Lecture.

RENAL CALCULUS, ITS DIAGNOSIS AND TREATMENT.

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A CLINICAL LECTURE DELIVERED AT THE PHILADELPHIA HOSPITAL.

GENTLEMEN,—I wish to call your attention to-day to a subject of considerable practical importance and one which we do not often have the opportunity of treating in the way which I propose to-day. The subject is that of renal calculus: its diagnosis and its management. The immediate suggestion for this lecture is a case which recently came under observation in this house, and whose fatal termination and autopsy have given us the morbid specimens I propose to show you.

I shall in the first place briefly give you the history. The patient was a woman, forty years of age and married. She had no knowledge of her relatives. She had lived in a healthy country place for fifteen years. She has been married and enjoyed fair health up to eight months ago, when she began to have pain in the left side, with frequent and painful micturition. In the course of a month or two, these symptoms disappeared, but the pain returned at times. About one month before admission she awoke in the morning with violent pain in the left side. This pain continued and was accompanied by loss of flesh and frequent vomiting. The pain was increased by straightening out the legs.

The patient was admitted to the hospital March 24th, 1886, with this meagre preliminary history, complaining of a dull aching pain in the splenic region, tenderness over the spleen and over the left kidney. The temperature was 100°, and the woman was weak and nervous. The most tender spot was mid-way between the crest of the ilium and the lower border of the ribs. The urine contained an enormous amount of pus, fully one-third of its bulk.

In the history of this case we note the following points: extreme pain, varying somewhat in severity, but always present, tenderness, most marked midway between the border of the ribs and the crest of the ilium, and purulent urine. Under such circumstances, there is no difficulty in pointing out the organ affected. Given purulent urine with pain in the locality described and tenderness so distinct and so easily determined, there must be something wrong with the left kidney.

The next question naturally asks the cause of the suppuration? There are three principal causes of pus in the urine where the kidney is distinctly involved. These are tuberculosis of the kidney, impacted calculus and what is known as surgical kidney.

It is well known that tuberculosis may affect the mucous membrane of the pelvis of the kidney and gradually encroach upon the substance of the organ, infiltrate it and break down, infiltrate again and break down, and thus continue, until the organ may be converted into a cavity filled with pus, more or less inspissated, and the walls covered with cheesy miliary tubercles.

The so-called surgical kidney, is simply a suppurative

affection of the kidney, the result of surgical disease. The term is not very well applied. It is usually the result of inflammatory disease of the bladder, the inflammation extending upwards along the ureter until the kidney becomes involved. This condition is produced by various causes, most frequently, probably, by stone in the bladder. Although a distinction is sometimes made between surgical kidney and the condition of the kidney resulting from impacted calculus, there is no essential difference in the nature of the process. Where suppuration occurs as the result of impacted calculus, the process is exactly like that where the inflammation is the result of extension from the bladder.

Which of these conditions had we to deal with in the case described? Under the most favorable circumstances, we are often compelled to allow this matter to rest in doubt. It occurred to us that taking the symptoms described in connection with the cachexia which this patient presented to a marked degree, there might be here tuberculosis of the kidney. Seeking further information on this point, the urine was examined for the tubercle bacillus, but none were found. We did not attach much importance to this, for although it is true that in tuberculous affections of the kidney the bacillus has been found, yet its absence cannot be said to exclude the presence of such disease. We therefore did not conclude from this negative result that tuberculosis was absent, and I must admit that I always inclined to the view that this was a case of tuberculosis. This view was favored by the absence of any definite history of nephritic colic. Where the suppurative process is due to impacted calculus, we usually are able to trace a long history of pain in the region of the kidney. In this instance we could obtain a history of pain dating back only eight months, and when the specimen is examined, this short history will seem still more surprising. Surgical diseases starting from the bladder and causing trouble in the kidneys, are accompanied by symptoms of irritation of the bladder. Nothing of this kind was present in this particular instance. Therefore taking all the evidence into consideration, while realizing the difficulties of making a positive diagnosis, I felt that the probabilities were in favor of tubercular disease. As an aid to diagnosis, we introduced the aspirating needle in the region of the kidney, but the pus was not reached.

The woman gradually sank and died a few days ago, and I have the specimen here to show you. Extraordinary and astonishing as this may strike you, let me assure you that this condition with these symptoms is not infrequent. Here is a stone which was removed from this case, and it is one of the most remarkable specimens that I have ever seen. It has a base or trunk from which spring four principal prolongations. The base corresponds to the pelvis of the kidney and the four prolongations to the four calices. The extensions of the stone are further subdivided to correspond to cavities which they filled in the organ. It is of course unnecessary to say that this large calculus must have occupied longer than eight months in its formation. Whether or not careful examination earlier than eight months ago, would have given evidence of disease of the left kidney or whether the woman had had symptoms before this time and had forgotten them, matters not. The autopsy has revealed this extraordinary concretion

filling up a large portion of the kidney substance, with a history of only eight months pain.

Let us return for a moment to the question of diagnosis. It was plain to us that we had to deal with disease of the left kidney, but beyond this point there was acknowledged uncertainty, although there was a leaning towards the idea of tuberculosis. This proved to be erroneous. Are there any circumstances under which a more certain diagnosis is possible? There are, and it was partly with a view to bringing these to your notice that I selected this case as a text. If we had at any time been able to collect sediment from the urine, or small calculi or their fragments capable of analysis, the nature of the case might have been determined. The difficulties in the diagnosis of renal calculi are often much less than are commonly supposed, because their analysis is much easier than is commonly supposed. It is really a very easy matter to get at the composition of a calculus.

In the first place, under what circumstances would a renal calculus be suspected? If there is a history of excruciating pain in the region of the kidney, extending into the groin, paroxysmal in character, a pain which is so severe that words cannot describe it, you at once suspect that there is a stone in the kidney which is seeking to find its way into the bladder. I think that there is no condition which is likely to be confounded with this. Given a severe paroxysmal pain in the region of one or both kidneys, extending to the groin with retraction of the testicle in the male, I know of only one condition that can cause it. It is true that there is described in the books what is called neuralgia of the kidney, a condition in which there are the symptoms described without the presence of a stone. For myself I doubt the existence of such a condition as idiopathic neuralgia of the kidney. What has been termed neuralgia of the kidney is in all probability nephritic colic, depending on the presence of gravel. For practical purposes, therefore, we may throw out of the question nephralgia or neuralgia of the kidney.

It is also true that we have here severe muscular pains which might be confounded with pain in the kidney. The majority of persons who think that they have kidney disease have their attention directed to it by the occurrence of pain in the lumbar muscles which they attribute to the kidney, the idea being that renal disease is associated with pain over the kidney. In point of fact, real kidney disease other than calculus disease, is rarely attended with pain in the back. The pain of lumbago or rheumatism of the lumbar muscles is different from that due to impacted calculus. Under ordinary circumstances the former pain is not so sharp. It is true we have almost all experienced at one time or other a sharp lumbar pain momentary in duration, most frequently coincident with a sudden motion or twisting of the body. But this is of short duration as compared with the pain of nephritic colic. The other lumbar pains of rheumatism are not so severe, although they may be of long duration. They are greatly aggravated by any movement of the body. They are also more readily removed.

There is one other rare condition which produces pain like that of nephritic colic to which allusion should be made, and that is floating kidney. Sometimes a floating kidney is so loose that it twists upon itself, closing the ureter very much as a rubber-hose is obstructed when it is twisted upon itself. Such ob-

struction causes an accumulation of urine back of it and gives rise to intense pain which is quite like that of nephritic colic. This, therefore, should be remembered.

Having made the diagnosis of nephritic colic we must not stop here, for it becomes a matter of extreme importance in treatment, to ascertain the nature of the stone causing the irritation. A rational treatment demands this. And while we cannot always do it, we frequently can, indeed more frequently than is commonly done, and the treatment which is so often only palliative and empirical, may become curative and rational. Such a diagnosis demands the presence of sediments in the urine or the passage of a small calculus.

Where there are constant or repeated sediments of uric acid or oxalate of lime recognized by the microscope, we are thus at once informed of the nature of the stone. Sometimes a small stone is passed, the structure of which cannot be unravelled by the microscope. Other means must then be used to determine its composition. In the first place there is something in the appearance of a stone which will aid in the diagnosis. Taking this large stone, I have little doubt that it is a phosphatic stone, composed largely of phosphate of lime. It is exceedingly rare, in fact, I think it never happens that a stone with any other composition reaches this size. In the second place, the stone is white in color. This is the color of phosphatic stones, but also that of oxalate-of-lime calculi, although they never reach the size of this one. They are further characterized by their roughness. On the other hand, stones composed of uric acid and their compounds are apt to be smooth and of various shades of red; at other times they are fawn-colored and again white.

I have here some samples of stone which I shall examine. Here is a part of a stone which was removed from the kidney of a little boy, ten years of age, who died under my care. This boy had purulent urine for a long time and for years had suffered with pain. On two occasions stones were removed from the bladder by operation. After death this large stone was found in the pelvis of the kidney. Here are also other smaller stones, some of them smooth and others rough.

The necessary apparatus for analysis is simple. In the way of instruments, you need a little piece of platinum foil, and a pair of forceps to hold it, or a platinum spoon, a mortar and pestle, some nitric acid, acetic acid, hydrochloric acid and ammonia. A fragment of the stone to be examined is reduced to powder in the mortar. The piece of stone which I shall use is white in color. As I have said, the phosphatic stones are white, so are those of oxalic acid. Uric-acid stones are apt to have a reddish tinge, but they may be almost white on the surface, at least. In this case you will note that although the stone was white, the powder presents a reddish tinge. I place a small portion of the powder on the platinum foil and heat it in the flame of a spirit-lamp. Instantly the powder blackens and partially disappears. In a few seconds, it is entirely gone. I need not go a step further in the examination of this stone. Given a powdered stone which disappears upon the application of heat, what is it? It is either organic matter, or pure uric acid, or almost pure uric acid, or one of those extremely rare forms of stone, known as cystin,

xanthine and urosteolith. The first never assumes a stony hardness, and the last three are so rare that they do not occur in an average man's life. I have seen but one cystin stone and none of the others. It may therefore be concluded with almost absolute certainty that this stone is uric acid. But this may be rendered absolutely certain by another test, the murexide test. A little of the powdered calculus is placed on a plate and dissolved in nitric acid. Heat is then applied and the acid evaporated. A little solution of ammonia is next added and you observe the beautiful purple color which comes out at the point of contact. This proves that this is a uric-acid stone.

Suppose, however, that on the application of heat the stone does not entirely disappear? We should then again apply the murexide test and if we obtain the reaction, the stone must consist of uric acid in combination with bases, and clinically speaking, this is equivalent to uric acid.

Taking another stone, the composition of which I do not know; I powder it and heat it to redness on the platinum foil. It at once becomes black, but a considerable residue is left. I then take a small fragment of the original stone, and without powdering, place it in the platinum spoon, and again apply heat. You will recall that in these examinations the question practically resolves itself into this: Is the stone composed of uric acid, oxalate of lime, or phosphates? A stone made up of triple phosphates of ammonium and magnesium is characterized by the peculiarity of fusing on the application of heat—fusible calculus. This enables us to recognize such a stone. This particular example does not fuse.

We, therefore, know that it is not composed of triple phosphates. It does not burn up, it does not melt into a bead; it is, therefore, either phosphate of lime or oxalate of lime. If it is an oxalate-of-lime stone, it has, by the process of heating, been converted into carbonate of lime.¹ If it is a phosphate-of-lime stone, its composition has not been altered by the application of heat. To the burned powder I now add acetic acid; if it dissolves with effervescence, it is derived from an oxalate-of-lime stone; if there is no effervescence, it is phosphate of lime. The best way to apply this test is to put some of the stone, which has been heated, on a glass slide, and apply a thin cover. The acetic acid is allowed to run in at the edges. If it is desired, under the microscope, with a low power, the evolution of the bubbles of carbonic acid may be easily studied, but we shall adopt the rougher method without the microscope. No bubbles of carbonic acid are liberated. I conclude, therefore, that the stone is phosphate of lime. A very rare stone in man, although common in horses, is the carbonate-of-lime stone. This is recognized by treating the *original* powder with acetic acid, when it will dissolve with effervescence, whereas, the oxalate-of-lime stone does not dissolve with effervescence until it has been heated to a red heat.

To recapitulate, you are to powder the stone and apply heat. If it disappears, it is in all probability uric acid, or compounds of uric acid. If there is any doubt, the murexide test may be applied. If the stone does not disappear upon being incinerated, it is composed either of phosphates or of oxalate of lime. If it is the triple, or ammonio-magnesian phosphate, the

application of heat to a piece of the original stone will melt it into a bead; if it does not melt, it is either phosphate of lime or oxalate of lime. If it is oxalate of lime, the incineration will convert it into carbonate of lime, which, in acetic acid, will dissolve with effervescence; if it is phosphate of lime, it dissolves without effervescence. Thus, with very little trouble, we may, with sufficient accuracy for practical purposes, ascertain the composition of a calculus. The bases are not ascertained, but this is not necessary.

Having determined the composition of the stone, what will be the treatment? The uric acid and oxalate of lime call for one treatment, the phosphates for another widely different. The latter is much more difficult to dissolve than the former. Uric acid is soluble in alkalies; oxalate of lime in neither acids or alkalies. Uric-acid sediments are thrown down in urine of acid reaction and dissolved by alkalies. The indication, therefore, is to give alkaline diluents, to render the urine alkaline, and if you do not cause the solution of the stone, you may, at least, prevent it from increasing in size. The experiments of Dr. Roberts, of Manchester, are almost too well known to be repeated. He imitated with alkaline solutions the dropping of the urine from the kidney into the bladder upon uric-acid calculi, and was able to effect a certain degree of solution. Whether this will take place in the body or not we do not know, but it is a rational method of treatment, and will tend to prevent the stone from enlarging, and as the passages enlarge, the stone may descend. The spasmodically contracted ureter, which grasps the stone, may, after a time, relax and permit the latter to drop into the bladder. If you can keep the stone from becoming larger, you favor this result.

The correct treatment for uric acid is, therefore, the alkaline treatment. For this purpose any alkali may be used, such as citrate or acetate of potassium. I prefer the citrate of potassium, in twenty-grain doses, four times a day, each time in eight ounces of water. Dilution is very important. It is of the greatest importance that you should, as it were, wash out the tissues of the patient with a tendency to gravel, in order to get rid of the *débris* of tissue metamorphosis. The introduction of large quantities of water into the system is an important element in the treatment. It is to the good effects of such treatment that the reputation of many of the mineral springs in the treatment of gravel is due. The introduction of plain water will accomplish this result as well as many of the spring waters. When, however, we come to springs like those of Vichy, which contain a large quantity of alkali, you can understand how useful they must be in the treatment of this form of calculus.

The same plan applies to the oxalate-of-lime calculus, but with less prospect of success, so far as solution of the stone is concerned. You cannot dissolve the oxalate of lime with acids or alkalies of such strength as it would be proper to use in the body. At the same time, the methods which prevent the formation of uric acid will prevent the formation of oxalate of lime. In the treatment of both of these varieties diet is of the greatest importance. In neither of them should the patient be allowed to eat a large amount of nitrogenous food, as meat or eggs. Fresh, succulent vegetables may be allowed in some cases, with a moderate amount of meat, or in bad cases, no meat at all. If there is one condition in which the

¹ For this, too high a degree of heat should not be applied. A long-continued white heat will calcine the oxalate of lime into lime; a red heat is sufficient to convert into the carbonate.

good reputation of a pure milk diet is justified, it is in the treatment of uric-acid calculus. So often have I been successful in obstinate cases of frequently-recurring uric-acid gravel with the pure skim-milk treatment, that it is the first thing that I offer the patient. I have noticed that if the skim-milk diet is kept up for a month or six weeks, and then stopped, the attacks of colic do not recur. In carrying out this plan of treatment, I recommend that during the first day, a glass of milk be taken every two hours. After this, the quantity is gradually increased until sufficient to satisfy the patient is taken. The quantity required to sustain life varies between three and seven quarts per day. It depends partly upon the size of the patient, and the amount of exercise taken. The milk acts both as a diluent and as an alkaline fluid. One set of vegetables should be avoided in the diet of persons having an oxalic diathesis, and that is those containing oxalic acid, such as tomatoes, sorrel, and especially the pie plant.

The importance of the diagnosis is shown in the fact that if the stone is composed of phosphates, the milk diet is much less valuable as a cure. The indication is here to increase the acidity of the urine, but while it is true that the phosphates are soluble in acids, it is, practically speaking, impossible to give acids in amounts sufficient to affect the calculus without injuring the system. By the use of benzoic acid, in ten-grain doses, the reaction of the urine may be rendered acid, and the further deposition of phosphates may be thus prevented, but nothing can be done towards dissolving the stone. Fortunately, most calculi are of the uric-acid variety. In phosphatic calculi, you can simply hope to prevent increase in size by rendering the urine acid, and in the course of time, if not too large, it may descend into the bladder. If too large for this, there only remains the operation of nephro-lithotomy, the growing frequency of which seems to be justified by its results.

Original Articles.

OPERATIONS ON NERVES.

BY MAURICE H. RICHARDSON, M.D.,
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- I. RESECTION AND SUTURE. (a) Musculo-spiral, (b) Median, (c) Ulnar.
- II. PRIMARY SUTURE. (a) Ulnar, two cases.
- III. EXCISION FOR PAIN. (a) Middle cutaneous of thigh, (b) Long-saphenous, (c) Inferior dental, (d) Infra-orbital.
- IV. STRETCHING. (a) Spinal accessory for spasmodic wry-neck.

THE cases recorded below were treated at the Massachusetts General Hospital during the past fifteen months, with the exception of the last, which was at the Carney Hospital. As will be seen, some of the cases are complete, while others are still under observation.

NERVE SUTURE.

Case I. Injury to median nerve from bursting of bottle. Healing. * Painful neuralgia in fingers and thumb, with loss of power in thumb. Removal of injured portion, suture, relief of pain, and restoration of motor function.¹

Patient, J. C., a young man, bar-tender, was injured

¹ Mass. Gen. Hos. Records, p. 73, vol. 220.

by the bursting of a ginger-tonic bottle July 20th, 1885, in the left wrist in front. The cut healed readily, but there was loss of sensation in the middle and fore-fingers and the palmar surface of the thumb. Accompanying the loss of sensation there was severe pain in the thumb and palm of the hand. This symptom of severe pain led him to come to the Nervous Department of the hospital where Dr. Putnam examined him and recommended an attempt to relieve the symptoms by surgical means.

July 18th, 1885, operation with ether.

The median nerve was quickly exposed at the point where it was supposed to have received injury, about one and one-half inches above the palm. The nerve was found involved in the cicatrix and almost entirely severed, being united by only a few fibres. The whole nerve was isolated from the surrounding parts and the injured portion entirely excised by a transverse section above and below. The ends, which were sharply cut and clearly defined, were then brought into apposition and sewed together. Considerable traction was first used so that there would be as little tension as possible. A cat-gut suture was then passed into the proximal trunk half an inch above the cut, and brought out in the centre of the divided end. It was next introduced into the centre of the end of the distal part of the nerve and brought out half an inch farther along.

The divided sheath of the nerve was then brought into close approximation by fine cat-gut sutures, care being taken to include only the sheath itself. The wound was closed with silk, drainage provided for, and the arm and forearm placed upon an internal angular splint with the carpus well flexed. The wound healed rapidly, though not by first intention, and the patient was discharged August 11th, to the convalescent ward. There had been no change in his symptoms except almost complete relief of pain. There was still slight pain in the top of the thumb, ulnar side.

August 29th, 1886, a little more than a year later, I examined him. There was a prominence in the anterior carpal region at point of suture. Sensation was good in all parts supplied by the median. There was no pain and had been none for months. Finally, the muscles supplied by the median alone, *adductor* and *opponens pollicis*, were well developed and responded to the man's will. In this case, therefore, the functions of the nerve were completely restored.

Case II. Stab in back of arm. Division of musculo-spiral nerve. Wrist-drop. Suture of nerve stump, suppuration, erysipelas, no improvement at end of three months. Second operation. Resection and suture. Complete and permanent recovery after four months.²

George Donahue, laborer, forty-three years of age. Came to the Massachusetts General Hospital, May 19th, 1885, having been stabbed by an Italian with the blade of a pair of shears. The external wound was small. The triceps was cut and the musculo-spiral nerve severed. Two small pieces of bone were clipped from the humerus. Had wrist-drop and inability to extend fingers.

Dr. Warren enlarged the cut. The ends of the nerve were found and united with six small cat-gut sutures through the sheath. The triceps was sewed up with cat-gut. Drainage-tubes were left in wound

² Mass. Gen. Hosp. Records, Vol. 220, p. 108.