be adopted; and, indirectly, for the many contributions made by him to the advancement of roentgenology, from which military roentgenology is profiting today together with roentgenology in general.

Major Caldwell exemplified the highest ideals of the "officer and gentleman," and, although not closely connected with army life, he had in the highest degree those qualities typical of the soldier—devotion to duty and patient endurance of hardship. Army officers who were honored with his friendship have, in the midst of their great sense of personal loss, a feeling of pride in his sterling worth as a man, as well as in his great achievements. They mourn his loss in company with his hosts of other friends. A. C. Christie.

ADDRESSES DELIVERED AT MEMORIAL SERVICE

Held June 23, 1918

At Campbell Funeral Church, New York

On occasions of this kind our first thoughts are always directed toward the loss sustained. In this case there is a loss to his family and to his personal friends as well as to the cause of medical science, which can never be replaced. Yet the measure of loss is, after all, the fullness of the life that it represented; and in all that makes for usefulness and progress the life of Dr. Caldwell was full to overflowing. This is not the place, and I am not the one, to attempt to picture the magnitude of his service or the far-reaching scope of his genius in his chosen field. Suffice to say that so long as the science he represents is used by mankind so long must his work endure.

Preëminently a man of high genius and kindly in all his traits, it is, in a way, strange that he should pass away while active in the greatest conflict civilization has known. While I am sure that the pomp and circumstance of the military in the time of peace would have no attraction for a man of his temperament and aims, yet there is something peculiarly fitting in the military connection at this time. As an example of the truest of soldiers, loyal to his country and the cause of humanity, obedient to the call of service, facing suffering and danger without a murmur, carrying through his fight to the bitter end, he was the embodiment of all that is true and noble in the military service. Eugene Caldwell was a hero in all that the word implies, and no word of yours and mine can add to a proper appreciation of his heroic work during these latter years when he was suffering hour by hour.

While his colleagues are sorrowful that his span of life was not prolonged and that the developments springing from his active mind were not completed, they one and all can be sincerely glad of the work he has done; and to his intimate friends who have known him so well, the memory of his aid and kindliness will be with them until they follow at the end. To the younger men his memory and his achievements should be an inspiration throughout their allotted time. J. S. Shearer.

A great and good man has gone from among us. Others may speak of his achievements in science and invention, of the benefits to the world from his professional accomplishments. I shall speak of him as one of the many who in the privileged and intimate relation of friendship, knew and loved him for his fine and gentle nature.

A sufferer for years and barred by his injuries from many of the more active pleasures of life, he never complained, never showed a trace of bitterness.

He was modest beyond reason as to his own accomplishments, and generous to an extreme in his appreciation of others.

Eugene Caldwell got much out of life, because he put much into it. Kindness begets kindness. Love begets love. He had many friends. He was well loved because he gave so generously of his affection.

I like to think that the staunch faith of his friends, the appreciation of his professional associates, and the love of his family and intimates may have compensated for and eased the sufferings which he endured for so many years.

He was a brave man. Above all he was loyal—loyal to his family, loyal to his profession, to his fraternity, to his country—loyal to the high ideals of early manhood.

A few nights before he passed away, I had my last intimate talk with him. In full realization of his condition and of the slight chance for his recovery, he spoke of many things: a little of his work, a little of great world happenings, a very little of himself, of his weariness and desire for release from pain. But finally, his eyes lighting up in the old brave way, he said, "Don't worry. I'll make the best fight I can."

No words of mine can paint the true character of Eugene Caldwell, nor assuage the grief of his sorrowing family, but mingled with their grief let there be a just pride in the thought that his life was a help to humanity, and an inspiration to others. Faithful to every obligation, he fought the good fight. His work will live after him. His friendship was a joy, his memory a blessing.

Lloyd Atkinson.

A few of the living many who are honored by having possessed the friendship of Eugene Wilson Caldwell are met here lovingly to dedicate the memory of it. To contemplate this life, now ended, is but to recall the lives of such men and such martyrs who have gone before—the early hardships, the tenacity to an ideal in the face of discouragement, the continued stimulation of labor never ending, for which no adequate earthly reward exists.

satisfying requital, not so much from the fact that he was the recognized father of American roentgenology as from the knowledge that it had grown and thriven, in the manner and direction he desired, on the nourishment of his own precept and example.

A patriot in every deed and thought, he planned ceaselessly for the scientific armament of our forces overseas, and the lips that utter these words are privileged in that they were the first to convey to him the certain knowledge that the medical service of our army is the more effective for his contributory influence.

Such glorious sacrifice of self, as exemplified in a life such as his, is too precious a treasure to be shown us for long, and undying Fame jealously snatches it away into her own keeping.

What is Life, dear friends, unless to be enriched for us by this fleeting glimpse we are permitted to obtain? One day the Treasure Chest shall be thrown open to each of us forever.

Percy Brown.

We are gathered here this afternoon to pay our tribute to the memory and achievement of a departed friend. Doubtless there are many here who had the privilege of a closer acquaintance with Dr. Caldwell, and a more scientific appreciation and understanding of the technique of his science. To me he was at first a friend's friend, but later when I came to know him better I was glad to claim him as my own friend, a personal friend. My only regret is that I did not know him better and more intimately than was my privilege.

It is said that "they also serve who only stand and wait." How much truer is it of one who like Dr. Caldwell, gave his life both figuratively and literally to the services of his fellowmen. I wish that I were qualified to tell you as some of those present doubtless are, of all the marvelous things which he did, of the discoveries which he made, of the apparatus which he the condition of mankind. Being a layman in his science, I cannot comprehend fully the significance of his accomplishments, but I yield to none in my admiration of the things that he did. As I look about this room and note the number of men clad in khaki, I am impressed by the possibility that many, many men thus arrayed will have reason to be exceedingly grateful for all the pains which he took and the contrivances which he devised, calculated to make their condition more tolerable and to facilitate the work of surgeon and nurse in the restoration of the wounded and injured. I wish that one competent to speak would tell of the marvels which he performed in the pursuit of his particular branch of science.

Our deepest admiration is bestowed upon the man who devotes his whole energy to the unselfish service of his fellowmen, and that admiration reaches its highest pitch when such a man sacrifices himself completely and gives up his life to achieve his purpose. That man wins, and deserves to win, the martyr's crown. Unobtrusively and quietly Dr. Caldwell pursued his course, and now has left a record of achievement, the memory of which is sweet and the reward sure. We honor Dr. Caldwell for all that he did, and we are glad of the privilege of his friendship. Words fail to tell the depth of our sense of loss in his departure.

There are those here who will tell you of what he was to them and to others. One was a fraternity brother, and two were closely associated with him in scientific studies and in the bonds of a common service to a common cause. They had the privilege of close personal acquaintance, and they will speak out of the depth of sorrowing hearts.

J. Frederic Gillette.

Resolutions adopted by the American Roentgen Ray Society

upon the Death of

Major Eugene Wilson Caldwell

WHEREAS: The American Roentgen Ray Society having lost by death its former President and esteemed colleague, Major Eugene Wilson Caldwell,

BE IT RESOLVED: (1) That this Society in convention assembled, herewith expresses its profound sorrow, and as a token of respect, that the Society adjourn.

FURTHERMORE, (2) that these resolutions be spread upon the minutes, and published in the official journal of the Society.

FURTHERMORE, (3) that a copy of these resolutions be transmitted to his family.

BY THE COMMITTEE

F. H. BAETJER
PERCY BROWN
H. M. IMBODEN

A SIMPLIFIED ADAPTATION OF CROSS-SECTION ANATOMICAL LOCALIZATION*

BY EDWARD S. BLAINE, M.D.

Captain, Medical Corps, U. S. Army

CAMP GREENLEAF, GA.

THE interest created by Flint's[1] recent article on the "profundometer" method of foreign object localization has served to stimulate the writer to simplify that more or less complicated procedure in order more conveniently to obtain the same end result. This end result is the graphic depiction of the projectile lying in the precise area in which it lies with regard to the surrounding anatomical structures, thus enabling the surgeon to determine at a glance its orientation and the best route of surgical approach. In a small percentage of cases the value of such graphic orientation is undoubtedly great, particularly in regions of vital structures.

Briefly, the profundometer method consists of obtaining, by fluoroscopic observation, three separate lines, each one passing through the projectile in the body, mark-

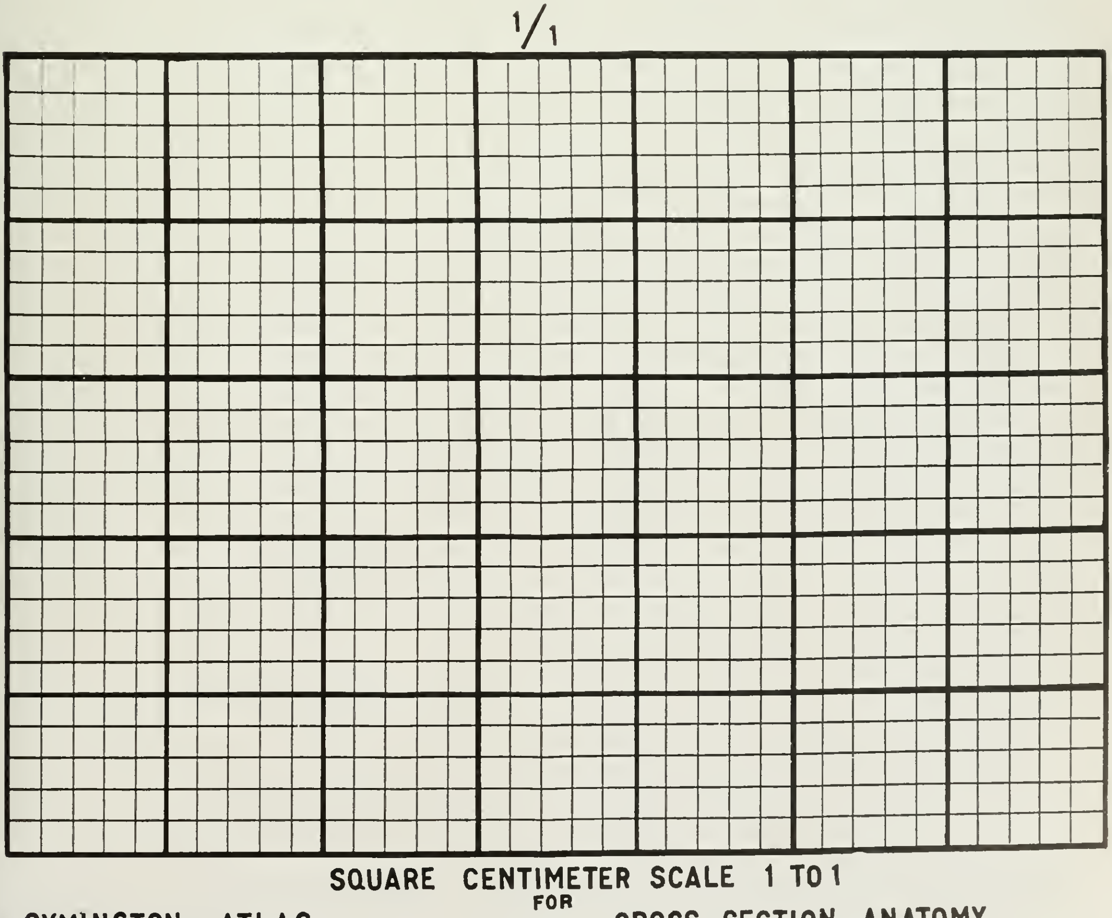

FIG. 1. TRANSPARENT SHEET RULING. EVERY 5TH LINE ACCENTUATED TO FACILITATE COUNTING.

*Read at 19th Annual Meeting of the American Roentgen Ray Society, September, 1918.

ing the points of inlet and outlet of the roentgen-ray on the skin, then wrapping or moulding a hinged metal strip around the circumference of the part, marking the overlap of the ends and transferring to this metal band the six skin marks. The strip is then removed from the patient and selecting that section of the body (from the key figure) upon which the projectile was found to lie and to draw in all the anatomical structures in the outline obtained by the moulded strip. This completes the proceeding and the drawing is ready for the surgeon's use.

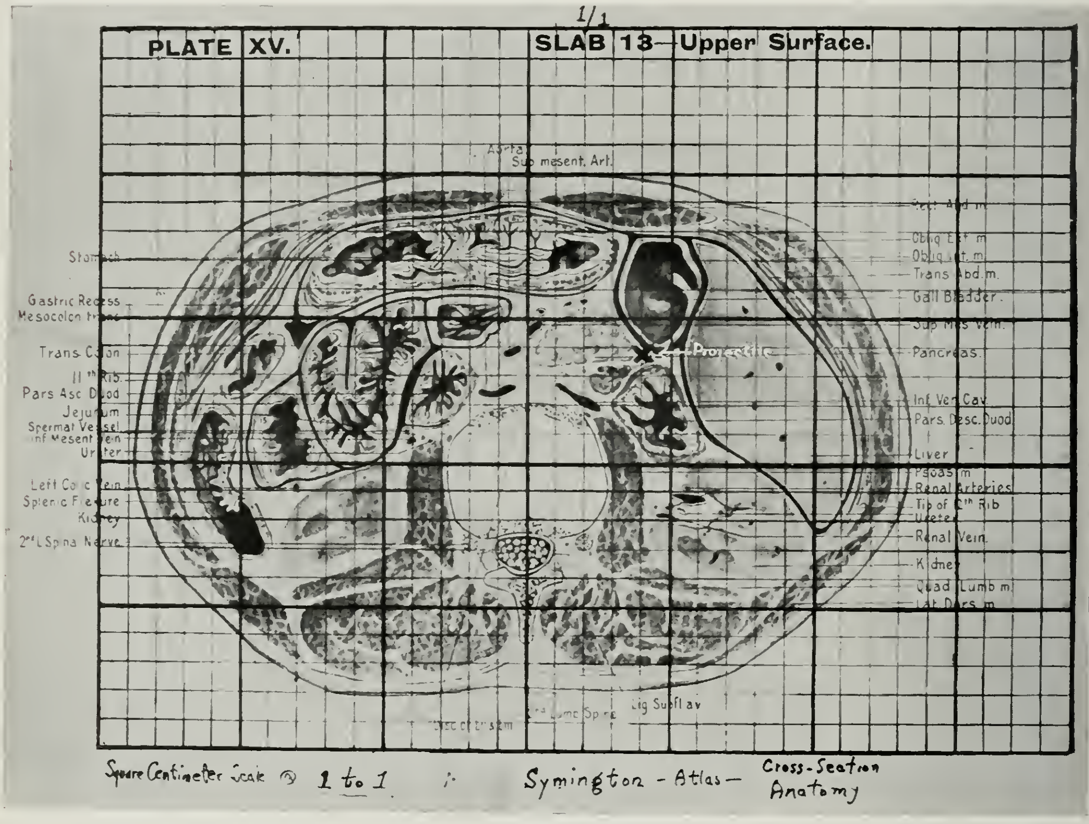

Fig. 2. Example Number I.

Foreign object found at the Upper Edge of Third Lumbar Vertebra.

D = 6. cm.
H = 11.5 cm.
L = 9. cm.
AR + PR = 4 cm.

Anatomical Location: the Projectile Lies in Close Contact with Outer Portion of Pancreas just Posterior to Gall Bladder and Internal to Edge of Liver, Immediately in Front of Descending Duodenum.

placed upon a sheet of drawing paper; a pencil is used to mark the shape of this mould and the three pairs of marks are transferred to the paper. Straight lines are drawn between each pair of marks and the point of their crossing indicates the position of the foreign object. It now remains to consult a cross section anatomy or atlas,

In the several steps of this operation difficulties are often encountered. These are: (1) placing the six skin marks indicating the inlet and outlet of the roentgen ray. This, however, can be more or less conveniently done with the aid of the Bowen ring pointers; (2) the difficulty in handling the hinged metal strips provided with the apparatus which, particularly the larger bands, are likely to get out of shape between moulding and tracing; (3) in spite of great care the three lines often fail to cross at a common point, thus forming a triangle; (4) possible failure of the artist to make allowance for individuals larger be questioned, it is not a method for use where speed and time are important factors. The identical end result can be accomplished by a much shorter technic and without the use of the metal strips or the need of a skillful artist.

This is done by fluoroscopically locating

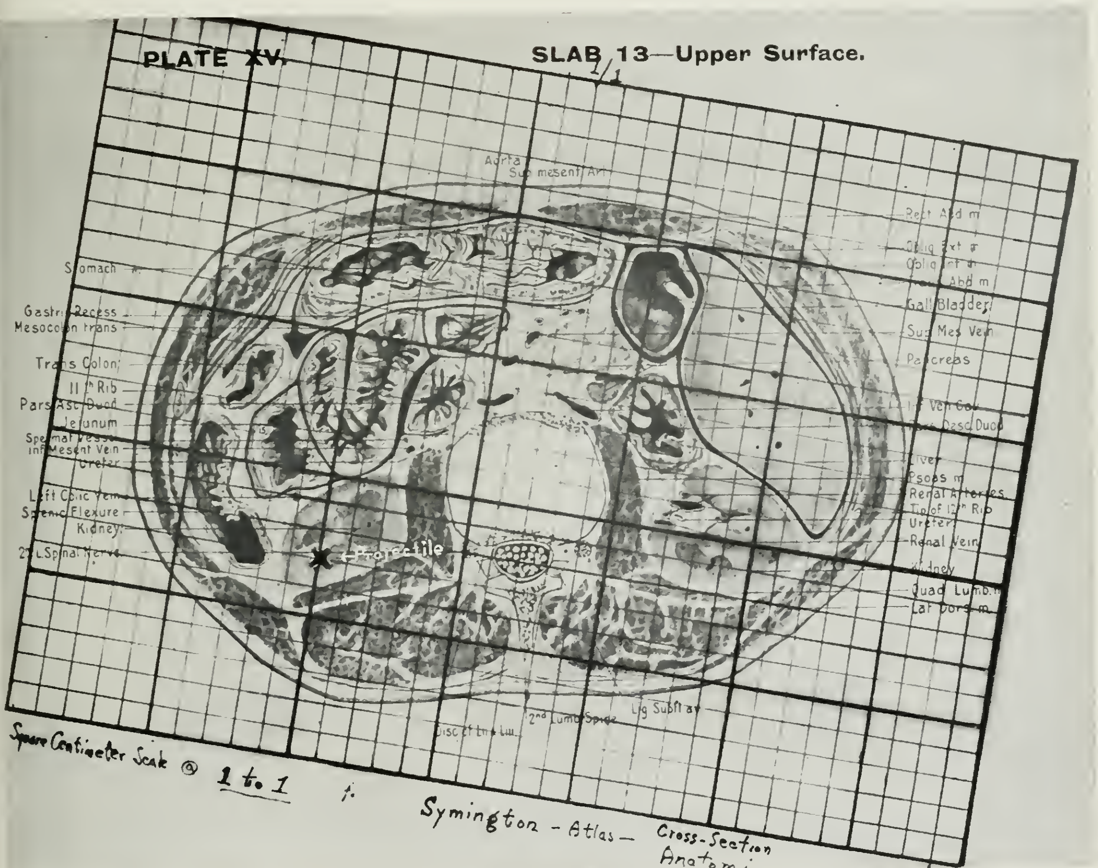

FIG. 3. EXAMPLE NUMBER II.

FOREIGN OBJECT FOUND AT THE LEVEL OF LOWER EDGE OF SECOND LUMBAR VERTEBRA.

D = 13. cm.
H = 4.5 cm.
L = 6.25 cm.
AL = 5 cm.
PL = 8 cm.

ANATOMICAL LOCATION: THE PROJECTILE LIES IN SUBSTANCE OF LEFT KIDNEY, LOWER POLE, POSTERIOR HALF.

or smaller than the average used for the illustration in the atlas and lack of a considerable artistic skill and experience necessary to a correct drawing of the anatomy present.

While the value of this anatomical localization in a few selected cases cannot

the foreign object with the U. S. Army parallax double-ring instrument,[2] obtaining therewith three skin marks at the body level of the projectile. This instrument gives two lines at right angles to each other, each one passing through the projectile and the scales give three skin-projectile distances at one setting. One of the skin marks is anterior, another is posterior, and the third is on the lateral skin surface. Measure and note the distance between the anterior mark and the median line, right or left—if the patient was squarely supine the posterior distance will be the same; but if, for any reason, he could not lie in such position, measure and note the posterior distance. Consult a cross-section atlas, examine the key figure for the body level on which the foreign object lies (noted at time of screen examination), turn to the proper section, and place over the page a transparent sheet which has been ruled in square centimeters, or reductions thereof, according to the atlas used, set the ruled sheet so that its middle line is in the median line of the cross-section illustration, and count the number of centimeters that the anterior (and posterior) skin mark is from the midline of the body. On this line count downward the number of squares that the depth of the projectile was localized below the skin. Check up by noting the lateral and posterior skin foreign object distances. Thus, if the patient be much larger or much smaller than the illustration (average normal subject), proper allowance can readily be made to obtain anatomically correct proportion. This completes the proceeding and the surgeon can see at a glance where the foreign object lies with reference to the surrounding anatomy.

The transparent sheet referred to is best made by washing off the film of an 11 x 14 roentgen-ray film. (See Fig. 1.) The squares may be marked by use of a steel sewing needle and rule. If the atlas used be the "Eyclesheimer-Shoemaker" it will be necessary to make the squares 8 millimeters each as the illustrations in that work are uniformly a $^4/_5$ reduction of a normal individual. If the "Symington" atlas be used the squares will be full centimeters because the charts in this work are life size.

From the foregoing it will be seen that this is a mere additional step to the parallax double-ring method of foreign object localization and takes but a few seconds of time after the three skin marks and distances have been obtained. In the event that the surgeon, or the roentgenologist, desires a graphic record of the case, a simple tracing through thin paper can easily be made by any one of the operating room assistants.

To illustrate by example the application of the above described proceeding let us assume a case in which a projectile was found, on fluoroscopic examination, to lie in the abdomen at the level of the upper edge of the body of the third lumbar vertebra. (See Fig. 2.) It is 6 cm. below the skin mark on the anterior surface, 11.5 cm. from the posterior mark, and 9 cm. from the lateral skin mark. Measurement of the distance of the anterior (and posterior) mark from the median line gives us 4 cm. to the right. On consulting the key figure of the cross section atlas, finding the section of the upper edge of the third lumbar vertebra, turn to that page and place the transparent sheet of ruled squares so that the centre line is on the median line of the illustration. Count 4 squares to the right. On this line the projectile lies. Count 6 squares downward. This is exactly the position of the foreign object. Check up on the other two figures, 11½ squares from posterior edge and 9 squares from the side. Any difference between the dimensions of the patient and the illustration can easily be taken care of by halving the amount of increase or decrease and slipping the sheet of squares to accommodate. Thus 6 (anterior) and 11.5 (posterior) equal 17.5 cm., the thickness of the patient at the level of the third lumbar. This is the same as the illustration so no allowance is needed. But if the thickness of the patient were 19.5 cm., he would be 2 cm. larger than the average used for the illustration and the sheet should be displaced 1 cm. anteriorly and the other 1 cm. posteriorly.

The x-ray report of this case will be as follows: "Anatomical localization: a foreign object (rifle ball, shrapnel, etc.), lies just posterior to the fundus of the gall bladder, in close proximity to the right edge of the head of the pancreas, internal to the edge of the liver and immediately in front of the descending duodenum."

A second example may be cited to illustrate a different application. In this case the foreign object is found at the lower edge of the second lumbar vertebral body; its depth is 13 cm. from the anterior skin mark, 4.5 cm. from posterior mark, and laterally, 6.25 cm. (See Fig. 3.) The distance from the median line anteriorly is 5 cm. left, and posteriorly left, is 8 cm., because the patient could not lie squarely supine. This requires that the squares be set on the respective distances anteriorly and posteriorly from the median line of the illustration. With this setting we count down on that line 13 squares which gives the precise location of the projectile.

The roentgen-ray report will read "Anatomical localization: the foreign object lies in the lower pole of the left kidney in the posterior position of same."

It will be seen that reports of this explicit nature are far more illuminating to the surgeon than mere figures as to depth, and convey to him a far greater degree of accuracy than is possible by the mathematical calculating methods.

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INOCULATION DAY

My blood the surgeons fortify
With antiseptic serum;
The dread bacilli I defy—
What cause have I to fear 'em?
We form outside the pest-house door
At one o'clock precisely,
But if we get our dose at four
We think we're doing nicely.
And in our arm the surgeon stabs
A hypodermic squirter,
E'en as the hungry hobo jabs
His fork in a frankfurter.
I'm full of dope for smallpox germs,
For typhus and such evils;
For broken heart and army worms,
For chestnut blight and weevils.
I'm doped against the bayonet
Wielded by German demons;
But no one seems to think I'll get
Dear old delirium tremens.

—A Private at Plattsburg, in the *Journal of the A. M. A.*

THE ROENTGEN INSTALLATION OF AN AMERICAN MOBILE HOSPITAL

BY CAPT. JAMES W. SQUIRES, M.R.C.

Roentgenologist to Mobile Hospital No. 39, A.E.F.

ALL roentgenologists will naturally be interested in the roentgen-ray equipment, facilities and problems presented in mobile sanitary formations, which have been adapted from the French Sanitary Service, one of which is now known officially as Mobile Hospital ——. To those who are not familiar with the nature and function of these units, the following extract from a report made by Lieut-Col. Flint to the Medical Department may be of interest:

Autochir.

"The Mobile Hospital or 'Autochir.' (Ambulance Chirurgicale Automobile) is a development of the old French field hospital, which, both in personnel and equipment, proved inadequate to meet the surgical demands of modern warfare. The conditions imposed by the present military situation required a formation equipped with the technical machinery of a highly organized hospital and operating room; that is to say, an adequate sterilizing and roentgen-ray plant, where a large staff could operate continuously. This, furthermore, had to be coupled with a considerable degree of mobility so as not to immobilize permanently an expensive equipment of this sort, and to allow it to be despatched to any point desired according to the military necessities.

"The earlier attempts of the French resulted in the formation of the Auto Chir., now known as Type 1915, which consisted of all the essential equipment of a modern operating room and x-ray room mounted on several trucks.

"The personnel of these units consisted of a staff of highly trained surgeons and roentgenologists, so that the organization in times of attack might operate continuously for periods of twenty-four hours. As organized at present, the staff forms the intensive operating machinery of the French evacuation hospitals or it is attached to field hospitals, used for non-transportable cases.

"Three years of experience with these formations has led to marked improvements in the equipment which was, at first, much too heavy and cumbersome. The saving of space and weight, as is shown in the latest product of the French factories, is the result of many experiments which have achieved reduction in both the number and weight of the cars employed.

"The earlier Autochir. carried only its operating personnel, but the latest type carries ward personnel, sufficient either to care for the most seriously wounded assigned to the unit, or to allow it to functionate as a small independent hospital.

"The recent development in German strategy, resulting in the absolute destruction of the terrain over which their troops retreat, makes it essential to provide some form of mobile hospitalization which can be used temporarily until more permanent hospitals are constructed. This aspect of the hospital problem has resulted in the production of a new Autochir., the so-called Ambulance Chirurgicale Automobile, Type 1917, known in the U. S. service as the Mobile Hospital."

Equipment.—"The equipment can be divided into an operating section and a section of hospitalization. With the unit there are four permanent trucks, on one of which is mounted the sterilizing apparatus and on another the roentgen-ray equipment. The other two cars are ordinary trucks which serve the purpose of carrying supplies from the base or railhead to the point where the mobile hospital is functionating. The organization is provided with a portable operating room barrack, adequately heated, and with a capacity that permits of two tables being used simultaneously. This barrack is carried on a trailer. A series of Bessoneau tents are employed for wards, each having a capacity of 20 to 25 beds. These wards are connected by a covered corridor. There is likewise a specialized Bessoneau tent, used as a reception and preparation ward for patients until they can be operated upon and hospitalized. The personnel is housed in Bessoneau or Tortoise tents. The latter are also used for offices, laboratory, mess, etc. The capacity of the hospital varies from 100 to 150 beds. Two rolling kitchens of the aviation type are also included in the equipment. With the exception of the portable operating barrack, roentgen-ray and sterilization material, the entire equipment of the hospital is transported by means of ordinary trucks which are temporarily requisitioned when necessity for transportation arises.

The Use of the Autochir.—(a) "In times of an attack at more or less fixed portions of the line, these units can store their hospitalization equipment and, with the addition of extra surgical teams, form the essential operating mechanism of the large evacuation hospitals. It is in this capacity that the Autochir. has operated with the French Army for the past three years.

(b) "In areas where sudden need for hospitals arises, they may be employed with their mobile tentage as small surgical units. Under the same conditions these organizations may follow the troops in an advance, after the roads are repaired, and work independently until more permanent hospitals can be built.

"Under conditions of sudden emergency, such as occurred in Italy last November, these were the only type of surgical hospital which the French had at their disposal. Several of them were attached to the French Army supporting the Italians, and formed their chief surgical units. According to the French standards there are about three such organizations per army corps of four divisions."

THE ROENTGEN-RAY EQUIPMENT OF THE MOBILE HOSPITAL

As practically all battle injuries necessitate the accurate localization of projectiles, much of the efficiency of the Mobile hospital depends on its x-ray equipment. Furthermore, as at any time the campaign may become one of movement, it is most important that this equipment should combine mobility and compactness with a maximum of efficiency. The French have met this problem by the introduction of a roentgenological truck possessing the qualities enumerated above. This truck comprises an electrogenic set and a specially designed truck body, which affords ample space for the transportation of the necessary radiological apparatus and accessories. As this equipment has been greatly improved since its introduction, a description of the latest model may prove of interest.

Technical Truck and Electrogenic Set.—This truck consists of a two and one-half ton Renault chassis, an electrogenic set and a specially constructed body. The motor of the truck has two functions, driving the car and operating the electric generator. It is of the four-cylinder, water-cooled type of 35 horse power and has an overland speed of fifteen miles per hour. The speed of the motor is regulated by a governor of the fly-ball type, which is mounted between the motor and the electric generator. This governor is ordinarily set for about 1100 R.P.M., but for use with the generator it is adjusted to give a motor speed of 850 R.P.M., which is maintained automatically at all loads from 0 to 50 amperes. The generator is mounted immediately in front of the motor and is supported by an extension of the chassis frame of the truck. It is compound wound, direct current, rated at 5 K.W. and is direct-connected to the shaft of the motor.

The control board is placed on the dash of the truck and comprises: An irreversible plug for the cable, conveying the current from the generator to the main distribution panel, a voltmeter, an ammeter, a field rheostat, a double pole main switch, two 60-ampere fuses and a cut-out switch in the field circuit, so that while moving on the road the generator runs idle and functions as a fly-wheel.

Body of the Truck.—The body of the truck is skillfully constructed for the reception of the roentgenological equipment and is used as a developing room and for storage of the excess equipment when the installation is in operation. Lengthwise through the body of the camion runs a central aisle, flanked on either side by drawers, cabinets, and shelves for the storage of the *x*-ray plates, chemicals, and the smaller accessories. The fragile material, such as the *x*-ray tubes and valves, is packed in specially padded wooden boxes. The practicability of the packing is shown by the fact that, while these camions are driven over rough roads, the fragile material is rarely broken. The tube boxes and the larger parts of the apparatus, to be described later, are held in position during transport, in various parts of the truck, by means of leather straps.

The interior of the truck is light tight, yet well ventilated, and fitted at its anterior end with a red glass window, shelves and other accessories for photographic work. For working with artificial light the interior is also fitted with conveniently placed red and white electric lights. Where running water is available, flexible hose connections may be made between the source of supply and the metal tanks for the washing of *x*-ray plates.

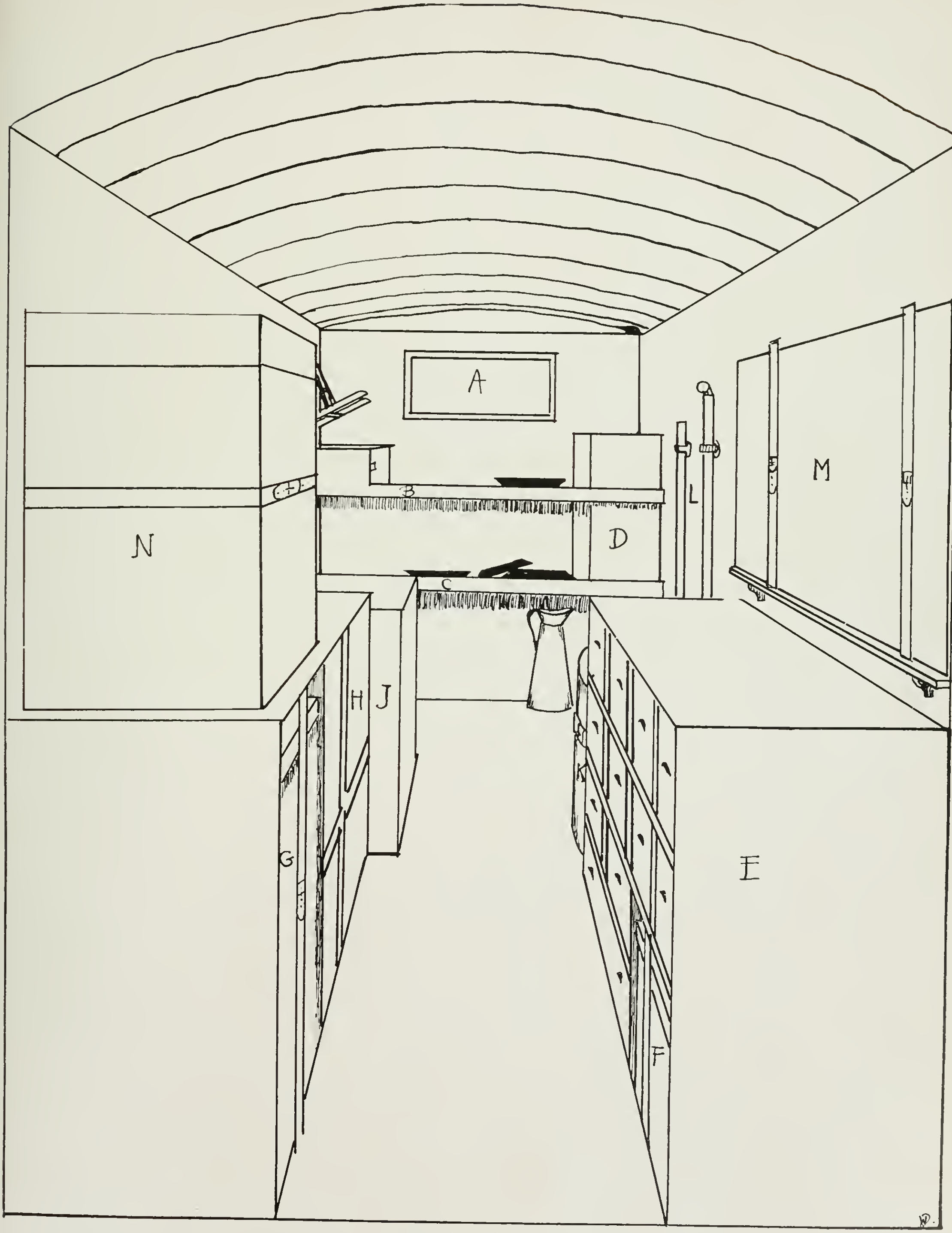
Roentgenological Equipment.—The French Service de Santé furnishes with the equipment the Chabaud and the Pilon roentgen-ray tubes and the Villard and Pilon valves. These require considerable regulation to maintain their proper vacuum. This unsatisfactory feature has been eliminated in our equipment by adapting the Coolidge tube installation to the French equipment. The Coolidge filament is heated by means of a 60 ampere hour, 12 volt storage battery which can be recharged as often as is necessary. On the main distribution board of the electrical equipment of the hospital there is a bank of lamps for charging the *x*-ray battery. We have simplified this procedure by placing a bank of lamps in the roentgen-ray room, thus rendering it unnecessary to move the storage battery for recharging.

The Gaiffe-Gallot *x*-ray table, which is supplied with this equipment, is a plain wooden table, seventy centimeters in width, and two meters in length. The top of the table is one centimeter thick. The table is fitted with folding legs which are clamped in position by means of set screws.

The tube stand, Drault model, small type, is separate from the table and runs on a small track placed on the floor. It is assembled by placing the upright rod on the stand base, then attaching the tube holder and cupule to the upright rod and adjusting the counter balance. The tube stand is small and compactly built, its weight being about seventy-five pounds. It is graduated in centimeters for vertical and horizontal tube shifts. The horizontal arm support of the cupule is arranged with a collar so that it can be rotated 26 degrees for the 26 degree method of localization.

The remaining important elements of the roentgenological equipment are divided into two units, the mobile roentgeno-surgical transformer unit of Ledoux-Lebard and a fluoroscopic operating unit and its accessories.

Mobile "Radio-surgical Unit" of Ledoux-Lebard.—The Ledoux-Lebard transformer and its accessories are enclosed in a nicely finished wooden case, mounted on rollers. The unit comprises a transformer, autonomous mercury interrupter, a condenser, spark gap, milliampere meter and a switchboard, to which is attached the rheostat, ampere meter, fuses and switches. The various parts of the unit are permanently connected in the case so that when the front and rear doors are opened and connection is made with the cable supplying the current from the generator to the transformer, the unit is ready for operation.



INTERIOR OF ROENTGEN-RAY TRUCK (REAR VIEW).

A. Red glass window. B. Developing shelf. C. Fixing shelf. D. Fixing tank. E. Drawers for electric material, *x*-ray accessories and chemicals. F. & G. Packing boxes for *x*-ray tubes and valves. H. Compartments for *x*-ray plates and accessories. J. Ledoux-Lebard Transformer Unit. K. Lead-lined box for fluoroscopic operating table. L. Tube stand. M. *X*-ray and fluoroscopic operating tables. N. Tools and *x*-ray accessories.

Owing to its simplicity the installation requires very little care. Once a day it is necessary to place a drop of lubricating oil in the motor of the mercury interrupter, to change the illuminating gas or ether vapor, and to clean the mercury as often as indicated. Observance of these simple precautions is all that is required to insure smooth running of the apparatus.

Fluoroscopic Operating Unit.—This unit is designed for surgical operation under the screen and is placed in the operating room, the current being conveyed from the transformer in the *x*-ray room to the unit by means of high tension insulated cables. The unit comprises a light fluoroscopic table and a tube holder box. The framework of the table is cast iron and its top is covered with a thin sheet of aluminum. Underneath the table is a lead-lined roentgen-ray tube box mounted on rollers which runs from one extremity of the table to the other on a small track. Provision is also made for lateral shifting of the tube. A Dessane bonnet is furnished with the equipment. This is worn by the roentgenologist for fluoroscopic observations which are made in the usual brilliant light of the surgical operating room.

Localizing Sets.—The localizing equipment furnished by the French *Service de Santé* consists of the Haret rule, the pierced screen, the Hirtz compass (radioscopic modification) and a collar fitted to the horizontal arm support of the cupule for the 26 degree method. In addition to these we have added the profundometer method,[1] the trocar and cannula method[2] and the device required for the Strohl method.

Installation of the Roentgenological Equipment.—The installation of the roentgenological equipment depends on the conditions under which the hospital is operating. If it is being used as an autonome unit, the roentgen-ray apparatus is installed in a room of the demountable barrack, adjacent to the operating room. If the hospital is operating in permanent buildings, such as barracks, a château, abbey or evacuation hospital, the apparatus would be assembled in a room or tent in proximity to the operating pavilion. At present, our hospital is installed partly in barracks and tents, the roentgen-ray department occupying a room adjacent to the operating pavilion and in the same barrack.

When the roentgen-ray room of the demountable barrack is utilized, absolute darkness is obtained by means of a large, black curtain impervious to light. In our present installation, a fixed barrack, the light is excluded by the use of shutters.

The Handling of the Wounded in the Roentgen-Ray Room.—The method of handling the wounded varies according to the injury. Where the patient's injuries are grave and he is carried into the roentgen-ray room on a stretcher no effort is made to move him, the heavy canvas of the stretcher offering practically no resistance to the ray. If the patient is only slightly wounded, and he can be moved from the stretcher without pain, he is placed directly on the table. Splints are not removed unless it is necessary for a more accurate examination. Bandages of the injured parts are removed when it is necessary to place marks on the skin for the guidance of the surgeon.

Skin Marking.—Numerous methods of marking localizing points on the skin have been described. A method which we have found valuable is the combined use of a saturated solution of pyrogallic acid and 2 per cent silver nitrate. A simple instrument employed for applying the solutions to the skin consists of a large darning needle fused in the end of a piece of glass tubing five inches long. The solutions are applied as follows: The pyrogallic acid solution is first lightly applied to the skin by means of the marking instrument at the point of emergence of the normal ray; then by means of a second similar instrument the silver nitrate is traced over the mark made by the first solution. The solutions thus applied made a distinct

(1) Flint—*Annals of Surgery*, Aug., 1916.
(2) Ibid.—*Military Surgeon*, March, 1917.

black mark which, after a few minutes of drying, cannot be washed off in the preparation of the patient for operation, and is distinctly visible after the application of iodine to the field of operation.

METHODS OF LOCALIZATION

In the localization and extraction of projectiles, two distinct problems have to be considered by the roentgenologist and surgeon: First, the recent wounds in which the tract of the projectile still exists; second, the healed wounds in which the tract is cicatrized and obliterated and, therefore, can no longer serve as a guide during the debridement and excision of the wound.

In wounds of the first type when the tract can be utilized as a secondary control in localizing the foreign body, a simple localization giving its size and depth beneath a skin point is usually sufficient, because, during the operation in these cases, it is really the tract that locates the foreign body. The localization, however, is none the less important, as it tells the operator the position and depth of the foreign body with reference to the wound of entrance. It enables him to make his incision intelligently so as to provide the best exposure to safeguard important structures, and to give himself the best surgical approach for the excision of all traumatized and infected tissues. If, however, the tract cannot be utilized as a guide, as in certain wounds of the chest or abdomen where the surgeon is forced to make an operative approach on the side of the body opposite the wound of entrance, or where the tract is obliterated, as in the case of healed-in projectiles, a simple depth localization will not suffice, because with a skin point localization and a healed-in projectile, the operator, in fifty per cent of the cases, will fail to find the foreign body or he will mutilate the tissues uselessly in a prolonged search for it. In these cases more complicated methods are required to give the surgeon special data as to the relations and position of the foreign body, and to furnish as well some physical guide to the projectile during the operation.

For the first type of wounds, particularly where one is faced with the problem of many wounded men coming in at one time, the methods of localization which will prove the best are those which combine simplicity and rapidity of technique with the maximum degree of accuracy. In our experience the Haret, Strohl and "26-degree" methods have fulfilled these requirements. Of these we have adopted the 26-degree method as a routine procedure. When, however, the angulating device required for the 26-degree method is not available, the Strohl or Haret methods yield rapid and satisfactory results.

For the healed-in projectiles and the type of cases which present special problems, the Hirtz compass (radioscopic modification) or the profondometer method is indicated, as these methods not only give the depth of the projectile, but are fitted with special apparatus for guidance during the operation. The guide of the compass and of the profundometer directs the surgeon to the projectile.

Special Points to be Observed in the Localization of Projectiles.—To render the greatest possible aid to the surgeon the localization should always be made in the plane that furnishes the best surgical approach. In fresh wounds, the surgical approach is almost invariably along the tract. In all cases the relation of the projectile to contiguous anatomical structures, the depth, position, size and number of projectiles should be tersely and accurately stated. The position of the part at the time the localization is made should be carefully recorded, as any change in the position leads to a disturbance in the relation of the skin marks to the projectile. To differentiate between deep and superficial projectiles distinguishing skin marks may be used. In our service, a cross signifies that the projectile is deeply situated, and a small circle indicates that it lies superficially.

Roentgenological Records. — We have adopted a simple method of dictating the roentgenological data during the examination of patients. A box, curtained at its open end, is mounted on a small table in one corner of the *x*-ray room. This box is wired and its interior illuminated by a small, red, electric lamp so that the scribe may take dictation from the roentgenologist without the introduction of light during the examination. By this method the data are compiled as the examination progresses and all delays and interruptions are avoided. All reports are made in duplicate, one copy accompanying the patient to the operating room, forming part of his clinical record; the second copy is retained by the roentgenologist. All copies retained are cross-indexed and filed in the usual manner.

RADIO-ACTIVITY

The Parent of Actinium.—Soddy, F. and Cranston, J. A. (*Roy. Soc., Proc.* 94, pp. 384-404, June 1, 1918.) In a full historical introduction, the data obtained in 1909 relative to the rays and products of uranium X are discussed in so far as they throw light on the various possible modes of origin of actinium. The minute growth of actinium previously put on record (see Abs. 1075, 1913) as having been observed in the old uranium preparations has been confirmed by their later history and is now established beyond doubt.

Uranium X_2 can be separated from UrX_1 by sublimation in a current of air charged with vapors of carbon tetrachloride at a temperature below visible red-heat. 470 gm. of a very pure Indian pitchblende were similarly treated, in the expectation of removing eka-tantalum, isotopic with UrX_2 and giving actinium in an α-ray change of long period. The preparations so obtained were initially free from Ac, but one of them has produced it continuously with the lapse of time. A direct comparison of the amount of Ac in this preparation after the lapse of two and a half years with that in the original pitchblende showed that it was equal to that in about 0.25 gm. On the assumption that eka-tantalum and actinium are both long-lived, that no intermediate members intervene between them, and that the preparation contained the whole of the parent Ac in the original mineral, the period of average life of Ac is calculated to be 5000 years. Nothing can yet be said definitely as to the period of the parent.

A second preparation separated from Joachimsthal pitchblende, the treatment of which commenced in 1903 and ended in 1914 with the carbon tetrachloride sublimation, has given a similar growth of actinium. The work was undertaken to test and confirm the view that the parent of Ac occupies the eka-tantalum place in the Periodic Table, and gives actinium in an α-ray change of long period, being itself formed as the product of UrY, discovered by Antonoff, who suggested that it was the first member of the Ac series. But this mode of origin of actinium, though at present the most probable, has not yet been conclusively established to the exclusion of all the other possible modes of origin, discussed in the historical introduction.—From *Science Abstracts*, Vol. XXI, par. 8.

THE PHYSICAL CHARACTERISTICS OF ROENTGEN-RAY INTENSIFYING SCREENS AS APPLIED TO ROENTGENOLOGY

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THE USE of fluorescent screens for the intensification of exposure is a rather widespread practice and is of considerable importance in roentgenology. In spite of the general use of these screens, however, in quite a variety of work, very little has been done in the study of the fundamental laws of such a system. Shearer[1], Edwards[2], Baker[3], and others, have contributed excellent papers to the general fund of knowledge from a strictly utilitarian standpoint. Recently Sheppard[4] advanced some interesting theories regarding conditions for the fluorescent state.

In a previous paper the author described a method which he had developed for the precise study of the reactions of a photographic plate to roentgen rays. The present paper is a continuation of the work begun in the first paper, being a study of the functions of the various factors in the intensifying screen system.

When roentgen rays strike the emulsion of a photographic plate, less than 1 per cent of their energy is absorbed to cause the formation of a latent image, the remaining percentage passing through without performing any useful function. Any method, then, which utilizes this waste energy and returns it to the plate in a photographically active form, is of considerable value. Such is the function of fluorescent intensifying screens. A large part of the energy of the beam transmitted by the object rayed is absorbed by the screen and returned to the plate in a proportion governed by several laws to be discussed later.

Two types of fluorescent screens may be utilized in such a process. The first type is one in which the emitted or fluorescent radiation is still of that frequency usually termed *x*-rays—that is, characteristic high frequency radiation. As is well known, such a phenomenon is dependent on the atom of the emitting substance alone. The second type is where the emitted fluorescent radiation is of such wave-length that the energy falls within the ultra violet and visible regions of the "ordinary" spectrum. In this case the fluorescence no longer seems particularly dependent on the individual atom, but rather on the arrangement of atoms in the molecular structure of the material. Of these two, the second is by far the more efficient for use in practical roentgenography, and is the only one considered in the present paper.

The general phenomenon of fluorescence is one which has commanded the attention of a number of investigators, chief among whom are Herschel, Stokes, Wood, Wiedeman, and Nichols and Merritt. Of these Nichols and Merritt have done the most complete quantitative work.

Briefly defined, fluorescence is a phenomenon in which radiant energy of one particular wave length is absorbed by a material and emitted again as radiant energy of a longer wave length. Fluorescence takes place only while the exciting radiation is allowed to impinge on the material. It is thus different from the phenomenon of phosphorescence in which the time-lag between excitation and emission may be considerable.

Of the materials which fluoresce to roentgen rays in the range of frequencies from the ultra violet to the red, there are only a few which can be used efficiently for photographic intensification. All of

* Read before the nineteenth annual meeting of the American Roentgen Ray Society, Chattanooga, Tenn., September, 1918.

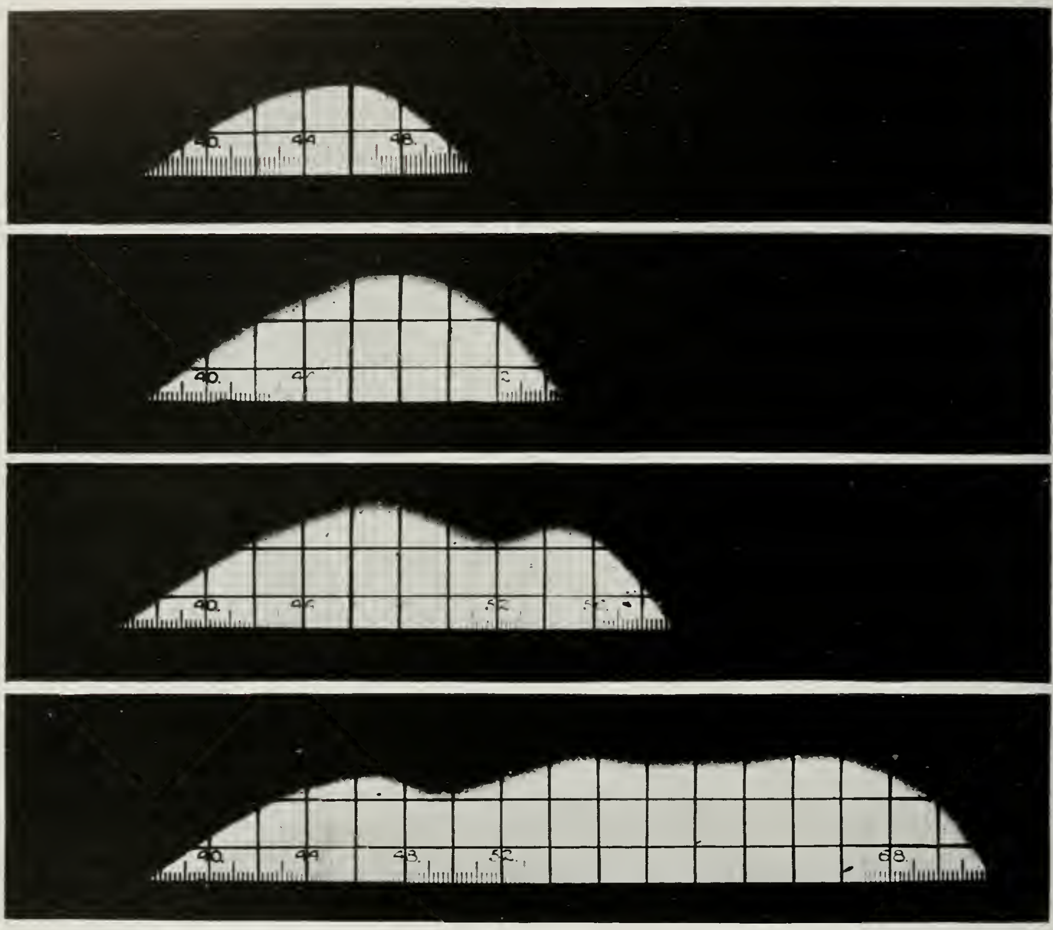

Fig. 1.

1. Roentgen Ray Plate.
2. Ordinary Plate.
3. Ortho-chromatic Plate.
4. Pan-chromatic Plate.

these substances must be in the crystalline state. Barium-platino-cyanide, barium salicylate, calcium tungstate, molybdenum tungstate, magnesium tungstate and some double tungstates of these metals fluoresce to a greater or less extent to roentgen rays, and the radiation is more or less active photographically. Of these materials crystalline calcium tungstate is by far the best with present photographic roentgen-ray materials.

The salt is usually powdered and coated with suitable binder on a support of some material of slight roentgen-ray absorption, such as cardboard or celluloid. This screen is then placed in contact with the photographic surface and exposure made through either the screen or the photographic plate or film.

The efficiency of any radiator as a source of photographic stimulation depends primarily on the comparative spectral distribution of the energy of the radiator and the spectral sensibility of the particular photographic plates used. While these relations have not been determined as yet on an equal energy basis for roentgen-ray materials, qualitative analyses have been made.

In Fig. 1 are shown the spectral sensibilities to white light of an (a) x-ray plate, (b) a fast ordinary plate, (c) an orthochromatic plate, and (d) a pan-chromatic plate.

The fluorescent spectra of calcium tungstate have been studied under the following conditions. The screens used were commercial types. Spectra were obtained using a Hilger quartz spectrograph on Seed X-ray, Seed 30 and Wratten panchromatic plates. The illustrations shown were made on Seed 30; the spectral distribution of photographic energy in the fluorescence does not, however, extend appreciably further toward the red than is shown on these photographs. The screen was placed immediately in front of the slit and the x-ray tube in front of the screen as shown in the diagram (Fig. 2). A Coolidge tube of medium focus was used, the length of exposures averaging 1000 milliampere minutes at a distance of 8 inches from the target to the screen. The photographic plate was carefully shielded from stray radiation during the long exposures, which, in some cases, were for 24 hours.

Spectrograms were made with the tube operating at 40 K. V., 60 K. V., and 80 K. V. (R. M. S.). These are illustrated in Fig. 3, losing, however, by reproduction. In Fig. 4, the spectrum at 60 K. V. is graphically shown in a relative scale compared with the plate sensibility curves of the previously mentioned photographic materials. An inspection of these curves will enable one to pick out the plate most efficient for use with the screen.

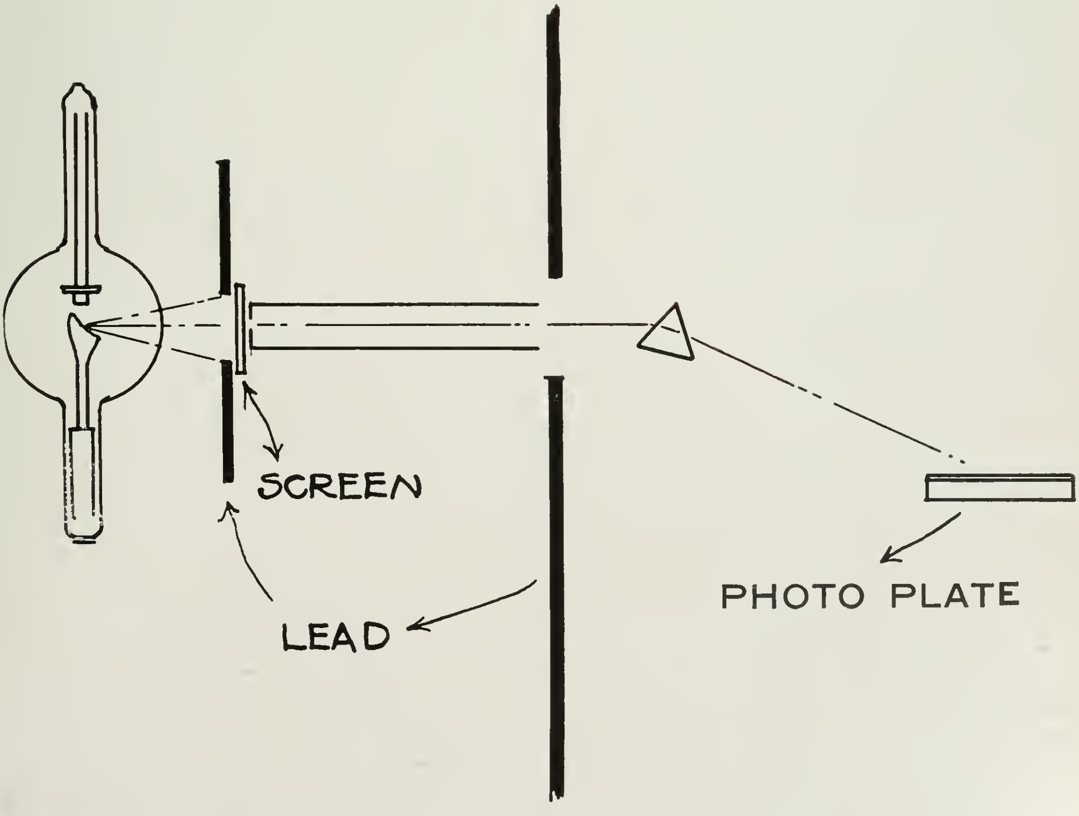

Fig. 2.

However, in a final consideration of efficiency, the sensitiveness of the material to the direct roentgen-ray beam must be given weight. It has been found that in a negative made from a screen system, about 20 per cent of the exposure is due to the absorbed energy of the direct rays, the remaining 80 per cent being supplied by the screen fluorescence. Hence, to decide the maximum efficiency in the case where the ratios of the screen fluorescence and plate spectral sensibility are the same for two photographic materials, their relative sensitiveness to roentgen rays alone should be considered.

As may be seen from the spectra in Fig. 2, the output of photographically suitable radiant energy increases with voltage. It also increases with current to a saturation value, dependent on the particular screen used. The limiting voltage, however, which it is permissible to use in practical roentgenography, is governed by the absorption of the object roentgenographed. That is, in the case of the average picture of body parts, in order to absorb enough of the incident *x*-ray beam to differentiate fine detail, the penetrating ability of the beam should be of a certain minimum value, of necessity limiting the tube voltage.

As to the technique of using a screen, the best practice is to expose through the support of the emulsion which is in contact with the surface of the fluorescing screen. Hence it follows that the support must be one of minimum opacity to roentgen-rays. In the case of two emulsions of equal sensitiveness, one on glass and the other on flexible film, the latter support should be used as it is more transparent to roentgen-rays.

Recently there has been considerable discussion among roentgenologists as to the efficiency of using double intensifying screens; that is, a screen system in which a photographic film is placed between the active surfaces of two intensifying screens, the exposure being made through one screen. The writer has studied the laws of such a screen system and has found that an increased efficiency over a single screen system exists only between rather narrow limits. It has been found that, using the average screens available for such work, the radiation must be of a rather penetrating type before the absorption of the front screen is slight enough not to have a great effect on the efficiency; indeed, it was found that, using a radiation governed by a $4\frac{1}{2}$-inch spark gap or less, the absorption of the front screen was so great as to make the resulting effective exposure less than it would have been if a single screen had been used in the usual way.

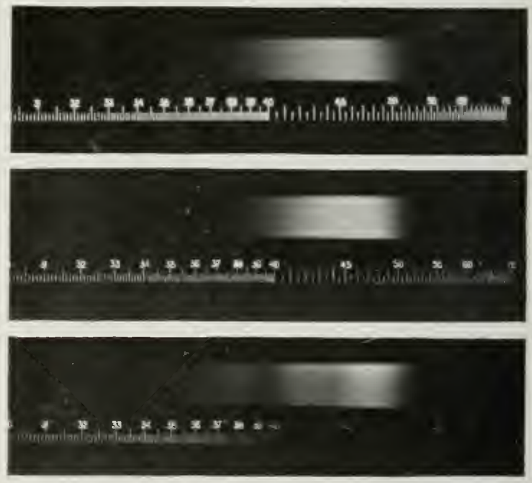

FIG. 3.

1. 40 K. V.
2. 60 K. V.
3. 80 K. V.

Beginning with a five-inch spark gap and on, the system began to gain efficiency over the case of a single screen until, using a six-inch gap, there was a noticeable increase in exposure as measured by the photographic result. With a further increase of penetration this efficiency increases. But inasmuch as secondary effects, such as scattering and hence graininess, increase also with this increasing penetration there is a certain maximum value which cannot be exceeded. This leaves working limits of between five inches and six and one-half inches for the spark gap factor. The gain of exposure under this condition is about

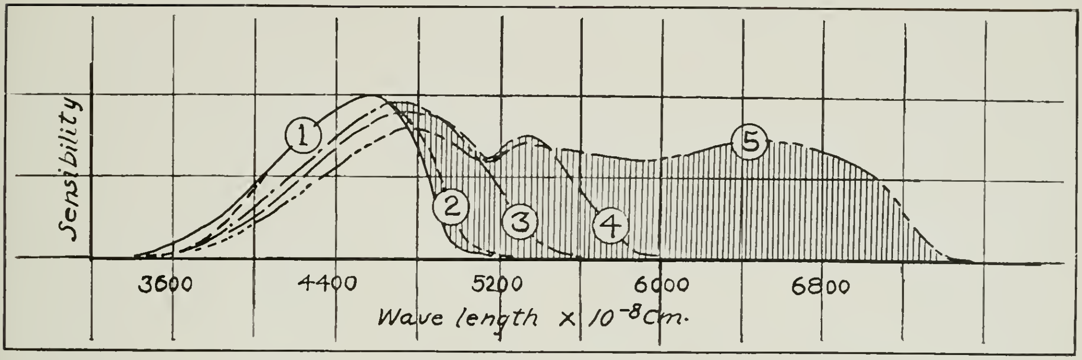

FIG. 4.

1. Emission Spectrum Ca'cium Tungstate.
2. Sensibility X-Ray Plate.
3. Sensibility Ordinary Plate.
4. Sensibility Ortho-chromatic Plate.
5. Sensibility Pan-chromatic Plate.

fifty to one hundred per cent, depending upon the individual screens. The value of such a method, then, depends upon the value of this gain in exposure. In cases where the exposure is of necessity long and relatively great, penetration must be used, such as in the radiography of the spine, head, etc. This amount of increase of exposure is, perhaps, desirable enough to take advantage of.

There is just one more factor which functions in obtaining efficiency with a screen system. That is the development. As brought out by the author in the paper previously mentioned, exposure in the case where a screen is used is mostly on the surface of the photographic emulsion; hence development proceeds differently from that in the case of exposure to roentgen rays where the effect is distributed evenly through the material. There is a tendency to over-expose and under-develop screen negatives, thereby failing to get the contrast and snap from a screen negative which is present in a direct negative. Development of a screen negative should be fully as long as that of a direct negative and the exposure timed so that this may be done.

NOTE—Since writing the foregoing paper double-coated films have been developed in the laboratories of the Eastman Kodak Company which make it necessary to add a few remarks to the portion of the paper devoted to double screen technique. It is found that by using this material, which is coated on both sides of the support, much added efficiency is gained in such a system by reason of the fluorescence acting directly from screen to emulsion in both cases.

The work in the foregoing paper was based on experiences with single-coated films. For example, it has been found possible to radiograph satisfactorily the chest in one second at 28 inches distance, using the Army type of Coolidge Radiator Tube run at a 5-inch gap and ten milliamperes. The writer hopes to describe the possibilities of some interesting experiments under way in this connection in a later paper.—[M. B. H.]

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TRANSLATIONS & ABSTRACTS

Fischer, I. F. Examination of Gall-Stones by Roentgen Rays. (*Nord. Med. Ark.*, Stockholm, 1917, Vol. I, Kirurgi, No. 12. *Surg., Gynec. & Obst.*, Vol. XXVII, No. 3.)

Renal calculi, as a rule, are more dense than gall-stones, and produce a much stronger shadow on the roentgen plate. Also the anatomic location of gall-stones prevents them from appearing on the plate.

In the Bispebjaerg Hospital, Copenhagen, for the past four years all patients presenting symptoms of gall-stones have been examined by roentgen rays. The patients numbered 141. The roentgenograms were positive in 11 cases. Of these eight were operated upon but stones were found in six only. Of the 141, fifty-four patients were operated upon and stones were found in thirty-nine. The low positive number of cases in which shadows of stones were seen on the roentgen plate shows very clearly that no weight whatever should be attached to the negative result of the roentgen examination, which showed calculi in only about eight per cent. of those examined. Even in three of the cases in which a positive roentgenogram was verified by operation, the number of stones found greatly exceeded those shown on the plate. This is accounted for by the fact that the calculi present in the same gall-bladder have different powers of absorption for the roentgen rays.

The author gives a number of illustrations of the appearance which gall-stones give on the plate. He also describes the errors which might be made in interpreting these shadows. The calcareousness of the stone, and not its size, is the determining factor in the vividness of the shadow cast on the plate.

Experiments show that no small number of the gall-stones embedded in a gall-bladder with abundant gall will not be demonstrable by the roentgen rays, because their chemical composition gives them less power of absorbing the rays than that possessed by the liquid. It is impossible to fix a limit of the percentage of gall-stones the demonstrability of which is within the margin of possibility. It will depend on the technique applied. Any improvement of technique will improve the roentgenologic diagnosis of gall-stones. W. A. Brennan.

Boggs, R. H. The Treatment of Carcinoma of the Breast by the Roentgen Rays. (*Interst. M. J.*, 1918, Vol. XXV, p. 210. *Surg., Gynec. & Obst.*, Vol. XXVII, No. 3.)

The author states that roentgenotherapy is today a recognized method in the treatment of postoperative cases, recurrent and metastatic, primary inoperable and primary cases which do not permit operation. He believes that, even in early cases, operation should be supplemented by roentgenotherapy, thereby preventing from 25 to 50 per cent of recurrences. To be effective this radiation should be done thoroughly by competent operators, giving full physiological doses to every chain of lymphatics draining the breast as well as to the opposite side of the body. Roentgen radiation produces a sclerosis of the lymphatics which in itself tends to oppose cancer dissemination. Such treatment is of value as an anteoperative as well as postoperative procedure, often rendering an advanced case operable; if deep metastases have not taken place, more permanent cures can be surgically obtained.

The author uses the cross-fire method as much as possible. Three or four areas on anterior chest wall and the liver area are given one anteriorly, laterally, and posteriorly. The axilla is given three or four doses and the lateral chest wall below the axilla an additional one. The supraclavicular region is divided into four areas. The supra- and subscapular areas on the affected side each receive a full dose. The mediastinum should receive one or two treatments through the back. The opposite side is rayed according to indications and never receives less than from four to ninety-eight treatments during the course. The epigastric region must never be omitted, as this is one of the avenues by which the liver and pelvic viscera metastasize.

Since operation has reached its limit and since ultraradical operations are not practical until some better form of treatment is discovered, the splendid results achieved through radiation furnish more than sufficient reason for giving every case of carcinoma of the breast postroentgen treatment. In recurrent and inoperable cases, a temporary cure can often be produced. Adolph Hartung.

Hartwell, J. A., and Butler, Ethan F. War Surgery and the Civil Hospitals. (*Surg., Gynec. & Obst.*, October, 1918, Vol. XXVII, No. 4.)

We quote the following *in extenso* as it discusses the relationship between hospital management, physicians and patients as it has been developed by the war.

"The war has demonstrated beyond further debate that corresponding progress can only be made in our civil hospitals when the patient is made the center of all their activities. The wards and operating room must have a staff of laboratory men just as they have a staff of surgeons. The art of surgery and the sciences on which it is founded cannot be compassed by the mind of one man. The laboratory scientist will become more proficient by close contact with the surgeon, and the surgeon will profit equally. Both these staffs must be largely composed of full time men. Our military surgeons and laboratory men find no distracting calls outside the hospital. No one can conceive that the advance made in three years would have been possible if the best trained minds had spent three or four hours a day at the hospital, and then left the patients to get on as best they might under the sole care of juniors and internes during the remaining twenty hours. It may be argued that to organize our hospitals on such lines is financially impossible. Such argument cannot be maintained. Money has always been forthcoming to foster any well thought out plan for the betterment of education and the best care of the sick and injured. Had the lessons which this war is teaching in treatment of the injured been in force during the past two decades, the money saved to our industries would have more than met the expense involved in learning them. The duty of spreading this teaching lies with our profession. Upon our success in this line depends our ability to give to the country one of the offsetting benefits with which war, to some extent, balances its horrors. Another phase of organization more easily accomplished, has been placed in evidence in the military hospital. Every service has had at its disposal well trained mechanics and carpenters. Most surgeons in civil hospitals have at some time vainly struggled to have constructed a simple piece of apparatus to meet some special requirement. There was no well equipped shop at hand with a competent workman who could promptly furnish the apparatus and, at the same time, suggest ways of meeting mechanical problems for which his training fitted him. Trustees of hospitals have been very loath to recognize that other artisans than surgeons may be advantageously employed in a surgical service. The results overseas should be very effective in convincing them that this view is no longer tenable."

Carman, R. D. Roentgenologic Aspects of Hour-Glass Stomach. (*Surg., Gynec. & Obst.*, October, 1918, Vol. XXVII, No. 4.)

Conclusions:—(1) Hour-glass stomach should not be considered a disease entity but an end-result of various pathologic processes, gastric and perigastric.

(2) The possibility of congenital hour-glass stomach must be admitted, although most cases reported have been questioned.

(3) The roentgenogram usually shows a much deeper constriction than is seen at operation, due to the fact that the organic narrowing is exaggerated by the spasm.

(4) Cases of spasmodic hour-glass, whether intrinsic or extrinsic in cause, are not seen by the surgeon, because they are relaxed by the narcosis. Therefore, if the hour-glass is the only roentgen sign present, the first thing to do is to exclude extrinsic causes.

(5) Belladonna or atropine does not differentiate between the organic and intrinsic types of spasmodic hour-glass stomach.

(6) Belladonna or atropine to physiologic effect will differentiate between the intrinsic and extrinsic types of spasmodic hour-glass stomach.

(7) Operations have proved that the organic type is the most common. However. the spasmodic, when intrinsic in origin, is just as important from a diagnostic standpoint as the organic.

(8) The varieties of hour-glass stomach, therefore, admit of the following subdivision:

(A) Congenital.

(B) Acquired.

(1) *Organic:* Constriction due to structural changes in or about the stomach. Causes: ulcer, scar of healed ulcer, perigastric adhesions, cancer, syphilis, corrosives, resection, gastrostomy, congenital (?).

(2) *Spasmodic* (or functional): Cramp of

the gastric muscle without structural change. Two types: (a) intrinsic; cramp directly produced by lesions in the stomach; causes practically the same as those of organic hour-glass; (b) extrinsic; cramp indirectly produced by causes outside the stomach: duodenal ulcer, diseases of the gall-bladder, disease of the appendix, neuroses, tabes, lead intoxication, morphine, nicotine.

(c) *Pseudo-hour-glass*: Simulating the hour-glass form without either spasm or structural change in the stomach. Causes: contraction of abdominal muscles, pressure of stomach against the spine, tumors outside the stomach, atonic stomach, gas and fecal matter in the bowel.

Kelly, Howard A. Two Hundred and Ten Fibroid Tumors Treated by Radium. (*Surg., Gynec. & Obst.*, October, 1918, Vol. XXVII, No. 4.)

The life history of a uterine fibroid possesses three striking clinical characteristics. They can nearly always be considered benign, they give trouble, either by compressing neighboring organs or by hemorrhage. The incidence of malignancy is small and the presence of carcinomatous or sarcomatous changes is almost always excluded by curettage and the microscope. The author contends that the following has been accomplished by radium treatment:

(1) Control of hemorrhage and the checking of menstruation.

(2) The shrinkage of the tumors.

(3) In many instances the disappearance of the tumors.

(4) In some cases (even after two years) the return of menstruation, either normal or scanty.

He states that when there is any doubt about the diagnosis, operation is to be elected in preference to radiation. Of the 210 cases, 146 were 40 years of age and over. Sixty-four were under 40 years of age.

He also states that results are obtained just as easily in young women as in those who are older.

In group I, 146 patients 40 years of age or over, 66 are at the present time cured. In 48 the tumor has diminished in size and the symptoms have been relieved.

Group II includes 64 fibroid tumor patients under 40 years of age. In 28, the tumor has either disappeared or has practically gone. In four of this group menstruation is known to have returned. In 16 patients the tumor has decreased in size.

In the discussion of technique Dr. Kelly states that it is best to produce an amenorrhea which shall last until the fibroid is gone. A single intra-uterine dose of 1500 millicurie hours is sufficient to produce an amenorrhea and shrinkage or complete disappearance of the tumor. An equal effect is produced with a gram of radium four inches from the skin, distributed at various points over the tumor for about 24 hours. It is not advisable to give more than 1500 millicurie hours inside the uterus.

For intra-uterine treatment a small glass bulb is set in the end of a short metal tube which is thick enough to screen off all but the gamma rays. This is then screwed to the end of an ordinary uterine sound and covered by a rubber cot. Then either with or without anesthesia the cervix is dilated and the sound is introduced to the fundus. These applicators remain not longer than a half hour in each spot.

In external treatment from 4 to 5 grams of radium are used, and the entire treatment is given in from five to six hours.

Sgobbo, F. P. The Action of *X*-rays in the Formation of Bone Callus. (*Riforma. med., Napoli*, 1918, Vol. XXXIV, p. 282, *Surg., Gynec. & Obst.*, Vol. XXVII, No. 4.)

The author gives the details of eight experimental studies to note the effects of roentgen-rays in the healing of fractured limbs of dogs.

The only work along this line which the author is able to trace is that of Cluzet and Dubreuil, who, in 1913, found by experiments on dogs that strong roentgen-ray irradiation made before and after fracture notably retarded the formation of callus and consolidation of the fracture. Sgobbo's researches have in every way confirmed these findings; while with single dose alone Cluzet and Dubreuil saw a retardation in the consolidation and formation of callus, Sgobbo by using minimum varying doses obtained, according to the dosage, retardation, limitation in the development, or even absence of callus. Even a single minimum dosage has effected retardation. The question as to whether the dosage of roentgen-rays used in practice for roentgenoscopic or roentgenographic research gives a similar result is now being investigated by Sgobbo; also the manner in which the harmful action of x-ray exerted on the various elements concerned in the formation of callus.

Twenty-two illustrative figures accompany the article.

Eisendrath, Daniel N., A.B., F.A.C.S., Chicago. The Diagnosis of Ureteral Calculi. (*Surg., Gynec. & Obst.*, Vol. XXVII, No. 5.)

The chief object of this paper is a plea for the more frequent use of the roentgen ray. He speaks especially of the value of stereoscopic plates and also emphasizes the use of the opaque catheter and pyelography. He discusses what he terms intensification of suspicious shadows. The scheme was first suggested by Kuemmel. If a very faint shadow is found upon the plate, Kuemmel advised injection of material opaque to the roentgen ray in the region indicated by the shadow, so that if there is a uric acid stone, some of the opaque material will adhere to its surface. A plate is then made, when the shadow will be found more intense.

Ochsner, A. J., M.D., F.A.C.S. The Practical Value of Electric Light in the Treatment of Infections. (*Surg., Gynec. & Obst.*, November, 1918, Vol. XXVII, No. 5.)

Dr. Ochsner relates his personal experience as follows:

"Four years ago, I suffered from a violent infection of my elbow and it became necessary to expose the ulnar nerve when the abscess was laid open. This gave rise to intense neuralgic pains which continued for many days without cessation, notwithstanding the use of wet and dry heat. At the suggestion of Dr. Saurenhaus, I applied an electric light apparatus. Within an hour the pain disappeared, and did not return. My natural skepticism regarding the effect of all therapeutic measures led me to think this might be merely a coincidence, and that possibly the pain would have subsided at this time even if we had not employed the electric light.

"During the past four years, however, I have had an opportunity to test this method at the Augustana Hospital in 78 similar cases of infection of the extremities. Invariably the pain promptly disappeared. Sixty-one of these cases were infections of the upper extremity, and 17 were of the foot."

Kretschmer, Herman L., M.D., F.A.C.S., Chicago. A New Procedure for the Localization of Ureteral Stone. (*Surg., Gynec. & Obst.*, Vol. XXVII, No. 5.)

This consists of catheterization of the ureter suspected to contain stone by an opaque catheter, followed by roentgen examination. Two exposures are made on the same plate. If the suspected shadow is a stone, it retains its relative position to the opaque catheter. If it is not a stone, it will be separated from the catheter.

Kreuscher, Philip H., M.D., Chicago. A Study of the Development of the Epiphysis. (*Surg., Gynec. & Obst.*, Vol. XXVII, No. 5.)

The contention is made that much useless surgery is done before ossification of the epiphysis. The author does not mention the importance of always making a roentgen examination of the unaffected side for comparison with the affected one. He draws the following conclusions:

(1) That a thorough knowledge of the normal structures and their time of appearance is necessary in order to treat intelligently the abnormal conditions.

(2) That fractures of the epiphyseal line should be recognized early and reduced completely to avoid deformities.

(3) That injuries about the joints in the young must never be treated lightly or in a haphazard manner.

(4) That operative injury of the epiphyseal line is inexcusable with our present knowledge of its importance.

Friend, Emanuel, M.D., F.A.C.S., Chicago. Subdiaphragmatic or Phrenic Abscess. (*Surg., Gynec. & Obst.*, Vol. XXVII, No. 5.)

The author attaches much importance to the roentgen ray findings which he interprets as follows:

"Roentgen-ray findings are those usually of an uneven level of the diaphragm on both sides; in other words, a marked bulging upward on the affected side with an acute costophrenic angle, together with a marked shadow over the pus accumulation, and a shadow distinctly less between the accumulation and the diaphragm caused by gas when the causative agent is the colon bacillus."

Dr. Daniel N. Eisendrath, in discussing the paper, says that in 75 per cent or 80 per cent of the cases all of the methods of diagnosis are supplanted by the roentgen plate and fluoroscopic examination.

Weld, E. H. The Use of Sodium Bromide in Roentgenography. (*J. Am. M. Ass.*, Vol. LXXI, No. 14, p. 1111.)

The writer says the ideal medium should be non-toxic, non-irritating and easily soluble in urine, one that is easily sterilized and that keeps well under all conditions and one that is easily procurable at a reasonable cost.

He states that bromide salts are not as irritating as the iodides and that they do not act like foreign bodies as the silver salts. The sodium bromide apparently smears over the surface of the ureters, the minor calices of the kidneys and small saccules of an inflammatory bladder much better than thorium. He prefers to use a 25 per cent solution for the following reasons: (1) It is a bland solution and does not damage the kidney. (2) It casts a clear shadow, outlining the entire pelvis and ureter as well as, if not better than, other mediums thus far advocated. (3) It is less irritating to the pelvis and vesical mucosa than other mediums. (4) It is the least expensive, and is readily procured. (5) It is very easily prepared, and is readily sterilized by boiling.

Hernaman-Johnson, F. The Value of *X*-rays in the Diagnosis of Abdominal Disease. (*Med. Press.*, 1918, Vol. CV, p. 409.)

The author states that the roentgenologist should not be judged by the number and beauty of his plates, nor by his electrical equipment, but by his success in unraveling the diagnostic puzzles sent to him for solution. He gives several helpful suggestions in diagnostic procedures, such as the localization of a renal stone by the method used in determining the vertical depth of bullets.

In the opaque meal and enema he suggests that the patient be examined while leading his everyday life and eating his ordinary food, as pathological conditions can sometimes be noted. Previous to the barium meal it is well for the patient to live on finely divided food for a day or two to avoid undigested lumps.

He sums up the usefulness of the roentgen-ray along the following lines:

1. Urinary system. Calculus in the kidney, bladder and ureter. Enlargements, malformations, alterations in the position of the kidney.

2. Alimentary tract. Disorders of function, ulcers of the stomach and duodenum; by inference in early stages, by direct demonstration in the later. New growths which alter the form of the gastric or intestinal shadow. Correlation of tender spots with particular parts of the tract, e.g., the appendix.

3. Liver and gall-bladder. Alteration of the liver outline (with or without inflation of the colon). Demonstration of an enlarged gall-bladder. Demonstration of gall-stones in 10 per cent of cases.

4. Genital organs in the female. Malformations in the uterus have been shown by the injection of collargol, but the scope of this is limited. By the demonstration of the cecum and appendix indirect information is, however, often obtained. In certain cases of doubtful pregnancy assistance may be obtained, but only at a somewhat late period. Calcification of myomata may be detected.

5. Spleen. This organ is somewhat neglected by modern roentgenologists, though it is mentioned in the textbooks of fifteen years ago. The normal spleen is visible in children and in very thin adults. Enlargements can often be demonstrated. The existence of this viscus should not be forgotten when interpreting roentgen plates of the left abdomen.

C. B. Hollings.

BOOK REVIEWS

UNITED STATES ARMY X-RAY MANUAL. Pp. 506. 219 illus. $4.00 Net. Paul B. Hoeber, New York.

This volume is the official army manual, authorized by the Surgeon-General, and prepared under the Division of Roentgenology. It is the successor to the very small manual which was hurriedly compiled at the beginning of the war, and is intended to be a guide to the roentgenologists who are doing the *x*-ray work in the military hospitals, and also as a textbook for instruction in military roentgenology.

The authors do not pretend that it is a complete treatise on roentgenology. They have aimed to present only the facts that have been established by experience and have avoided all controversial points. They have succeeded in producing a textbook which is above all things practical, and at the same time have not sacrificed anything of value.

The book is evidently a composite, produced by a number of men. One who is familiar with the various idiosyncrasies of our leading roentgenologists can easily detect their hands in many of the sections. This adds considerably to the interest in looking the volume through.

The first chapter, which includes nearly one-quarter of the entire book, is entitled "X-Ray Physics." It contains not only what is ordinarily included under this heading, but also sections on the care and operation of the various types of tubes, transformers, coils, etc., hints on dark-room technique, exposure-tables, and numerous points in practical technical roentgenology. The chapter is not written in the usual dry didactic fashion found in the average textbook, but it is evidently written with the object of making a firm impression on the minds of the readers, who some time may find it necessary to be practical electricians as well as physicians. The descriptions are interspersed with definite directions for operating, and looking for trouble. This chapter contains a very clear description of the Coolidge tube, its action, control and peculiarities. Also, there is a description of the new form of small, self-rectifying Coolidge tube, the so-called "radiator" type, which is arranged to rectify its own current, and runs at a small current, 5 to 10 Ma. on a 5-inch spark backup.

In a chapter on "New Apparatus" are described the various new appliances which have been developed for army purposes. The *U. S. Army Portable X-Ray Unit* consists of a portable power plant, a special type of army table, and a self-rectifying radiator type of tube. The power plant is a "Delco" outfit with gasoline engine. The *U. S. Army Bedside X-Ray Unit* is the other important contribution. This unit consists of a combined cabinet and tube stand, a radiator type of Coolidge tube, a special lead glass shield, and a transformer and control apparatus. All the complicated apparatus for rectification is absent. The transformer is designed to run on alternating current of any ordinary frequency, and a space is reserved in the bottom of the cabinet for a rotary converter, where only direct current is available. This unit has been of great value in the wards of the army hospitals. It is useful for both bedside radiography and fluoroscopy. The bedside unit is destined to revolutionize the method of doing portable *x*-ray work in civilian life after the war.

The chapters which follow are on standard positions in radiography, dangers and protection, and the technique of fluoroscopy.

The chapter on "Localization" is the clearest and best arranged textbook description of the numerous methods which the reviewer has had the privilege of seeing. The manual aims to present only certain standard methods which have been proven of value. These methods are grouped under six heads:

(A) Two wire, double tube-shift method.
(B) Parallax method.
(C) Tube-shift method with mechanical triangulation.
(D) Profundometer.
(E) Hirtz compass with accessory devices.
(F) Cannula and trocar with harpoon.

The first three groups are suitable for use in the evacuation hospitals where most of the work must be done with the fluoroscope. The last three are the methods for use in base hospitals. Proper accessories have been provided for these various methods in the regular army outfit, and these are all described and illustrated.

Methods of fluoroscopic assistance during operations are also described. For foreign bodies in the eye, the method of Sweet is adopted, and his localizer apparatus carefully described. There is appended a very valuable table of the *depth of anatomical landmarks beneath the skin.*

The chapter on "Bones and Joints" is very clear and comprehensive, although condensed. The technique for various difficult exposures is well illustrated. The section on bone tumors is worthy of special attention. The differentiation is based on careful study of four "cardinal points": origin of the tumor, the presence or absence of bone production, the condition of the cortex, and the presence or absence of invasion of the neighboring tissues. The use of the so-called "law of probabilities" as an aid in bone diagnosis recalls one of our well-known pioneer roentgenologists.

The remainder of the volume is devoted to chapters on Sinuses and Mastoids, Teeth and Maxillæ, Thoracic Viscera, Urinary Tract, Gastro-Intestinal Tract, Measurement of *X*-ray Dosage, and Cutaneous *X*-ray Therapy.

All these chapters attempt to cover their entire fields fairly, though in some instances very briefly.

The facts regarding examination of the "thoracic viscera" are especially well presented. The attitude towards the diagnosis of early pulmonary tuberculosis is very sane, yet by no means ultra-conservative.

The section relating to cardiac disease is very clear. The method of heart measurement adopted by the cardio-vascular service at the Army Medical School is described, and in connection with this are printed the tables of heart measurements compiled by Dr. C. R. Bardeen. These tables form a valuable supplement to the very meager information that has been available up to the present time regarding cardiac measurements in the healthy.

The entire book is, of course, primarily a military manual. As such it contains many pages of directions for setting up apparatus, etc., which would be of service only with the standard army outfits. At the same time, however, we have an elementary textbook of general roentgenology which, from the practical point of view, is one of the best and clearest which has been published in any language. Practically every phase of the work is touched upon, and the essentials clearly brought out.

The manual will prove a valuable and dependable guide for the beginner in the field, and, at the same time, contains much of interest and profit for the experienced roentgenologist.

Isaac Gerber.

History of Medicine. Suggestions for Study and Bibliographic Data. By Fielding H. Garrison, A.B., M.D., Principal Assistant Librarian, Surgeon General's Office, Washington, D. C. Second edition revised and enlarged. Octavo of 905 pages with many portraits. W. B. Saunders Company, Philadelphia and London, 1917. Cloth, $6.50 net; Half Morocco, $8.00 net.

This excellent book, which now appears in its second revised and enlarged edition, shows evidence of an enormous amount of painstaking research for which the medical profession is greatly indebted to the distinguished author. No library is complete without this work.

It is with some disappointment, however, that the roentgenologist turns through the book in vain for any particular reference to his specialty. Only two brief references occur, if the index may be relied upon; yet the *x*-rays have come to play such an important part in the field of medicine of to-day that it does seem as if a brief history of the development of roentgenology should properly have been included. Of course, it may be argued that the roentgenologist is overestimating the dignity of his specialty.

The importance of the study of medical history is becoming more and more recognized. The publisher of our own journal is now engaged in a new venture, The Annals of Medical History, edited by Dr. Francis R. Packard of Philadelphia.

A.W.Crane.

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