

## CALCULOUS ANURIA: ITS DIAGNOSIS AND TREATMENT.

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ANURIA may result from calculous disease of the kidneys in two ways. It may be the result of the gradual disorganization and destruction of the kidneys in consequence of a pyelitis and pyelonephritis caused by the irritation of the stones. This form of anuria appears as the end result of the disease and is usually accompanied, indeed is often preceded, by recognizable symptoms of uræmia. It is often preceded also for a long period by a polyuria similar to that which is seen in interstitial nephritis.

In this form of anuria, the diminution in the amount of urine comes on rather gradually, and the suppression is rarely complete until the end of life.

The other form of anuria in these cases is brought about by the stoppage of the ureter by a stone. Under these circumstances, the anuria comes on suddenly and is often complete from the start. If the stoppage is complete, the suppression persists to the end of life, or till the stone is removed either naturally or by operation.

This latter form is that properly known as *Calculous Anuria*.

Calculous anuria is to be distinguished from other forms of anuria by the sudden onset and by the absence of uræmic symptoms. The length of time during which complete suppression may persist in these cases without evidence of uræmia varies in different patients from three to ten days according to Morris. Sometimes death supervenes without uræmic symptoms.

Occasionally, the stoppage is not persistent. The sup-

pression lasts for several days, and then is followed by the profuse escape of a watery urine. This course of things may repeat itself several times. It is to be explained by the presence of a calculus in the renal pelvis which causes an intermittent stoppage of the upper end of the ureter, or it may result from the impaction in the course of the ureter of an irregularly shaped stone which by a slight shift of position permits at times the escape of urine alongside of it.

This intermittent anuria is not infrequently associated with a condition of hydronephrosis.

Calculous anuria may be brought about by the simultaneous stoppage of both ureters by impacted calculi. As a rule, however, when both ureters are stopped by stones, one of them is a long-standing impaction, and the kidney on that side is practically destroyed. The anuria is then the result of the stoppage of the ureter on the functionally active side.

A similar condition is produced when one kidney is congenitally absent or destroyed by any form of antecedent disease, and then the remaining one is shut off by a stone.

Cases are reported in which, although the other kidney was comparatively healthy, a fatal suppression has followed the stoppage of one ureter. Authentic instances of this occurrence are, however, so rare that it may be stated, as a rule, that sufferers from calculous anuria are patients with but one kidney.

Leguen, analyzing thirty cases in which the condition was proved by autopsy, found that the other kidney was absent in three cases, was more or less destroyed by calculus in twenty cases, and had the ureter stopped in six. In but one case was the kidney in fairly good condition, and in that there was epithelial proliferation in the tubes.

Morris, by similar analysis of twenty-eight cases, found the other kidney absent in six; marked atrophy in eight, in two of which the ureter had become impervious; almost entirely disorganized by calculus in eleven; destroyed by a hydatid cyst in one; enlarged in two.

Calculous anuria is so distinctly a mechanical condition

that it requires surgical measures for its relief, except in those rare cases in which Nature works a cure by furthering the escape of the calculus along the ureter into the bladder.

Occasionally, also, it happens, as has been said, that a calculus blocking the upper end of the ureter falls back into the pelvis of the kidney, and so removes the obstruction.

Unfortunately, cases of recovery from this affection are rarely studied with sufficient accuracy to thoroughly explain their mechanism. Morris mentions <sup>1</sup> a case of James Russell, in which the anuria lasted twenty days, and terminated by the discharge of ten litres of urine in twenty-four hours. A year later the patient died, and at the post-mortem examination there was discovered a double hydronephrosis with calculi in the pelvis of each kidney.

He also reports a case of his own as follows: "In one of my cases, complete anuria, accompanied with pain and a tumor in the left renal region, occurred on many occasions, lasting two or three days at a time. The right kidney was packed with calculi, calculi being felt to grate on one another, and the left kidney, which had undergone compensatory hypertrophy, was in an early stage of hydronephrosis and contained a single round calculus, the size of a small cherry, which was freely movable in the renal cavity. The left ureter was unobstructed and normal throughout."

These cases would seem to belong to the second category of those in which the calculus blocked the upper end of the ureter for a time, and then fell back into the pelvis.

Morris does not report any cases of recovery from calculous anuria in which recovery was brought about by the spontaneous escape of the stone into the bladder.

I find that Demons <sup>2</sup> reported a case in which the anuria ceased on the expulsion of a calculus.

Féréol <sup>3</sup> also reports the case of a man of forty-nine who had anuria for eight days, and then suddenly began passing urine of low specific gravity to the amount of ten litres in twenty-four hours, and shortly expelled from the bladder a uric acid calculus of the size of a pea, with several small ones.

The reason that the spontaneous escape of the stone downward in these cases is so rare is because the anuria is so complete. The excretion behind the plugged ureter ceases, and there is no longer any pressure from behind to push the stone along.

Cases that the writer will presently report seem to show that these stones may sometimes require but little forward push to accomplish their escape into the bladder; and it is quite possible that in some cases of spontaneous recovery from calculous anuria an immediate washing of the bladder with a litholapaxy pump might have obtained calculous matter, and thus have shown that the stone escaped in this direction. No case has been found, however, in which this demonstration has been made.

The possibility of an occasional spontaneous recovery raises the question as to whether we are ever justified in treating these cases on the expectant plan.

I feel that such a termination of calculous anuria is so rare that it is better judgment to interfere surgically as soon as it is plain that a cessation of renal function has become established.

Leguen studied fifty-six cases of anuria that were not operated; of these sixteen recovered, the excretion of urine being re-established on the third day in one case; between the fifth and tenth days in ten; on the thirteenth, fourteenth, and fifteenth days, one each, and in two cases at a still later day.

Morris similarly collected forty-eight cases not operated upon. Of these, thirty-eight died and ten recovered.

We have then a mortality of from 72 to 80 per cent. following the expectant plan of treatment.

The reported cases of surgical intervention are as yet few, but already it is clear that the results are far better than a 75 to 80 per cent. mortality.

With the object of making surgical interference effective, such a case should be carefully studied to determine the probable condition of the two kidneys. It is to be borne in mind

that usually one kidney is already functionally inactive. Such being the usual condition, it is obviously of first importance to determine which kidney has just been stopped by the calculus, and can probably be restored to usefulness by operation. The history and examination of the patient will usually clear up this point. If the pain at the onset of the attack was distinctly localized in one side, especially if that kidney is enlarged and tender, it is reasonably clear that it is on that side that the calculus is lodged. Not infrequently, however, the suppression is so complete from the start that tension in the affected kidney is but slight and of short duration. As a consequence, the pain is moderate in degree and quickly subsides.

In one of the writer's cases (Case I) there was no pain on the sixth day, when the patient was seen. At the onset of the attack the pain had been sharp in the left kidney, but quickly became diffused over the whole back. This patient had had previous attacks of renal colic in which the pain was thought due to rheumatism until the passage of a stone revealed its true nature. In the other case the pain was distinctly referable to the right kidney, which was enlarged and tender.

In the absence of pain and tenderness over the kidney, the course of the ureter should be explored by palpation over the abdomen and loin. The writer in one case <sup>4</sup> of ureteral calculus (not anuric, although the urine was much diminished) found an exquisitely sensitive point in the loin just above the crest of the ilium, and cutting down on this found and removed a calculus as large as a small bean.

Rectal and vaginal touch should also be used to explore the lower end of the ureters. In another <sup>5</sup> of the writer's cases (not anuric) a large stone was felt in the lower end of the ureter by vaginal touch, and removed by incision through the vault of the vagina.

The X-ray may be of distinct service in locating the calculus. Enough ureteral stones have been accurately determined in this way to show the value of this method of investigation. In a case of Dr. J. W. Elliot's <sup>6</sup> seen by the writer, the skiagraph gave a clear picture of a small stone lodged in

the ureter, just above the crest of the ilium. It was removed by Dr. Elliot from this place, and the finding of the X-ray was confirmed in every respect.

Cystoscopy, too, should not be neglected. Morris says, "The ureteral cystoscope in cases of anuria is quite unnecessary, and in my opinion out of place, as it can give no information which is not more fully ascertained by rectal and vaginal examination, and by a sound in the bladder." With this opinion the writer cannot agree.

Certainly, when all necessary information can be obtained in other and easier ways, it would be unwise to waste time over cystoscopy.

But in a difficult case, when the evidence is insufficient to tell even in which ureter the stone is lodged, the cystoscope in skilled hands may bring the needed information.

Catheterization of the ureters in the hands of an expert may lead to the correct understanding of a doubtful situation that has baffled other methods of investigation. In short, no means should be left untried in dealing with these perplexing conditions.

Before proceeding to the consideration of the operative treatment of calculous anuria, the following cases are reported to show the difficulties to be encountered. The first case has already been reported<sup>7</sup> and is briefly recapitulated here.

CASE I.—E. A. P., a strong man of sixty years, seen in consultation with Dr. G. K. Sabine, of Brookline, Massachusetts, on December 12, 1892.

Always subject to rheumatism. Seven years ago an attack of renal colic in the left kidney and passed two stones. Then well until two years ago, when he had an attack of pain in the right side and passed a stone that was larger than the previous ones. The pain in this attack was thought to be due to rheumatism, and was not so severe as is usual in renal colic, so that its origin was not suspected until the stone was passed.

Then free from trouble until November, 1892. Early in that month he had some twinges of pain in the right side, which were thought to be due to rheumatism. They passed off. Then

a similar pain came in the left side on the 19th of November. The pain in this attack was not severe, but was recognized as similar to that which he had had two years before, when he passed a stone. December 5th was seized with an acute pain in the back. This was so severe as to throw him into a profuse perspiration; the pain was felt through the abdomen as well as in the back, and was distinctly referred to the left side.

December 6th it was noticed that he was not passing any urine. Anuria continued through the 7th, 8th, and 9th. On the latter day a catheter was passed, but only a drachm of turbid urine was obtained. From that time there was no water up to the time that I saw him on the evening of December 12.

He looked quiet and easy, not at all sick; he had no nausea, no headache, no drowsiness,—in fact, he said he felt perfectly well. Examination could detect nothing either in the abdominal or lumbar region. There was no tenderness anywhere, even to forcible pressure. Advised to take considerable water, to have a mustard poultice over the kidneys, and sugar of milk freely through the night.

The following day he had passed no urine, he was a little more dull, his tongue was very dry, he had no pain, his pulse was 76 and of fair strength. Some relish for food, and no nausea. There was a little more resistance in the right renal region than in the left. The rectal examination showed a prostate of moderate size, but nothing above the prostate, either of tenderness or hardness, in the region of the ureters. An operation was advised.

It was designed to open the abdomen by a median incision, to examine both kidneys and their ureters, and then to proceed, in the best way possible, to the correction of whatever condition was found. The operation was performed on the morning of December 14, between seven and eight days after the establishment of complete anuria.

On the morning of the operation he had begun to show evidence of constitutional disturbance. The pulse and temperature had risen decidedly, and there was some commencing mental hebetude.

Operation was done under ether. Median incision between umbilicus and pubes. Right kidney was felt to be enlarged to perhaps three times the normal size; its surface was irregular and divided into large lobes. Palpation of the ureter was diffi-

cult, on account of the abundance of fat in the post-peritoneal tissues, but no hardness suggesting a stone could be felt anywhere in that pelvis or ureter. Left kidney was of normal size, and its pelvis was not distended with fluid. The ureter on this side was followed down with great care from the kidney to the bladder, but nothing like a stone could be detected. The bladder was contracted in the pelvis. The condition of things thus confirmed the previous opinion that the right kidney was previously disabled, and that the stone which caused the final suppression was blocking the left kidney.

With the object of more carefully palpating this organ, which was deeply buried in fat, I made an oblique incision in the left loin and uncovered that kidney. With one hand in the abdomen and the other in the wound in the loin, very careful search of the pelvis of the kidney and of the upper part of the ureter was possible, but the result was negative.

The opinion was expressed to the friends that possibly our thorough manipulation would be found to have dislodged the obstructing body.

The patient recovered well from the ether, and about three hours later, when I saw him, there was a slight escape of urine through the urethra, and on passing the catheter, thirty-seven ounces of light-colored urine were drawn. Two gallons of urine were obtained in the first twenty-four hours. In the second twenty-four hours the amount fell to about five quarts, and after that there was a steady, gradual diminution, until the daily amount had reached the neighborhood of seventy ounces, at which it held.

Convalescence was satisfactory, and about a fortnight after the operation I washed out the bladder with a litholapaxy pump, obtaining a few grains of calcareous matter, thus completing the evidence that the ureter had been stopped by a calculus, which had been displaced by my manipulations.

Not long after the patient had gone from the hospital, he had another attack of discomfort in the left side of the abdomen, accompanied by a chill and high temperature. I saw him after this had persisted for a good many hours, and found him passing an abundant quantity of water, but still suffering from discomfort through the lower part of the abdomen on the left. Careful examination detected nothing abnormal in that region.

Remembering the experience of the previous attack, I made



considerable massage through the abdominal wall, down along the course of the ureter, and as deeply into the pelvis as I could reach. From the time of my examination he was comparatively comfortable. A week or two later a stone was passed that was decidedly larger than the calculous bits that were obtained by pumping after the operation. I have not seen the patient since, but have heard that he had still another attack of pain, with again the passage of a stone, since which time he has remained well.

CASE II.—J. H. P., a strong, vigorous man of fifty-seven years, entered the Massachusetts General Hospital on March 3, 1903, with the following history. Gonorrhœa thirty years ago. Typhoid fever fifteen years ago. For the last fifteen years he has been subject to attacks of severe pain, starting in the right lumbar region and shooting down into the right groin and into the penis. These attacks have occurred about once a year, and have been accompanied by nausea, vomiting, and by bloody urine. They have been usually followed by the passage of stones from the bladder. These calculi have been sometimes one-half of an inch in diameter. Two years ago he had an unusually severe attack; but this time the pain was on the left side. This attack was accompanied by fever and made him much sicker than ever before. This laid him up for several weeks. A few months later he had another very severe attack on the left side. During the past year he has had these attacks in the right side about once a week. For the last three weeks he has had persistent, almost constant, pain in the right side with nausea and vomiting each day, but has passed no stones. The urine has been greatly reduced in amount and has not exceeded, he thinks, two or three ounces in the twenty-four hours. He has severe burning pain in the glans penis.

Physical examination showed a mitral, systolic murmur with some increase of cardiac dullness. The abdomen was soft and tympanitic everywhere except in the right lumbar region, where there was great tenderness and muscular rigidity. There was a deep sense of resistance over the right kidney. The prostate was little, if at all, enlarged. The catheter drew one ounce of clear urine, no stone was touched. A skiagraph of renal and vesical regions was negative.

I saw the patient twenty-four hours after entrance, during which time he had passed no urine beyond that drawn by the

catheter. It seemed probable that the right kidney was stopped by a calculus, and that the left kidney was practically useless. The two severe attacks in the left kidney were believed to account for its inactivity. I therefore cut down upon the right kidney, following the line of Israel's incision. The fat capsule was tense and œdematous; the fat being stiff, almost as if frozen, and closely adherent to the kidney beneath.

The kidney was enlarged to nearly double the usual size. On account of its size, it was rather difficult to lift it out of the wound. It was dark purple in color and was dotted with little prominent yellow points, strongly suggesting miliary tubercles. One of these was cut out and at once examined by Dr. J. H. Wright. It was found to be a little abscess containing a few indeterminate crystals.

An incision along the convexity opened the pelvis, which was explored with the finger, but no stone was found. The ureter was followed down towards the bladder, but nothing could be felt in it. It was carefully stripped from above downward in order to dislodge any stone that might have escaped observation. A drainage tube was then introduced into the renal pelvis, the capsule was split along the convexity, and the wound was closed as far as drainage would allow. Within the next six hours, the patient passed voluntarily 900 cubic centimetres of urine. In the next twenty-four hours he passed 1500 cubic centimetres, and as much more was estimated to have escaped through the tube into the dressings.

On the fourth day the urine suddenly ceased coming through the bladder, and a proportionately increased amount escaped through the tube into the dressings. After this condition had persisted for forty-eight hours, the patient by a forced attempt at urination squeezed out a few drachms of greenish pus. Some hours later urination by the bladder was resumed and the drainage through the tube again diminished. On the eighth day the pain had wholly ceased, and the patient expressed himself as "feeling better than for ten years." The tube was removed and the leakage through the wound quickly stopped.

On the twelfth day he had two short attacks of pain in the left lumbar region, similar to those he had had formerly, but of slight intensity. On the fourteenth day the bladder was washed

with the Bigelow Evacuator. Two stones about the size of a grain of wheat were obtained, and a larger stone was heard to click against the tube. This stone, measuring one centimetre in diameter, was crushed and pumped out under cocaine anaesthesia on the twenty-fourth day.

From this time recovery was uneventful, except that on one day when he got up the urine ceased to flow. After being up for six hours, he returned to bed, and the urine at once began to pass in large quantities. After convalescence was fully established, the bladder was examined with the cystoscope. The right ureter was about three times the normal size and the urine could be seen to come from it in jets. The left ureter was occupied, and fully filled by a string of thick pus which was not moved or stirred by any urine escaping alongside of it. On the following day, the cystoscopic examination was repeated, and again the left ureteric orifice was seen to be occupied by a plug of pus. While, now, this orifice was clearly kept in view, an assistant made pressure over the left kidney. At once a gush of thick pus was seen to come from the ureter. Dr. W. W. Gannett, who was present, saw this phenomenon repeated a moment later. Again no urine was seen to issue from the left ureter.

These two observations, together with the fact that when on the fourth day after operation the right kidney ceased to send its urine to the bladder, that viscus remained empty for two days, seemed to prove beyond question that the left kidney was practically destroyed. As it was wholly insensitive, and gave him no trouble, the patient did not care to consider its removal.

These cases are especially interesting taken together, because in both of them it was impossible to locate the stone, and it was subsequently shown that the stones were very small.

Judging from the immediate relief that followed the thorough palpation of the ureter, it seems probable that these small stones were arrested just where the ureter enters the bladder. A case reported by M. Duffan-Lagarosse<sup>8</sup> shows how a very small stone at this point may lead to partial anuria.

The first case occurred before cystoscopy was commonly practised, and in the second case the indications for operation

on the right side were so clear that it was not thought wise to waste time examining the interior of the bladder. It seems probable to the writer, however, that in either of these cases an inspection of the ureteric orifice might have shown a bulging, or even the commencing protrusion of the calculus. If inspection was negative, a catheterization of the ureters might have been relied upon to furnish important evidence; and in a doubtful case this should certainly be tried.

In Vol. xii of the *Annales des Maladies des Organes Génito-Urinaires*, Kaefer reports a case of death from anuria in which the autopsy showed that both ureteric orifices were occupied by stones that projected slightly into the bladder cavity.

These cases are chiefly interesting, finally, because they were both relieved by a method that I have not found described in treatises upon calculous anuria, and which was so efficacious that it ought not to be lost sight of by operators on these cases.

In Case I it would perhaps have been wiser to have done a nephrotomy, and thus afforded drainage behind the point of obstruction. The kidney being of normal size, with no distention of the pelvis, the propriety of opening did not suggest itself.

*Operative treatment* in calculous anuria aims first at the removal of the stone.

If the case is seen early, that is, within two or three days of the onset, it will be well for the surgeon to remember that a stone may be assisted along the ureter by manipulations.

Both of the cases just reported show what can be accomplished in this way.

Case I is especially interesting, because in the attack subsequent to the operation the calculus was dislodged and forced on to the bladder by massage applied through the abdominal wall. During examination of the patient, then, vigorous massage down along the course of the ureters should be made, and it may occasionally happen that a cure will be brought about in that way.

This possibility should never lead to delay of operation, but during the first days of the anuria, while the case is being studied, efforts to thus dislodge the stone may well be made.

If the locality of the stone is made out, it may be dealt with according to the following plan.

If the stone is in the pelvis of the kidney, it may be reached and removed by a nephrotomy, which also affords opportunity for drainage.

A stone between the kidney and a point two or three inches above the bladder may be reached and dealt with through the incision described by Israel, running from the twelfth rib downward and forward just in front of the anterior superior spine of the ilium. Through this incision, in a thin subject, the greater part of the ureter may be reached without injury to the peritoneum. In a stout person, however, there is difficulty in dealing with the last few inches above the bladder. In the female, this part of the ureter is accessible through the vagina.

Emmet removed a stone from the bladder end of the ureter through a vaginal incision, but felt that only stones in the extreme end of the ureter could be safely reached from this direction on account of the danger of wounding the peritoneum. The writer later<sup>9</sup> showed by dissections that in women the last two and often three inches of the ureter lie below the peritoneum, and in such relation to the vagina that it may be opened into from the vaginal side without fear of injury to the abdominal cavity. In connection with the account of this investigation, he published the report of a case in which a stone weighing 190 grains was safely removed from this part of the ureter.

The writer has also had one case (not anuric) where the stone, which was very irregular and branched in shape, was sticking in the part of the ureter that lies in the bladder-wall. It projected somewhat into the bladder, and was dislodged by manipulation of the finger introduced through the dilated urethra.

This lowermost part of the ureter in the male is more difficult of access. The writer in the article above alluded to pointed out the fact that this portion of the canal could be reached extraperitoneally by a Kraske incision with removal or displacement of part of the sacrum. Morris operated in this way in 1900.

We now come to consider the proper procedure in cases where the location of the stone cannot be made out.

If we can determine with reasonable assurance on which side the useful kidney is, it is plainly best to cut down on it, open and explore the pelvis, and if the stone is not there to follow down the ureter. If still no stone can be found, the ureter should be thoroughly stripped from above down to endeavor to dislodge the stones which, from the very fact that they cannot be felt, may be presumed to be small.

In this connection, it is well to call attention to the fact that it is not necessarily the enlarged kidney which should be approached by operation.

In the writer's first case, the right kidney was found to be enlarged, but it was plainly the one which had long been inactive. In the second case, however, it was the enlarged kidney that was functionally active, and was therefore properly subjected to operation.

Lastly, in certain cases, the symptoms and physical signs will fail to give us reliable information, and we shall approach the operation without any certainty as to which side should be attacked. In these cases an exploratory laparotomy, by enabling us to accurately examine both kidneys and to follow the ureters through their whole course, may supply the information needed for our guidance. Any slightly added risk from opening the abdomen will be more than counterbalanced by the added light that such an exploration is likely to throw on the case.

In some cases, the aid of the hand within the abdomen may enable us to remove a stone deep in the pelvis through an extraperitoneal incision.

## REFERENCES.

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- <sup>2</sup> Société de médecine et de chirurgie de Bordeaux, 1888.
- <sup>3</sup> Société médicale des Hôpitaux, February 14, 1890.
- <sup>4</sup> Reported in Boston Medical and Surgical Journal, September 11, 1890.
- <sup>5</sup> Boston Medical and Surgical Journal, December 25, 1890.
- <sup>6</sup> Boston Medical and Surgical Journal, May 16, 1901.
- <sup>7</sup> Boston Medical and Surgical Journal, August 31, 1893.
- <sup>8</sup> Annales des Maladies des Organes Génito-Urinaires, January, 1892.
- <sup>9</sup> American Journal of the Medical Sciences, January, 1892.