

## THE LOWER END OF THE URETER \*

By Laurence F. Tinckler, M.D., Ch. M., F.R.C.S., D.T.M. & H.

(Professor of Surgery, University of Singapore)

The lower end of the ureter may be defined as its lower third or that portion which lies between the level of the pelvic brim and the junction of the ureter with the bladder. The ureter is an organ that might be described as more sinned against than sinning in that it receives many of its pathological insults second-hand from above and below and from adjacent structures.

Pathology rarely originates in its tissues primarily; neoplasia either as papilloma or transitional cell carcinoma, is rarely encountered, for example, but it is not infrequently involved in tuberculous spread from a focus in the kidney and its junction with the bladder is commonly obstructed by spread of vesical malignant disease; stones may impact at its entrance into the bladder, having descended from their site of origin in the kidney and it is vulnerable to damage during any operative procedure in the pelvis, for example, excision of the rectum, hysterectomy and other gynaecological procedures (Fig. 1).



Fig. 1. The uterine artery is closely related to the lower end of the ureter which it crosses en route to its distribution.

The lower end of the ureter is distinguished by playing an important role in protecting the upper urinary tract from the effects of back pressure from the bladder, and also from a practicable viewpoint in being the least acces-

sible part of the ureter. As a whimsical thought, one might say that the ureter merely wants to be left alone in keeping with its humble but essential task of water carrier.

### URETERIC REFLUX

Reflux of urine from the bladder up the ureter is pathological, and only occurs when the urinary tract is abnormal. The evidence for this statement is largely negative in that of 243 healthy volunteers examined, no ureteric reflux was demonstrable. Incidentally, these volunteers were all either children or convicted criminals! (Johnson 1962).

It is apparent that there is a normal mechanism for preventing ureteric reflux, and its purpose is obvious in that it prevents the transmission of back pressure from the bladder to the renal pelvis and parenchyma. Young (1897) demonstrated that it was possible to distend the post-mortem bladder to the point of bursting without producing reflux. The functional integrity of the vesico-ureteric junction is dependent upon the oblique course of the intramural portion of the ureter through the bladder wall, producing a flap valve mechanism; increasing distension of the bladder and rising intra-vesical tension during micturition, causes the anterior and posterior walls of the intramural portion of the ureter to approximate and thereby obliterate the lumen. At the same time, trigonal muscle fibres leading from the distal end of the ureter to the bladder neck (muscle of Bell) draws the orifice of the ureter downwards tending to increase the obliquity of its course as detrusor contraction takes place.

Clinically, ureteric reflux is found to be associated with enuresis, congenital infra-vesical obstructions such as urethral valves and bladder neck contracture, neurogenic bladder, the so-called idiopathic megaureter (Williams, 1958) and urinary tract infections. With regard to the latter, infection and oedema of the bladder wall, in particular affecting the intramural part of the ureter, is considered to make that portion

\* A Paper given to the Monthly Combined Surgico-Pathological Conference on 27th July, 1965.

of the ureter relatively rigid preventing approximation of its walls and thereby interfering with its flap valve function.

Persistence of ureteric reflux sooner or later is associated with urinary tract infection of which pyelonephritis is the most damaging and which resists attempts at sterilization while ureteric reflux remains. Rosenheim (1963) has shown that ureteric reflux leads to chronic pyelonephritis with progressive injury and scarring of the kidneys and the onset of renal hypertension. It is evident that ureteric reflux should be corrected whenever it is encountered by the removal of the cause if that is diagnosable, for example, by excision of ureteral valves or resection of the bladder neck or in those cases in which the reflux is regarded as idiopathic and a primary failure of the uretero-vesical valve mechanism, then the reconstruction of the uretero-vesical junction by uretero-vesicoplasty of which there are several different versions, requires to be carried out. Mr. Herbert Johnson (1962) has described his experiences of the various uretero-vesicoplasties in a Hunterian Lecture.

Ureteric reflux is best demonstrated by urethro-cystography which entails catheterization of the bladder, the instillation of radio-opaque dye and radiological observation of dye reflux up one or both ureters on filling the bladder or when the subject subsequently micturates during the taking of a micturating cysto-urethrogram. In such cases, the bladder may be shown to be trabeculated, the ureter dilated and tortuous, the kidney hydronephrotic with some degree of irregularity and decrease in depth of the renal substance (Fig. 2). Reflux may also be demonstrated by radio-isotope cystography and cinefluoroscopy, using an image intensifier. Control of infection by administration of urinary antiseptics is a necessary adjuvant to surgery, and in those patients in whom marked damage to the urinary tract and function has already occurred, urinary diversion by means of a bilateral uretero-ileostomy is life saving (Figs. 3 & 4).

#### VULNERABILITY OF LOWER END OF URETER

The ureter in its intra-pelvic course is susceptible to damage by spread of pathology from such adjacent organs as the bladder, the rectum, the uterine cervix, and may be damaged and

strictured inadvertently by radiotherapy administered for carcinoma of the cervix in particular, and also may be accidentally damaged during the course of any intra-pelvic operation. A typical circumstance may be recounted as follows.

#### CASE REPORT

A difficult total hysterectomy had been carried out. The patient had some lower abdominal discomfort and was pyrexial during the post-operative convalescence and some 3 weeks later, complained of the passage of fluid down the vagina with constant wetting. The suspicion of a urinary fistula into the vagina was confirmed on investigation and was considered to be due to operative damage to the lower end of the left ureter with the subsequent development of a



Fig. 2. Urethro-cystogram showing bilateral ureteric reflux which is more advanced on the left side.

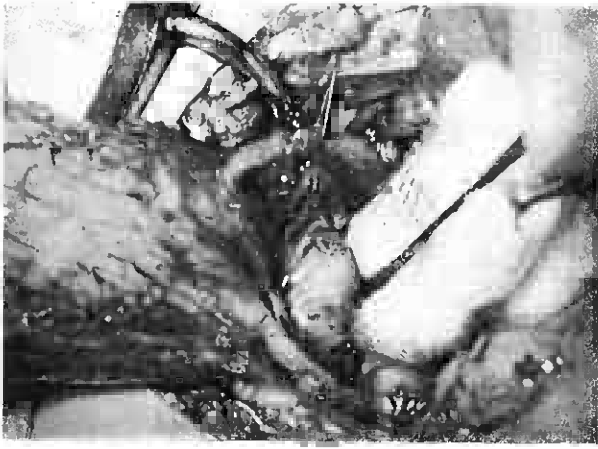


Fig. 3. Ureter vesical junction exposed extraperitoneally.



Fig. 4. Transvesical view of the ureteric orifices in their new position.

uretero-vaginal fistula. Intravenous pyelography showed reduced function and hydronephrosis of the left kidney. (Fig. 5)

Cystoscopy was carried out; an attempted retrograde catheterization of the left ureter failed because of an obstruction encountered just proximal to the intramural portion of the ureter (Fig. 6). The presence of a traumatic ureteric-stricture was confirmed. The ureter was explored surgically and found to be dilated in its upper two-thirds with its intra-pelvic portion bound fast in adhesions and recent scar tissue and too damaged to be salvagable. A Boari's procedure was performed in which a full thickness flap of the bladder wall was mobilised on a pedicle of the superior vesical vessels and tubed by appropriate suturing (Figs. 7 & 8). In this way, a new lower end of the ureter was created from the bladder and anastomosed to the proximal healthy portion of the ureter after transecting it from its damaged lower end which was abandoned (Figs. 9 & 10). Satisfactory drainage of

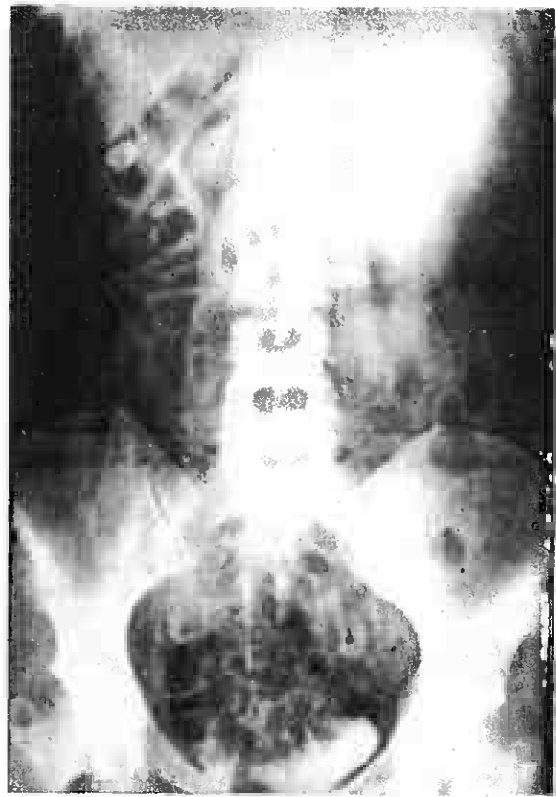


Fig. 5. The function of the left kidney was impaired.



Fig. 6. Obstruction encountered on catheterisation of left ureter.

the kidney and restoration of renal function was obtained (Figs. 11, 12 & 13).



Fig. 7. Tongue of bladder mobilised based on superior vesical arterial pedicle.



Fig. 10. Proximal end of ureter anastomosed to the bladder tube.



Fig. 8. The tongue of bladder is 'tubed' by suturing.



Fig. 11. The completed uretero-neo-cystotomy.



Fig. 9. The ureter is divided and its damaged distal portion abandoned.



Fig. 12. Return of good function to the left kidney.

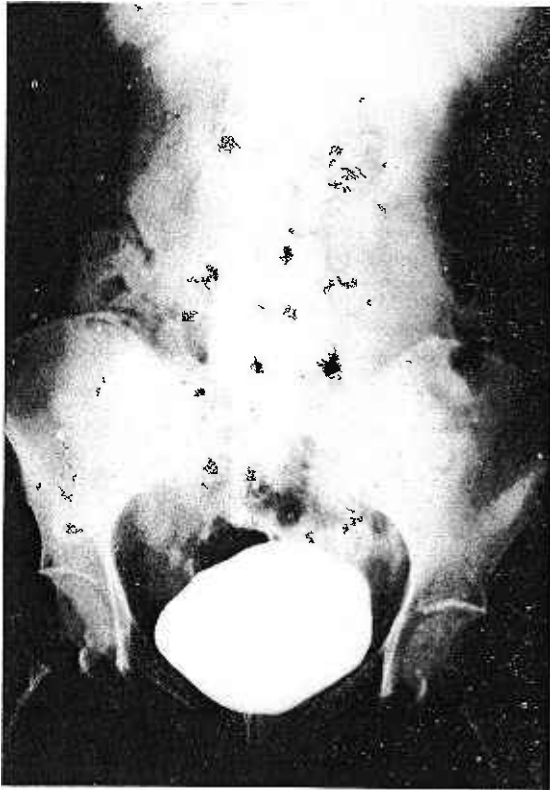


Fig. 13. Post-operative cystogram demonstrating absence of ureteric reflux.



Fig. 14. Operative retrograde pyelogram showing the outline of the damaged right kidney which was considered worthwhile salvaging.

**TUBERCULOSIS OF THE URETER**

Spread of tuberculous infection from foci in the kidney may affect the ureter in toto throughout its length or discreetly at its lower end. Control and sterilization of these tuberculous lesions can nowadays be efficiently and almost invariably achieved by the exhibition of anti-tuberculous drugs. Unfortunately, however, the healing process taking place by fibroplasia and subsequent contraction of the maturing collagen tissue may cause stricture formation resulting in obstruction when a narrow lumen such as that of the ureter is affected. The urinary tract, thus saved from the damaging effect of a progressing tuberculous infection, may now continue to be damaged by the effects of obstruction consequent upon healing, in which event obstructive nephropathy must be avoided by operative intervention at the site of stricture.

**CASE REPORT**

A young Chinese woman being treated for pulmonary tuberculosis was found to have tubercle bacilli in the urine and urological investigations revealed involvement of the right kidney which was hydronephrotic. Attempted retrograde pyelography demonstrated an obs-

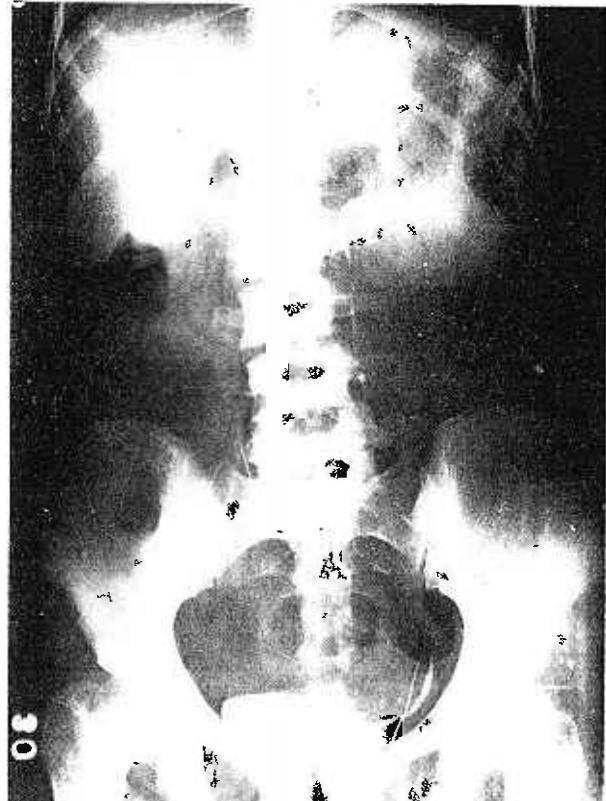


Fig. 15. Renal function on the right side subsequent to a reconstruction of lower end of the ureter.

trusion at the lower end of the ureter. The ureter was explored at operation and a retrograde radiographic study was made of the right kidney by intubation of the exposed ureter on the table (Fig. 14). The kidney was considered worthwhile conserving in the belief that with the relief of obstruction, anti-tuberculous drug treatment would be enabled to sterilize the urinary tract. A Boari's procedure was carried out as it was not found possible to excise the involved portion and leave sufficient ureter proximally to bring down to the bladder for direct implantation. Subsequent renal function was shown on I.V.P. as illustrated in (Fig. 15).

### URETERIC STONE

It has been well said that "It is the smallest dogs that make the most noise", and the same may often be said of stones passing down the ureter. This point is illustrated by the following case history.

### CASE REPORT

A man in his middle forties, previously in a good state of health, experienced attacks of pain in his left loin and flank characteristic of renal colic. Radiology showed no stone shadow as might have been anticipated by the mode of presentation, but there was opacification of the renal parenchyma on the left side giving a so-called nephrogram effect which was consistent with some obstruction to drainage from the kidney (Fig. 16). His symptoms were of short duration and disappeared spontaneously. He continued to be symptom-free for about 8 months when he had a further attack of pain of similar character, following which an intravenous pyelogram showed no function in the left kidney. An attempt at cystoscopy to carry out a retrograde pyelogram failed because of inability to pass a ureteric catheter beyond the intramural portion of the left ureter.

The intra-pelvic portion of the ureter was explored surgically and no obvious cause of the obstruction found on palpation. On opening the ureter, it was found that a bougie passed easily down its lumen into the bladder. The cause of the obstruction encountered on attempted retrograde pyelography and the cause of the patient's symptoms and obstructive nephropathy remained a mystery until on opening the bladder, a small rough oxalate stone was found and which had apparently been displaced from the intramural portion of the ureter by the exploring

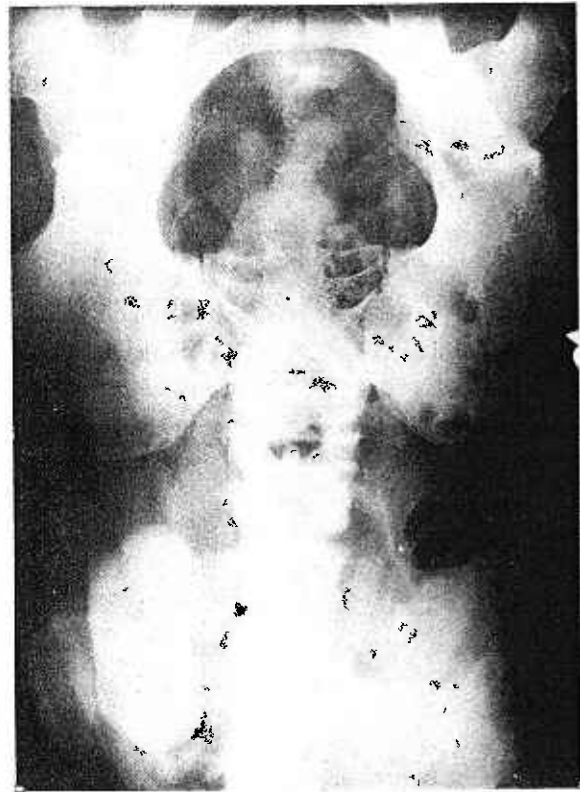


Fig. 16. Intra-venous pyelogram showing nephrogram effect (left kidney).

bougie passed through the uretectomy. This tiny stone (Fig. 17) had been responsible for more disturbance in the way of producing symptoms and jeopardising renal function out of all proportion to its size. Its failure to pass spontaneously over a period of 8 months was doubtless due to its rough surface engaging the lining of the ureter, causing inflammation and oedema of the ureteric wall with virtual complete obliteration of its lumen.

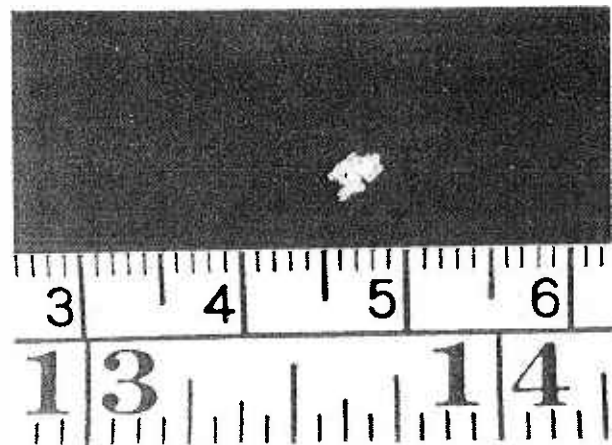


Fig. 17. "Little dogs bark loudest".

## SUMMARY

Surgical aspects of the lower end of the ureter are discussed including vulnerability to accidental operative trauma, tuberculous stricture formation, stone impaction and its role in preventing reflux from the bladder.

## REFERENCES

1. Johnson, H. (1962): "Vesico-ureteric Reflex: Its Anatomical Mechanism, Causation, Effects and Treatment in the Child", *Ann. Roy. Coll. Surg.*, 30, 324.
  2. Rosenheim, M.L. (1963): "Problems of Chronic Pyelonephritis", *Brit. Med. J.*, 1, 1,433.
  3. Williams, D.I. (1958): "Urology in Childhood", Heidelberg, Springer.
  4. Young, H.H. (1897): "Mechanism of Micturition", *Maryland Med. J.*, 38, 45.
-