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OBSERVATIONS

ON

THE URINE IN CHOLERA.

BY

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FORMERLY SENIOR PRESIDENT OF THE ROYAL MEDICAL SOCIETY.

EDINBURGH:

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OBSERVATIONS

ON

THE URINE IN CHOLERA.

One of the most invariable and characteristic symptoms of Asiatic cholera, is the entire, or almost entire, suppression of the urine. The examination of the characters presented by that secretion, at the period of its restoration after the collapse, is, therefore, an object of much importance. The changes undergone by the urinary secretion in the course of cholera form the subject of the following inquiry.

If the entire suppression of the urine be looked upon as a sign of most unfavourable import, its re-appearance may be regarded as in the highest degree favourable, for in very few cases will ulterior bad symptoms manifest themselves after a copious discharge of urine has occurred.

The mode of fatal termination in many cases of cholera has satisfactorily shown, that the retention of those matters in the system, which it is the province of the kidneys to eliminate, may be regarded as one great danger to be apprehended, and, if possible, avoided. That this danger is not equally imminent in all cases in which the urine is suppressed, we know, and that it should not be so, we can easily understand; for chemical examination of the fluids passed from the bowels has pointed out, that, after the kidneys have ceased to perform their function, the urea may find an exit by the intestines. After a time, however, this channel fails, and the morbid matter being retained, death in the way adverted to is rendered almost certain; or, at all events, the case presenting these features assumes a still more alarming aspect. That death, in the way of coma, attributed to this cause, should take place so much more rapidly in cholera than in any other disease, is, I think, to be accounted for in the fact, that the nervous prostration prior to the occurrence of symptoms threatening coma, has been excessive, and that consequently the action of even a smaller amount of morbid matter is rendered more speedy and certain.

These preliminary observations will suffice to show the importance

of attention being given to the urine in cholera; while I trust that the facts now to be communicated will be considered as proofs of the interest attending its examination.

Through the kindness of Dr Robertson, physician to the Cholera Hospital, I have had ample opportunities afforded me for making repeated and careful examinations of the urine in this disease. From these examinations, tables of the various characters and phenomena presented by the urine were formed. The tables were placed at the disposal of Dr Robertson; what is now to be said in regard to the urine being deduced from these records by myself.

The urine examined was, as a general rule, that first passed by the patient after recovering from a state of collapse. In one or two instances the urine was withdrawn by the catheter during life, and in a few by the same means after death. The characters presented by the urine I shall notice in succession, and on some of these, in concluding, offer a few observations.

1st. As to the appearance and other external characters. The amount was almost invariably small, on several occasions so small as to prevent the density of the fluid being ascertained. The appearance of the urine varied greatly, and no accurate statement can possibly be made as to the most common colour. A large proportion of the urines deposited a distinct sediment; others were muddy and opaque, but presented no evident deposit; very few were perfectly translucent. The odour was not characteristic; in a few it was ammoniacal.

2nd. The average density was considerably lower than that of healthy urine; for, though it varied greatly in different cases—the highest examined being 1·045, and the lowest 1·007—the largest number were at 1·012, and the succeeding at 1·016, 1·018, 1·020, and 1·014. Of twenty-two specimens, the densities of which were ascertained more than once, in five the specific gravity had risen a few degrees at the second examination, in nine it had fallen, and in eight it continued the same; while, in two of the nine, it is noted that, at the third examination, it had again increased.

3rd. In thirty-seven out of seventy-two specimens in which the reaction of the urine was ascertained, it was noted as acid; in nineteen it was strongly, highly, or powerfully acid; in three it was faintly acid; in seven it was neutral; in four it was alkaline; and in two strongly, highly, or powerfully alkaline. On subsequent examinations of several of these urines, the reaction was found unaltered; while in one or two of those which presented at first an acid reaction, it was found to be neutral or alkaline; and, on the contrary, in a few of those in which, on first examination, the reaction had been alkaline, it had become acid. It is worthy of note, that in at least one of the latter class the urine was in the first instance withdrawn by means of the catheter, symptoms of retention having manifested themselves; in this there probably existed a sufficient cause for the alkalinity of the urine.

4th. Of sixty-seven urines tested for the presence of albumen, by

the application of heat and the addition of nitric acid, in sixteen the urine was noted as being coagulable, or decidedly coagulable; in seventeen as being highly or powerfully coagulable; in twenty as slightly or faintly, or very slightly or very faintly, coagulable. In fourteen there was no coagulability.

In a number of those in which albumen existed, subsequent examinations were made at an interval of one or two days, with the effect of finding that at the second examination in most it had partially disappeared, and that in very few it was present on the third. In one or two instances the first urine voided was not coagulable, but a subsequent examination detected a very small amount of albumen. In all, the albumen, though present at the first examination, even in large quantity, was but transient in its duration.

5th. In twenty-eight out of sixty-eight specimens, it was noted that bile existed, or was decidedly present, or that its existence was characteristically displayed upon adding a few drops of nitric acid. In fifteen others there existed a slight trace of bile, or an equivalent term was used in expressing its presence. In twenty-five the addition of nitric acid gave no indication of the existence of bile. In several, bile was found on subsequent examinations, and in two was found to manifest its presence for the first time on the third examination. In most, though undoubtedly present, its duration, like that of the albumen, proved short.

6th. In eighteen specimens of urine the amount of urea present was ascertained. The mode adopted was the following:—A thousand grains of urine were first accurately weighed, and then evaporated to the consistence of an extract, to which alcohol was added, and after thorough digestion had been allowed, the alcoholic solution of urea thus obtained was filtered and then evaporated. To the mass left nitric acid was added, the nitrate of urea was thus formed, and being collected on a filter, was carefully weighed. In eight out of the eighteen urines, however, in which this process was adopted, it was found impossible, from its extreme minuteness, to estimate the amount of urea present; accordingly, in regard to six of the eight, it is noted that there did not exist sufficient urea to crystallise with nitric acid; and in regard to the other two, that there remained of the nitrate of urea a mere trace upon the filter. These eighteen specimens were the only ones in which I attempted to estimate the exact amount of urea contained; but in a large number of the urines examined, the usual method for arriving at an approximation as to the contained urea was practised, namely, by gentle evaporation and the addition of nitric acid. In all the urines treated in this manner the urea[1] was

[1] The reader will remember that the amount of urea in healthy urine is 30 grains in 1000 of urine. To test the accuracy of my own experiments in estimating the exact amount of urea in cholera urines, I, at the same time, conducted the examination of the urine in other diseases as well as in health, and as the results were uniform, I think the table given above is worthy of confidence.

found to be deficient in quantity. In the ten specimens the weight of the nitrate of urea obtained was as follows :—In one, 28 grains; in one, 20 grains; in two, 19 grains; in one, 18 grains; in one, 11 grains; in one, 10 grains; in one, 9 grains;[1] in one, 8 grains; in one, $1\frac{1}{2}$ grains.

From these results it appears, that from none of the urines, the urea in which was made the subject of quantitative analysis, was there obtained of the nitrate an amount equal to that of the urea[2] contained in healthy urine.

7th. The microscopic appearances presented by the urine in sixty-four instances were noted. In two of the sixty-four no deposit of any kind existed. In regard to the remaining sixty-two, it is noted that, in fifty, epithelium existed in greater or less amount. In fifteen of these it was present in very large, in three in very small, quantity. In twenty-four urines the casts, or epithelial moulds of the small tubes of the kidney, were present; while in almost all the specimens examined, an appearance resembling these tubes, as if lacerated or broken up, existed. Amorphous urate of ammonia was present in fourteen cases; in one or two others the urate of ammonia evidently existed in a crystalline form. Besides it, the crystalline deposits met with were—the uric acid, the ammoniaco-magnesian phosphate, and the oxalate of lime. The former was present in sixteen instances, the triple phosphate in twelve, and the latter in four; in three of these the dumb-bell was the form assumed; in only one the octohedral. In two urines blood corpuscles, and in other two pus corpuscles, existed, all in small quantity, and all in the cases of females, so that in all probability their presence depended on the existence of some vaginal or uterine discharge.

Exudation corpuscles, or the compound granular cells, were present in three urines. In one of these, the patient, at the period of her seizure with cholera, was just convalescing from a severe attack of pneumonia. These granular cells are very commonly met with in the urine, about the critical period in acute inflammations of the lung. With the history of the other two patients in whose urine these cells were found, I am unacquainted. Spermatozoa and the spermatic globules were detected not unfrequently in the urine, when drawn off, by means of the catheter, from the dead body. In one instance in which dissection was performed a very short period after death, the animalcules appeared living; the urine in which they moved was of acid reaction, and in this respect confirmed an observation I have frequently had occasion to make, that the acidity of the urine is favourable, and its alkalinity unfavourable, to their vitality. In this way the preservation of their life in urine containing pus (according to some authors the only urine in which their vitality can be con-

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[1] This analysis was conducted by Dr Douglas Maclagan.

[2] According to M. Regnault, 100 parts of the nitrate should contain 48·938 of urea.

tinued for any time), may be accounted for; such urine is almost invariably acid; on the other hand, urine containing much mucus, in which these animalcules are never found living, may reasonably be supposed to offer as secure a retreat to them as the former, but that urine is invariably alkaline.

From these details of the examinations of a large number of specimens of urine in cholera, it appears, that besides being at first entirely absent, or greatly diminished in quantity, when the secretion is again restored, it is very materially changed as to quality. It is of a lower specific gravity than healthy urine, and though its reaction is generally acid, it for the most part contains abnormal ingredients, of which the chief are albumen and bile, with a greater or less amount of perfect and abortive epithelium, derived from different parts, and assuming also different forms; and besides containing abnormal ingredients, one of its own principal constituents is absent, or exists in very limited amount. It is this absence or deficiency of urea, the consequences of which are known to us, and are represented in cholera, and in other diseases also, by what are now regarded as very evident signs, which is the only truly important morbid condition of the urine; the abnormal ingredients present are of interest as indicating an alteration in the quality of the urine, but only of importance when taken in connection with this. In the present paper, however, the changes alluded to merit a little more of detail. It is, I think, of interest to observe the circumstances with which the presence of albumen in the urine of cholera is attended; generally bile co-existed with it, if not throughout its entire duration, at least at its commencement, or before its disappearance: further, albumen was always associated with, and in general held a ratio commensurate with the amount of epithelium found on microscopic examination. Taken in connection with the former, its presence, as indeed that of the secretion itself, is an indication of a most favourable tendency, nothing less than that of commencing convalescence, the bile almost always manifesting its presence in the urine at the period when it re-appeared in the stools. No urine which contained albumen did not contain epithelium; and, on the other hand, no urine in which epithelium was present in any amount, was destitute of albumen: further, as the albumen disappeared, so also diminished the epithelium. This association of albumen and the cells of epithelium, is exactly what we observe in the urine of certain other diseases; of scarlatina, for example, from which, at a particular period of the disease, neither, I believe, are ever entirely absent; and though variety, to a considerable extent, exists in the amount of both present, they uniformly exist in corresponding ratio. The presence of epithelium in the urine of cholera, is the evidence of the existence of a process of desquamation, to which the mucous membrane lining the urinary passages is subject, equally with that which lines the intestinal canal, from which desquamation, to a considerable amount, occurs. When such changes are taking place in the epithelium lin-

ing the small tubes of the kidney, the office of the cells composing which is to eliminate from the blood the matters which, in the normal state of the renal function, form urine, it is not surprising, that albumen and bile, in greater or less amount, should find their way into that secretion, and that the urea it contains should be at first so deficient in quantity. In but few instances did the two former continue to manifest their presence in the urine for more than a few days at most, while, as a general rule, the lapse of the same period was sufficient for the increase in the urea to have taken place, if not to the normal standard, at least to a point not far distant from it.

Frequent observations on cholera urine have shown me, that the uric acid is not generally deficient in quantity; this was proved by microscopic examination, as well as by the addition of a small quantity of nitric acid, when the usual change in appearance, illustrative of its presence, occurred. Under the microscope the usual form presented by the uric acid was that of small lozenges; generally they were void of colour, but occasionally possessed a deep yellow hue. The crystals of the triple phosphate were always present when the urine was alkaline—they possessed their usual form. Crystals of oxalate of lime were only observed four times; it was not ascertained whether the patients, in whose urine they occurred, presented the symptoms which are known to accompany the presence of this salt in the urine, and this inquiry was not deemed necessary, for we know that the oxalate frequently appears unassociated with any dyspeptic symptoms. The observation of Dr Prout, that, during the prevalence of cholera in 1832, the oxalate of lime was more frequently present than before or after the epidemic, has not been confirmed, at least in the case of hospital patients, during the existence of cholera in Edinburgh. From numerous observations, conducted with the intention of estimating the relative frequency of the various urinary deposits, I have found that crystals of oxalate of lime occur as frequently in the urine of hospital patients in Edinburgh, as either of the other common crystalline deposits. Oxalate of lime is very common in the urine of patients labouring under all the forms of organic disease in the abdomen, with the exception of that of the kidney. The same observations showed that no increase in the frequency of the occurrence of oxalate of lime, took place during the epidemic of cholera.

On a review of these observations, the following conclusions in regard to the urine passed during recovery from cholera, may, I think, be deduced.

1st. That the urine, besides being affected as to quantity, is materially altered in quality.

2nd. That this alteration consists in the presence of a very small quantity, or in the entire absence, of urea, and in the presence of albumen and biliary colouring matter.

3rd. That on examination by the microscope, there will be found

uniformly associated and existing in amount commensurate with the albumen, epithelium assuming different forms, and derived from different parts of the urinary system.

4th. That one or other of the following deposits will probably be present—amorphous urate of ammonia, uric acid, ammoniaco-magnesian phosphate, or oxalate of lime—the two latter being less frequently present than either of the former.

5th. That the healthy condition of the urine, in so far as the increase in the amount of urea, and the disappearance of the albumen and bile, are concerned, is generally restored in the course of a day or two, if the case go on favourably.

6th. That as the association of albumen and bile, in particular, as well as the other general characters of the urine which have been stated to exist, are by no means of common occurrence, it follows, that the careful examination of the urine in cholera is of importance both in diagnosis[1] and practice.[2]

To which I feel disposed to add another conclusion, though it is not brought fully out in the preceding observations.

7th. That the characters which have been stated to be those of cholera urine, will be always best marked in the severest cases.

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[1] I have made frequent examinations of the urine in diarrhœa, and in the so-called choleroid diarrhœa, but have never found albumen and bile associated with epithelium, and a small amount of urea, to be the characters of such urine.

[2] Dr Robertson prescribed colchicum in a case where a small quantity of urine, deficient in urea, was voided, and with the desired effect upon the urine, and with great benefit to the patient.

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