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WITH REMARKS UPON THE ANATOMY OF THE PELVIS
OF THE KIDNEY.

BY

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presented by the author



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A CASE OF NEPHRO-URETERO-LITHOTOMY,

WITH REMARKS UPON THE ANATOMY OF THE PELVIS OF THE KIDNEY.

BY S. W. TORREY, M.D.,
OF BEVERLY, MASS.

Mrs. M., of Beverly, whose case forms the subject of this paper, began to suffer from pyelitis some time in 1883 or 1884, when she was about forty-three years old. From the beginning up to the time of operation, pus was present in the urine, in varying amount, but never absent; and occasionally there was albumin in small amount; almost always oxalate of lime, and very frequently uric acid crystals. There were no attacks of renal colic, never any very severe pain, but always a dull aching discomfort in the lumbar region. The only medicine that alleviated the trouble much was lithiated hydrangea, which distinctly lessened the amount of pus, and gave some relief to the lumbar aching.

On January 2, 1888, after not having seen the patient for several months, I was called to attend her in an attack of acute bronchial catarrh, mainly affecting the left lung and accompanied by very distressing dyspnoea. Under treatment she was relieved in two days of her harassing cough and extreme difficulty of breathing, when she began to complain of severe pain in the left renal region, not spasmodic in character, but gradually increasing in intensity until it became agonizing, preventing her from sleeping and from changing her position in bed. The urine, which had been loaded with pus when I was called to her, became quite suddenly clear, and remained so until after the nephrotomy. Soon there developed exquisite tenderness over the left kidney, chills, rise of temperature and pulse, complete loss of appetite, vomiting and uræmic symptoms, and, by January 6th, an obscurely defined tumor in left side of the abdomen. The urine continuing free from pus, but now showing albumin and blood, I inferred that the pus was accumulating in the left kidney, rendering it functionally useless, and that the right kidney was in a state of hyperæmia from being suddenly called upon to do double duty.

January 7th Dr. C. W. Haddock saw the patient in consultation, and agreeing in the diagnosis of abscess of the kidney, he etherized her while I passed a medium-sized aspirating needle through the back into the kidney. I was fortunate enough to strike the abscess on the first puncture, and withdrew three ounces of pus. Temperature 101° at time of aspirating. The next day the patient was comfortable, and the temperature was normal; the tumor was not so easily mapped out, but still could be found; the tenderness on pressure was less, and the uræmic symptoms somewhat relieved, but pus was still absent from the urine.



I then stated to the family that the sudden stopping of this long-continued flow of pus, without a very appreciable lessening of the daily amount of urine passed, proved that the pyelitis affected the left kidney only, and that the urine was coming solely from the right kidney, and that the cause of the obstruction must, almost of necessity, be located in the ureter to insure a complete blockade, and there was nothing so likely to cause this blockade suddenly, considering the patient's past history, as an impacted calculus; and I further stated that I considered incision and exploration of the kidney, with removal of the stone, if found, to be the only means of saving the patient's life.

Further counsel was desired, and on January 12th Dr. A. T. Cabot, of Boston, saw her in consultation. He concurred in the diagnosis and emphatically advised nephrotomy.

On Sunday, January 15th, I operated, there being present and assisting, Drs. C. W. Haddock and Stickney, of Beverly, and Drs. Johnson, Kittredge, and T. L. Perkins, of Salem. I made an incision three inches long in the lumbar region (reaching from the lower rib to the ilium) over the kidney, and on reaching that organ first aspirated the abscess, removing about $\frac{3}{4}$ of pus. I then incised the kidney and examined the pelvis with the finger, but found no stone; the pelvis was quite small and of a somewhat rectangular shape with two openings on the ureteral side, one at the lower end, about the calibre of a No. 10 catheter; the other about one inch higher up and only about half as large. These openings I searched with a uterine probe, finding nothing in the upper canal, but soon touching a stone in the lower one, about one inch from its opening into the pelvis.

Examination of the stone with the probe proved it to be much too large to draw through the small orifice into the pelvis, and thence through the incision I had made into the kidney, unless the orifice could be dilated. I endeavored to do this with the finger, but with no success; I also tried to accomplish my object with various instruments, but I could only increase the calibre very slightly.

In endeavoring to dilate by means of a pair of curved short-bladed forceps, gradually expanding the blades, the opening suddenly tore bilaterally, and I then had room to seize and extract the stone. There was only one stone. No hemorrhage of any moment attended any of the steps of the operation. Two rubber drainage tubes were inserted, one into the pouch from which the calculus was extracted, the other in the direction of the upper opening before referred to; each tube was secured in place by a silver wire passed through the capsule of the kidney and out through the skin, thus drawing the kidney in close apposition to the external wound, so as to prevent as far as possible extravasation of the pus and urine into the loose tissues about the kidney. I then irrigated the cavity through the drainage tubes with a solution of chlorinated soda and water 1:15, continuing the flushing until the solution returned clear. The external wound was closed loosely with interrupted sutures and dressed with iodoform gauze and absorbent cotton, and the patient put into bed, with hot water bottles to the lower extremities.

There was considerable shock, which gave me anxiety for about two hours, but after that passed off improvement began at once, and there were no untoward symptoms of any sort. The temperature never rose above 98° , and for the greater part of the time was about half a degree

subnormal; the urine passed by the bladder in a short time became clouded with pus, showing that the cause of the complete obstruction undoubtedly had been the stone; and the amount of pus, at first quite free through the drainage tubes, soon became much less both through the artificial and the natural outlets, proving conclusively that the old pyelitis had been due solely to the irritation from the stone.

Eight days after the operation I removed the upper drainage tube, and in five days after that I found the other one forced out of the wound, so I took it away and packed the rapidly contracting sinus with iodoform gauze: from that date the discharge diminished very rapidly (I irrigated the kidney daily as long as I could force the nozzle of a syringe through the fistulous canal) and the wound healed with a speed that rather alarmed me when I reflected upon what I had been led to think was the necessary sequel to such an operation—a slow-healing fistula. But as the urine speedily became normal in character, and as the discharge from the wound soon ceased entirely, the evidence was convincing that the removal of the stone had stopped the chronic inflammation, and that the wound had as good a right to heal rapidly as a clean-cut, aseptic wound would have in any other part of the body.

As to the treatment of the case after operation there is little to call attention to. I used Labarraque's solution, 1 to 15, for the first six days, after that a solution of boracic acid, for irrigation; I substituted oakum for absorbent cotton as a dressing, applying iodoform gauze immediately over the incision, and using it to pack the sinus after removing the drainage tubes; and at every dressing I bathed the parts with a solution of corrosive chloride, 1:3000. The stone was about the size and shape of a Spanish olive stone— $\frac{1}{2}$ in. long, $\frac{3}{8}$ in. shortest diameter.

In referring to the points of interest in this case I would allude briefly to the question of diagnosis, which is not always easy in these cases, as has been proved occasionally when operators have incised the kidney with the confident expectation of removing a stone, and none has been found. Fortunately, in this instance, the diagnosis made itself, as I have explained in reciting the history of the case.

Another point is in regard to the shape and size of the pelvis of the kidney, which differed from the generally received idea of its anatomy as delineated by Gray, Harrison Allen, and others, particularly in its having two openings into the ureter instead of one and in being of a rectangular instead of a pyramidal shape.

Shortly after the date of my operation there appeared in *The Practitioner* an article by Mr. Jordan Lloyd, of Birmingham, on the diagnosis of renal stone, in which he states that the anatomy of the pelvis of the kidney, as given in most text-books, is entirely incorrect, and that, instead of being "a funnel-shaped membranous sac," it really consists of a cluster of branching tubes; and that the procedure of exploring the kidney through an opening into the pelvis is only practicable in dilated kidneys, and that the precise arrangement of the pelvis and ureter is as follows:

"The ureter, as it approaches the kidney, enlarges from its normal calibre—about that of a No. 10 English catheter—until it measures from one-third to one-half inch in diameter, and immediately upon entering the hilum it breaks up into two, or sometimes three, primary tubular branches, varying in diameter from a No. 10 to a No. 20 English catheter, and measuring from one-half inch to one inch and a half in length. These, in turn, give off secondary tubes, smaller in size—some less than a line in width—which end in cup-shaped calices. Sometimes tertiary branches, still smaller in calibre, shoot off from these secondary tubes, to end in calyces. With such a conception of the structure of the kidney's interior, many of the occasional difficulties with regard to symptoms, prognosis, and treatment of renal calculus are made more easy to understand."

That this "precise anatomical arrangement" is subject to exceptions is proved by the evidence my finger gave me of a rectangular sac of a capacity of about two fluidrachms, and I do not think I had to do with a dilated pelvis, for the collection of pus could not have had that effect; the kidney contained six ounces of pus at the time of operation, which caused a distention of the capsule of the kidney, filling to their utmost capacity all the tubes and calyces, but the pressure in the pelvis could hardly have been great enough to cause any great alteration in its capacity in so short a time, without also permanently dilating the tubes leading from it, and of that there was no evidence.

This pelvis, differing also from that depicted in Gray, in conformation, and in having two outlets into the ureter instead of one only, made me curious to look into the matter a little further, and I procured, through the kind favor of Professor Fitz, of the Harvard Medical School, two kidneys, both from the same subject, the pelves of which differ from each other and from that of my case. These kidneys I have drawn (from photographs which I made of the organs) so as to show the arrangement of the pelvis and ureter of each; the illustrations are of two-thirds natural size, and Fig. 1 shows the familiar pyramidal-shaped pelvis of Gray and Harrison Allen, with the loose tissue and the parenchyma cut away so as to show the interior of the pelvis, which is slit open so as to give a fair idea of its capacity. Fig. 2 presents the type which Mr. Lloyd considers the "precise anatomical arrangement" of the pelvis, the anatomy is quite different from that of the kidney I operated upon, and an idea of which I have tried to give in Fig. 3, where I have added to Fig. 2 the sort of pelvis my finger mapped out for me when it was hunting for the stone which I finally found in the lower of the two tubes which join in the ureter, as I have shown in the drawing.

These variations in the anatomy of the pelvis furnish valuable suggestions as to the surgical treatment of stone in the kidney, the first of which is that it is not advisable to incise the organ immediately upon uncovering it, with the expectation of finding a cavity which may be searched by the finger, for there may be no enlarged space, either funnel-formed, rectangular, or otherwise; and the knife very likely will sever

FIG. 1.



Typical kidney.

FIG. 2.



Kidney with double ureter.

FIG. 3.



Form of kidney found in Case of Mrs. M.

one or more of the tubes described by Mr. Lloyd, which will materially affect the quick healing of the wound, even if the stone be successfully removed. My own incision was particularly fortunate in not injuring the integrity of the tubes leading from the pelvis, and in part explains the extremely rapid closure of the wound, drainage by the natural channels not being interfered with, as might have been the case if the tubes had been wounded.

The second suggestion, following obviously from the consideration of the first, is that on laying bare the kidney a safer procedure is to explore the organ by acupuncture, using the knife only after locating the stone.

In the March and April numbers of *THE AMERICAN JOURNAL OF THE MEDICAL SCIENCES* for 1888, is an extremely interesting and valuable paper by Prof. Nathan Bozeman entitled "Kolpo-uretero-cystotomy," giving a description of a new method of diagnosis and treatment of chronic pyelitis, and detailing the history of two cases, in one of which the cause of pyelitis was stone. If I do not misunderstand the writer of this paper, he holds, with Gray, that the pelvis is a funnel-shaped membranous sac, which sac, his experiments show him, has a normal capacity of about five drachms; which may be correct for a great many kidneys, but surely not for the type which Mr. Lloyd insists is the only correct one, nor for such a kidney as Fig. 3 shows, where there is no true pelvis.

This error is of practical importance, because it affects the question of diagnosis of renal stone by a method which Prof. Bozeman says is easy and accurate; and which consists in making an artificial vesico-vaginal fistula (I refer now only to females) directly over the orifice of the ureter where it enters the bladder, and then passing a flexible steel sound or a rubber catheter through the ureter into the pelvis of the kidney. Doubtless diagnosis in this way may be easy if the kidney has a true pelvis, and if that pelvis is entered, according to Gray, by one tube only; in such a case the tip of the sound will almost surely touch any stone in the pelvis or in a pouch of the ureter; but if there is the arrangement of tubes described by Lloyd, and no pelvis, I do not see how it is possible to direct the point of a flexible sound working through the entire length of the ureter, so as to enter the several tubes one after the other in the hunt for a stone.

The treatment of chronic pyelitis by Dr. Bozeman's new method, whatever the cause, is irrigation of the kidney by means of an ureteral catheter, and the irrigation is kept up as long as there is any evidence of irritation of the pelvis and tubes. This treatment may give permanently successful results if there is no stone as a cause of the pyelitis, or if there be a stone of small size, or of friable character, located in a position from which it may be dislodged or disintegrated by the irrigating current; but if there are two entrances from the ureter to the pelvis, and the catheter always takes the one which does not contain the stone (Prof. Bozeman uses a catheter sufficiently stiff to retain the peculiar curve given to it by the ureter on its first introduction, hence if it goes wrong first it is more than likely to keep up the error), the operator may flatter himself, on the disappearance of the pus for several days or weeks, that he has cured his patient, and proceed to sew up the fistula too soon.

Prof. Bozeman says, "By this new method of treatment the patient is exposed to but little danger in comparison to that involved in the grave operations of nephrotomy and nephrectomy." It seems to me, however, that this method, not being easy for any but an expert gynecologist, and, as I have shown, not being infallible either for diagnosis or treatment of renal stone, ought not to be tried where the symptoms point strongly to calculus, but rather that the preliminary operation of laying bare the kidney by the lumbar incision, and the careful exploration of the pelvis and tubes by means of a very fine needle is not only justifiable but preferable; for if a stone is found, and it is the sole cause of the pyelitis, its immediate extraction will probably be followed by a rapid cure, as in my own case; whereas, in Dr. Bozeman's case, in which the cause of the pyelitis was calculus, the patient was under treatment and the fistula discharging for over six months before it was deemed expedient to close it; and as the report is written only five weeks after sewing up the fistula, I think it is too soon to claim a cure.

In addition to the greater facility and, as I think, safety of acupuncture in detecting the stone, the incision into the kidney, which will be necessary for the extraction of the calculus, affords a ready way of irrigating not only the pelvis of the kidney, but, by means of a flexible catheter introduced into the upper orifice of the ureter, of flushing that canal and the bladder also, and emptying all the pus and débris through an urethral catheter into a basin.

I have to say, in conclusion, that I saw the lady who is the subject of this paper a few days ago, and was happy to find her in blooming health, such as she had not enjoyed for years before the operation.

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