

## Clinics in Diagnostic Imaging (54)

SY Fong, S K H Yip, K H Tay



**Fig. 1** Frontal radiograph of the abdomen and pelvis.



**Fig. 2** Initial cystography performed through the indwelling suprapubic catheter.

### CASE PRESENTATION

A 29-year-old man was admitted in a critical condition after being knocked down and run over by a fire-engine. He had left hip pain, a lower abdominal wall haematoma, and de-gloving injury to his scrotum. The prostate was not palpable on rectal examination. Radiograph of the abdomen and pelvis was taken (Fig. 1). A diagnostic peritoneal lavage was positive. An emergency laparotomy was performed as he lapsed into hypovolaemic shock. A large non-expanding retroperitoneal and pelvic

haematoma found during operation was left alone and the scrotal laceration was repaired. A suprapubic cystostomy catheter was inserted.

Angiographic embolisation of both internal iliac arteries was performed the next day in view of persistent hypotension. At the same time, an expanding haematoma involving the penis and scrotum, as well as bleeding from his urethral meatus were noted. An antegrade cystography via the suprapubic cystostomy catheter (Fig. 2) was performed. What is the diagnosis?

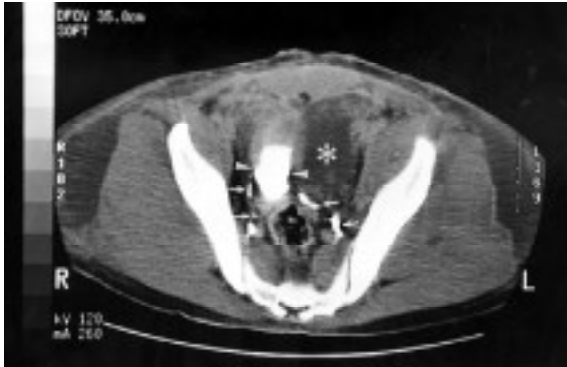
Department of  
Urology  
Singapore General  
Hospital  
Outram Road  
Singapore 169608

S Y Fong, MBBS,  
FRCSE  
Medical Officer

S K H Yip, MBBS,  
FRCSE, FHKAM,  
FAMS  
Associate Consultant

Department of  
Diagnostic  
Radiology  
K H Tay, MBBS,  
FRCR  
Registrar

Correspondence to  
S K H Yip  
Tel: (65) 321 4693  
Fax: (65) 227 3787  
Email: gurykh@  
sgh.gov.sg



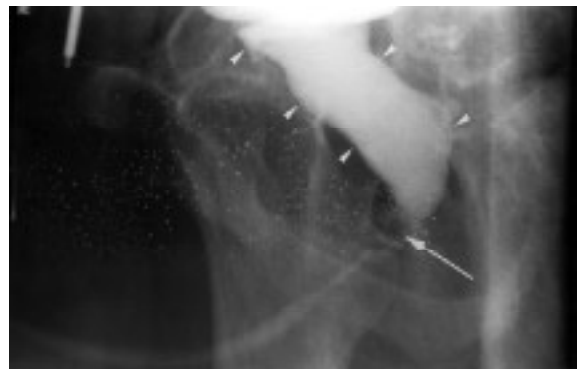
**Fig. 3a** Post-cystography CT scan taken at the level of the iliac crest shows displacement of the contrast-filled bladder (arrowheads) cranially and to the right upper pelvis by a large pelvis haematoma (asterisk). Several embolisation coils are noted within the internal iliac arterial branches (small arrows).



**Fig. 3b** Post-cystography CT scan taken at the level of the hip joints show extraperitoneal leakage of contrast (arrowheads) from the posterior urethra. The pelvic haematoma (asterisk) and bilateral superior rami fractures (long arrows) are present.



**Fig. 3c** Post-cystography CT scan taken at the level of the ischial tuberosities. Extension of extravasated contrast from the urethra into the perineum (arrowheads) and left medial thigh muscles (small arrows) is demonstrated. Note the left superior pubic ramus fracture.



**Fig. 4** Micturating cystourethrography (pre-urethroplasty) shows a large false passage (arrowheads) and a stricture of the membranous urethra (long arrow).

### IMAGE INTERPRETATION

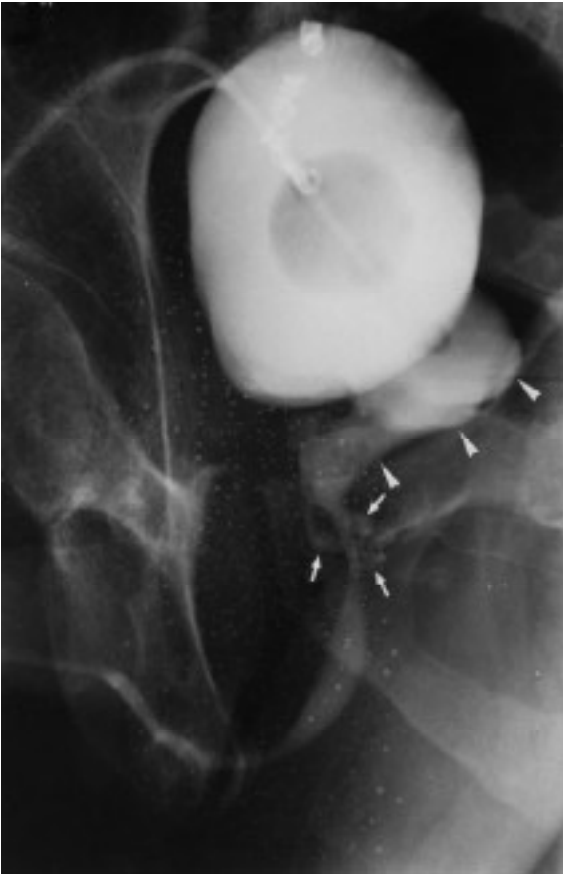
The abdomino-pelvic radiograph showed an unstable pelvic fracture involving the left iliac wing, and both superior and inferior left pubic rami, typical of the Malgaigne-type fracture (Fig. 1). The cystography performed via the suprapubic catheter (Fig. 2) revealed that the bladder was compressed and displaced superiorly and to the right (a “pie-in-the-sky” bladder). There was marked extravasation of contrast from the level of the posterior urethra into the extraperitoneal space. This extended inferiorly into the ischio-rectal and scrotal regions. No intraperitoneal contrast leakage was detected. Multiple steel coils from the recently-performed bilateral internal iliac artery embolisation were also seen. The cystographic findings were confirmed on computed tomography (CT) scans of the pelvis. The large pelvic haematoma, extent and site of contrast leakage from the posterior urethra, and pubic rami fractures were well-delineated (Figs. 3A-C).

### DIAGNOSIS

Malgaigne-type pelvic fracture with complete urethral rupture

### CLINICAL COURSE

The patient was subsequently stabilised haemodynamically. He was transferred one month later to a rehabilitation centre with the suprapubic catheter in-situ. Six months after his initial injury, micturating cystourethrography via the suprapubic cystostomy catheter showed incomplete emptying of the bladder with a large residual urine volume and bilateral vesico-ureteric reflux. A widened tube-like passageway could be seen between the posterior urethra and the bladder neck, with a short stricture of the membranous urethra just distal to it (Fig. 4). This was confirmed during surgical exploration when an epithelised false passage leading from the bladder neck to the strictured membranous urethra was found. The original bladder neck was now a blind-ending pouch, and the prostate gland was atrophied and fibrosed. The urethral stricture was excised and reconstruction of the posterior urethra was performed using a tubularised anterior bladder wall flap. Postoperative micturating cystourethrography showed free passage of contrast down the urethra without any intravesical retention (Fig. 5). A small, localised contrast leak which was present at the posterior urethra was treated



**Fig. 5** Micturating cystourethrography (post-urethroplasty) shows passage of contrast through the reconstructed posterior urethra (arrowheads). A small area of leakage (small arrows) is present.

conservatively. One year after his surgery, despite the problem of erectile dysfunction, he had made great improvement in his rehabilitation, especially with regards to urinary continence.

## DISCUSSION

Almost all injuries of the posterior urethra in male patients occur in conjunction with fractures of the bony pelvis. In modern society, 90% of these injuries are caused by motor vehicle accidents (68-84%) or falls from a height (6-25%)<sup>(1)</sup>. However, not all pelvic fractures produce posterior urethral injury. Two large reviews of 2419 cases of pelvic fractures indicated that the posterior urethra was injured in about 10% of all males<sup>(2,3)</sup>. This incidence has not changed much in the more recent studies.

The unstable pelvic fracture, caused by a vertical shearing force, is associated with a relatively high rate of morbidity and mortality. 21% of patients who sustain a fatal injury in a motor vehicle accident have a Malgaigne pelvic fracture<sup>(4)</sup>. The Malgaigne fracture runs anteriorly through the ischiopubic rami or symphysis pubis, and is associated with massive posterior disruption through the sacrum, ipsilateral

sacroiliac joint or ilium. The high magnitude of injury force ensures that the Malgaigne fracture is the predominant fracture type associated with urethral injury<sup>(5)</sup>. In a prospective study of 203 consecutive men with pelvic fractures, the involvement of the posterior pelvic arch was found to considerably increase the risk of urethral injury in ipsilateral pubic rami fractures from an odds ratio of 0.76 to 3.40<sup>(6)</sup>.

Urethral rupture due to pelvic fractures is most commonly caused by the shearing force associated with pelvic bone disruption. The prostate (attached by the puboprostatic ligaments) is pulled in one direction while the membranous urethra is pulled in another direction. This causes dislocation of the frail, unsupported prostato-membranous urethral junction. The pelvic haematoma which results from disruption of the periprostatic venous plexus frequently displaces the prostate and bladder cranially. This causes the bladder to ride high out of the pelvis, producing the "pie-in-the-sky" bladder. If the perineal membrane is disrupted, as in this case, the distal end of the urethra may retract into the perineum. This results in extravasation not only into the pelvis, but also into the perineum, scrotum (via the inguinal canal), thigh (via the obturator foramen), the anterior abdominal wall, or retroperitoneally up to renal level.

Besides perineal and digital rectal examination, urethral bleeding and gross haematuria in a patient with pelvic fractures are the best indicators of urethral injury, with a detection rate of 91-100%<sup>(7)</sup>. However, total transection of the urethra may result in little bleeding, and the patient's inability to void may occur from pain or shock from the fractured pelvis. Diagnosis therefore relies on a high index of suspicion in the presence of pelvic fractures. Retrograde urethrography remains the gold standard in the diagnosis of posterior urethral injury. This technique is nearly 100% accurate, if performed correctly. However, some desperately ill patients who may have urethral injuries must be taken directly to the operating room for emergency laparotomy prior to imaging. Under such circumstances, the patient must not be catheterised per urethra in order to avoid further damage. Instead, a suprapubic cystostomy catheter can be inserted through the dome of the bladder for drainage at the time of the surgery. The lower urinary tract may then be studied radiologically in the postoperative period and the appropriate therapy instituted.

Spiral CT scan of the abdomen and pelvis has become an increasingly valuable first-line imaging modality in the trauma setting. It has the ability to rapidly image the head, entire abdomen and pelvis in a short period of time, minimising potentially

valuable time spent in the CT suite. However, when compared to cysto-urethrographic studies, Kane et al showed that CT is sensitive in the detection of bladder injuries, but only detected one out of three posterior urethral injuries<sup>(8)</sup>. Haas et al, on the other hand, reported that spiral CT only diagnosed 9 out of 15 bladder ruptures (60%), and 6 out of 11 extraperitoneal ruptures (55%), further casting doubt on the reliability of CT in the initial evaluation of lower urinary tract injuries<sup>(9)</sup>.

Of all injuries to the urinary tract, the most debilitating are those affecting the posterior urethra. If not managed properly, this injury may lead to lifelong deleterious consequences impairing the voiding ability, maintenance of urinary continence, and the capacity to reproduce<sup>(10)</sup>. The continuing unresolved debate on its initial treatment revolves around the vulnerability of patients to these late complications, which may occur as a direct consequence of injury, or because of the initial treatment. Of the three conventional treatment methods, primary suturing of the disrupted urethral ends has the greatest complication rates of incontinence (21%) and impotence (56%). Primary realignment (whether open or endoscopic) has a higher incidence of impotence (36%) but lower incidence of stricture formation (53%), compared to suprapubic cystostomy and delayed repair (19% and 97%, respectively)<sup>(11)</sup>. In this patient, the stricture was successfully treated by delayed repair. The continence mechanism was preserved after reconstruction of the bladder neck mechanism. We intend to initiate intracorporeal injection therapy for the patient's impotence, but he will probably require assisted reproductive technique in the future.

## REFERENCES

1. Antoci SP, Schiff MJ. Bladder and urethral injuries in patients with pelvic fractures. *J Urol* 1982; 128:25-6.
2. Levine JJ, Crampton RS. Major abdominal injuries associated with pelvic fractures. *Surg Gynecol Obst* 1963; 1 16:223-5.
3. Wilkinson FOW. Rupture of the posterior urethra. *Lancet* 1961; 1:1125-7.
4. Kricun ME. Fractures of the pelvis. *Orthop Clin North Am* 1990; 21:573-90.
5. Lowe MA, Mason JT, Luna GK, et al. Risk factors for urethral injuries in men with traumatic pelvic fractures. *J Urol* 1988; 140:506-7.
6. Koraitim MM, Marzouk ME, Atta MA, Orabi SS. Risk factors and mechanism of urethral injury in pelvic fractures. *Br J Urol* 1996; 71:876-80.
7. Fallon B, Wendt JC, Hawtrey CE. Urological injury and assessment in patients with fractured pelvis. *J Urol* 1984; 131:712-4.
8. Kane NM, Francis IR, Ellis JH. The value of CT in the detection of bladder and posterior urethral injuries. *AJR* 1989; 153:1243-6.
9. Haas CA, Brown SL, Spimak JP. Limitations of routine spiral computerized tomography in the evaluation of bladder trauma. *J Urol* 1999; 162:51-2.
10. Trafford HS. Traumatic rupture of the posterior urethra. *Br J Urol* 1955; 27:165-6.
11. Koraitim MM. Pelvic fracture urethral injuries: the unresolved controversy. *J Urol* 1999; 161:1433-41.

## ABSTRACT

**A 29-year-old man sustained a pelvic fracture and haemorrhagic shock after a road traffic accident. He underwent an exploratory laparotomy open cystostomy, and iliac artery embolisation. Subsequent antegrade cystography and computed tomography showed a complete traumatic posterior urethral rupture with a "high riding" bladder. Delayed repair of the posterior urethra was performed 6 months later with good functional outcome. The risk of urethral injury in pelvic fractures, the mechanism of injury, and the role of imaging in the diagnosis of possible urethral injury in pelvic fractures are discussed.**

**Keywords: urethral rupture, pelvic fracture, urethrography, cystography**

*Singapore Med J* 2000 Vol 41(10):511-514