URETERIC CALCULI*

Diagnosis, Behaviour and Appearances, with Seven Case Histories

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The symptoms which are produced by the presence of a calculus in the ureter are well known. The pain is situated in a line from the loin down to the groin and may be referred to the testicle or upper part of the thigh, its location depending on the site of impaction in the ureter. If the stone is lodged in the upper part of the ureter, the increased tension in the pelvis of the kidney due to blockage causes pain and tenderness in the posterior renal angle. If the impaction is lower down in the ureter, the pain and maximum tenderness are situated in the anterior abdominal wall in the upper or lower quadrants, in the region of the lateral border of the rectus abdominis muscle. If the obstruction is in the distal end of the ureter, the pain is referred to the groin, perineal or rectal region, though in most instances renal pain and tenderness are also present. By the alteration of the site of the pain, the patient will appreciate the descent of the stone down the ureter.

The pain is usually colicky in nature and varies in intensity, lasting a few minutes, causing sweating, pallor and vomiting in severe cases. Abdominal distension may also occur. In addition, urinary symptoms of haematuria, increased frequency and dysuria may be present. In some cases a stone or 'gravel' may be passed per urethram a few days after an attack of colic.

The presence of an excess of oxalate crystals in the urine, or infection of the urinary tract, may simulate pain of calculous origin. In cases of haematuria from the kidney, the passage of blood clots along the ureter may produce colicky symptoms similar to that described above. Sometimes a mistaken diagnosis of cholecystitis, appendicitis or diverticulitis is made, depending on the localization of the pain. Abdominal distension, accompanied by intermittent colic and tenderness, will simulate intestinal obstruction, but the presence of posterior renal discomfort and tenderness, and perhaps urinary symptoms, will lead to a correct diagnosis.

Occasionally a ureteric stone may be silent and be discovered accidentally by a routine radiograph

of the urinary tract (Fig. 1). In the majority of such cases an antecedent history of past urinary symptoms or infection can be obtained. During the initial attack, a small stone originally from the kidney becomes lodged in the ureter, usually in the lower third, where it will nestle and become embedded in the ureteric wall, ultimately blocking the ureter by further incrustation. Infection and back pressure will eventually cause irreparable damage to the kidney.

As a rule, in most cases the signs and symptoms of ureteric calculi are characteristic and can be diagnosed with confidence, but sometimes even after full investigation the presence of a stone cannot be demonstrated; its detection radiologically depends on the size and chemical composition of the calculus and whether it is obscured by extraneous bowel shadows in the radiograph.

In some instances an opacity in the course of the ureter will require further elucidation by means of intravenous and retrograde pyelography. The former will show the relation of the line of the ureter to the opacity and indicate the function of the kidneys; in the latter, ureteric catheterization may encounter an obstruction, or at the cystoscopic examination a stone may be seen lodged in the ureteric orifice. The intravenous injection of indigo carmine (10 cc. of 0.4 per cent. solution) will demonstrate whether the outflow of the urine is obstructed, by the absence of its excretion, after a few minutes, into the bladder. It will also indicate the function of the kidney on the healthy side. The dye should normally become visible in good concentration at five minutes after the injection. If a ureteric catheter can be manipulated beyond the stone, temporary relief of pain can be obtained for drainage of the urine above the obstruction will lessen the tension in the renal pelvis. A specimen of urine should be collected via the ureteric catheter, examination of which will show the degree of infection of the kidney and the causative organism. If the stone prevents the passage of this catheter, the slow introduction of an opaque fluid up the catheter will outline the calculus and distend the ureter below. This method was adopted in Case 2; thereby the outline of a translucent ureteric stone became visible, and thereby

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FIG. 1.—A large ureteric stone on the left side of the pelvis (Case 6).

FIG. 2.—The passage of a ureteric catheter is hindered by an obstruction at 6 cm. from the distal end of the ureter (Case 2).

FIG. 3.—The introduction of a few ccs. of uroselectan via the catheter outlines the lower end of a ureteric calculus. This urate stone is translucent to X-rays.

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FIG. 4.—This shows that the catheter in the left ureter and an oval opacity on the left side of the pelvis are in alignment in the antero-posterior view (Case 1).

FIG. 5.—Likewise in the oblique view, the ureteric catheter and the opacity are in line. Is this opacity a ureteric calculus? (Case 1).

FIG. 6.—A small stone lying in the middle of the penile urethra (Case 4).

introduction of the catheter. The fluid aided the descent of the stone into the bladder (Figs. 2 and 3).

On the other hand, if a catheter can be passed up the ureter without difficulty, the opacity is probably not a stone. Two radiographs should be taken of the area, and if they show that the rounded shadow and the line of the catheter are approximate in *both* antero-posterior and oblique views, the opacity is probably in the ureter, but if they are remote in *either* view it is most likely to be extra-ureteric—probably a phlebolith. Difficulty arises when a shadow, such as a phlebolith, is adjacent to the ureter, as in Case 1, and in these circumstances stereoscopic views may be used with advantage.

Case 1. Mr. F. F. Aged 63.

September 1946. Onset of intermittent pain in the left loin. No micturition symptoms. Intravenous pyelogram showed a shadow in the line of the ureter without obstructing its excretion. This was assumed to be a stone and was treated expectantly with retrograde catheterization and dilatation of the ureter. Antero-posterior and oblique views on two occasions showed the 'stone' to be in juxtaposition to the catheter (Figs. 4 and 5).

In view of the continued symptoms and failure of the calculus to descend, operation was performed in April 1949. A ureteric catheter was passed as a preliminary measure and the lower end of the ureter was exposed by an extra-peritoneal approach, and the 'stone' was seen to be adjacent to the ureter. It was, in fact, a phlebolith lying in a small vein; this vessel was divided after ligation above and below the phlebolith; the vein wall was incised and the phlebolith was removed without difficulty. In appearance it was a smooth, oval, calcified mass about 6 mm. x 4 mm. (Fig. 10c).

The patient made a good recovery and fortunately his loin pain was relieved. He was symptom-free when seen a year later after this surgical interference.

Case 2. Mrs. G. D. Aged 38.

June 21, 1949. Onset of pain in the left iliac fossa radiating to back; constant ache and occasional colic which caused her to double up, associated with occasional increased frequency of micturition.

July 12, 1949. Cystoscopy. Bladder normal. Left ureteric catheter was held up at 6 cm. from the ureteric orifice.

September 13, 1949. The ascending pyelography was repeated and the catheter was held up at the same site. An opaque dye was injected

along the catheter and showed a cup-shaped filling defect at its upper limit as if outlining a stone (Figs. 2 and 3).

September 27, 1949. Exploration of ureter advised.

November 12, 1949. The stone was passed per urethram whilst patient was awaiting admission to hospital. It was a urate stone (Fig. 6a).

December 6, 1949. Intravenous pyelogram showed return of function to the right kidney with good excretion after five minutes.

June 1950. No further symptoms.

As urate stones are usually translucent to X-rays, their presence is liable to be overlooked unless a complete investigation is carried out. Fortunately this type of stone is uncommon.

Case 3. Mr. R. S. Aged 36.

Past History. 1944 discharged from the Army on account of small right renal calculi associated with colic. He had haematuria on one occasion and intermittent symptoms since that time.

February 1, 1948. Blood in the urine, pain in the right loin and urgency of micturition.

February 17, 1948. Passed elongated stone per urethram (Fig. 6b).

Case 4. Mr. J. F. Aged 54.

August 21, 1949. Difficulty of micturition; intermittent flow; tenderness in penile urethra. No previous history of renal pain or colic.

August 28, 1950. X-ray showed stone in urethra (Fig. 6). On passage of a sound a stricture was encountered about 3 in. from the external meatus. After dilatation under an anaesthetic the calculus was manipulated past this stricture and extracted.

Past History. Gonorrhoea 32 years ago.

Further investigation showed that he had a few small calculi in the left kidney, which were probably secondary to the obstruction in the urethra.

Case 5. Mr. C. S. Aged 68.

October 17, 1949. Admitted as an emergency with a diagnosis of subacute obstruction with a history of ten days' pain in the left iliac fossa, associated with nausea, but no urinary symptoms. There had been no bowel action for five days prior to admission. Examination showed a distended abdomen with tenderness in the left lower quadrant. This attack was relieved by an enema. Signoidoscopy was normal and a barium enema showed a few diverticula in the pelvic colon. Blood urea was 38 mgm. per cent., and the urine was sterile. He was discharged a week after admission with a tentative diagnosis of diverticulitis.

September 10, 1950. Re-admitted with a similar history of constipation, pain in the left side and vomiting. The pain did not radiate and there were

FIGS. 7 and 8.—Two opacities in the pelvis, the upper one of which is less distinct than the rounded one below (Case 6).

no abnormal physical signs apart from slight tenderness in the left iliac fossa. There were no urinary symptoms and relief was again obtained after an enema had been administered.

September 21, 1950. An intravenous pyelogram showed that both kidneys were excreting normally after five minutes, and in the line of the left ureter there was an opacity (Figs. 7 and 8). It did not appear to obstruct the flow of dye and there was also a phlebolith below this ureteric stone on the same side; 14 days later the patient passed a small stone per urethram.

Past history. In 1943 he had a similar attack of pain and passed a small stone.

Case 6. Mrs. V. D. Aged 30.

September 1947. She reported to hospital for examination on account of amenorrhoea, which was, in fact, early pregnancy. She suffered from occasional frequency of micturition but had no recent kidney or bladder pain.

Past history. For the past 18 years she had suffered from intermittent attacks of pyelitis, the last attack of renal pain being about three years ago. Seven years ago she developed pulmonary tuberculosis for which she received treatment, the lung condition now being quiescent.

Investigations. Intravenous pyelogram showed non-functioning of the left kidney due to a large stone at the lower end of the ureter, which probably originated a few years ago (Fig. 1). There was also a small stone in the right kidney, which was functioning normally. Urine showed a growth of coliform bacilli.

Case 7. Mr. J.R. Aged 57.

October 25, 1949. Two years' history of urgency of micturition and increased frequency day and night. Moderate enlargement of the prostate. Examination showed that he had a narrow external meatus which required dilatation before a cystoscope could be passed. Apart from trabeculation of the bladder the cystoscopic appearances were normal. Straight X-ray showed a linear shadow in the region of the left ureter (Fig. 9). An intravenous pyelogram indicated that this was outside the line of the ureter and was probably calcification in one of the iliac vessels. This opacity was an incidental finding which could have been mistaken for a ureteric stone.

The cases quoted above illustrate a few of the problems of the diagnosis of ureteric calculi and their manifestations.

FIG. 9.—Excretory urogram showing a line of calcification lying outside the line of the ureter—probably calcification in a vessel. Case 7.

The specimens obtained in Cases 1, 2 and 3 respectively are illustrated in Fig. 10, namely, an oxalate stone, a urate stone and a phlebolith. The surface of the oxalate calculus is spiculated (Fig. 10b) and this irregularity renders the passage of this type of calculus down the ureter more difficult than a stone with a more even surface.

The urate stone is smoother (Fig. 10a), and on its surface a longitudinal groove can be seen which will enable a fine stream of urine to pass along the ureter, thereby preventing complete blockage from above. Should this channel become blocked the tension in the pelvis and ureter above will increase, thereby causing renal and ureteric pain. Contraction of the musculature above the stone may clear this obstruction and relieve the pain. This process is usually intermittent, which would account for the exacerbation of symptoms. Descent of the stone into a more capacious part of the ureter, or into the bladder, would produce alleviation. This phenomenon of canalization of ureteric calculi occurs more commonly than is generally appreciated, and no doubt accounts for the surprisingly long survival of kidney function in some cases after the impaction

FIG. 10.—Specimen A—a urate stone (Case 2). Specimen B—an oxalate (Case 3). Specimen C—a phlebolith (Case 1).

of a stone in its ureter. This, however, does not justify a complacent attitude and delay in treatment of the obstruction.

The phlebolith has a regular surface and is oval in shape (Fig. 10c). Phleboliths are usually multiple and lie in a line on either side of the pelvis, and if single may often be difficult to distinguish from a ureteric calculus, though characteristically they give a laminated shadow on radiography. In Case 1 it was perhaps excusable that a wrong diagnosis was made, but operative removal of phleboliths is to be deprecated as they occur commonly in adult life and are symptomless. Also, this needless operation may be a hazardous procedure.

A calcified tuberculous gland, if situated in the line of the ureter, may be difficult to distinguish from a stone, but usually in the former the calcification is irregularly distributed and the gland margins are not circumscribed; further they are often multiple, and if situated in the mesentery can be moved with change of posture.

Occasionally calcification of the iliac arteries may simulate a stone, as in Fig. 10, but the linear distribution of the calcification will signify that it is in the vessel walls. If, however, it only affects a short portion it may be confused with a ureteric stone. An intravenous pyelogram in this case shows that it is remote from the line of the ureter.

The radiograph depicting a small stone impacting the urethra is of interest, as it is not often that one has the opportunity to demonstrate radiologically a calculus in that position. This stone originated in the kidney and descended down the

urinary tract to become held up by the urethral stricture (Fig. 6).

The above remarks deal with a few aspects of ureteric calculi, namely, their diagnosis and appearances. In conclusion, a stone in the ureter should not be considered as a separate entity, but as a manifestation of calculous disease affecting the whole urinary tract. In some patients the passage of a ureteric stone is but an incident; in others it may preface a chapter of further urinary disorders which, it is to be hoped, will have a happy ending.

VALE ATQUE AVE

A By-way of Domestic Education in the 18th Century

By DR. A. MEIKLEJOHN

In the Potteries district of North Staffordshire Burslem has always been regarded as the mother of the five towns, and the first free school there was erected in 1749. Early in October 1950, almost exactly 200 years later, a university college was instituted at Keele, just a few miles distant from the original school.

The subscribers to the original free school probably had no vision of a university or even a university college for the sons and daughters of poor workmen, but Josiah Wedgwood has left us some record of his views on the education of children of the middle classes. His concern was, as it must always be for most of us, the education of his family.

Josiah Wedgwood was born at Burslem in 1730, where as a very young child he attended the dame school to which the local children were sent 'more to be out of the way of mischief than for the learning to be obtained there.' When seven years old and he could walk the distance of seven miles daily, he accompanied a group of children to Mr. Blunt's private school at Newcastle-under-Lyme. Here the master instructed his pupils in reading, writing and arithmetic, while his wife taught the girls knitting and sewing. On the death of his father in 1739 young Joss was taken from school and apprenticed to his brother Thomas in the family potworks. So his formal education ended at the age of nine years. Forty-four years later, in 1783, in recognition of his profound contributions to ceramic science, he was elected, at the same time as his friend Joseph Priestley, a Fellow of the Royal Society. His monument in the

Parish Church, Stoke-on-Trent, bears the inscription:

Sacred to the Memory of
Josiah Wedgwood, F.R.S. and S.A.
of Etruria in this county.

Born, August 1730. Died January 3rd, 1793.
Who converted a rude and inconsiderable
Manufacturing into an elegant Art and An
important part of National Commerce.

In 1764 he married his cousin Sarah Wedgwood and between 1765 and 1778 a family of four sons and four daughters was born to them. It is in relation to the four eldest surviving children (Richard died in infancy), Susan or Sukey (the mother of Charles Darwin), Jack, Joss and Tom that Wedgwood has recorded for us a father's thoughts on the education of his family.

As was the custom of the times, all about the age of six or seven years were sent off to boarding school; Sukey went to Manchester while her brothers attended a school at Bolton conducted by the Revd Mr. Holland. This school seems to have been much in demand and vacancies not always available, for on November 8, 1776, Wedgwood writes:

'You were so obliging to tell us some time since that you could take our Son Joss under your care the next summer, which offer we shall thankfully accept, and shall be glad if you can at the same time make room for our *youngest* (Tom born 1771), who wishes to accompany his Brothers, and will be a pretty little sort of a Scholar by midsummer.'