CASE REPORT

Microbubble-enhanced ultrasound to demonstrate urethral transection in a case of penile fracture

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SUMMARY

A 47-year-old man attended the emergency department following trauma during sexual intercourse after which he developed penile swelling and haematuria several hours later. A penile fracture was suspected but given the slightly atypical history, ultrasound was performed to look for a fracture. Given the history of haematuria, both a standard Doppler ultrasound and a microbubble-enhanced retrograde ultrasound urethrogram were performed. The Doppler confirmed the suspected diagnosis of penile fracture, and microbubble urethrogram demonstrated a urethral injury. This facilitated prompt surgical treatment and helped guide the surgical approach. Retrograde microbubble enhanced ultrasound urethrogram is a novel technique that can be used in conjunction with standard ultrasound to confirm the presence of a concurrent urethral rupture in penile fracture.

BACKGROUND

Penile fracture is an uncommon urological emergency. Failure to recognise and treat can lead to long-term morbidity with erectile dysfunction.¹ Concurrent urethral rupture occurs in 10%–20%^{2,3} and can complicate the management of penile fracture, with a potential increased risk of urethral stricture and urethra-cavernosal fistula.²

Clinical assessment of the penis, along with a classical history, normally confirms the diagnosis. Typically, surgery is carried out on clinical grounds however when urethral injury is suspected or there is an atypical history, a retrograde urethrogram under fluoroscopy is recommended.^{1,4}

Ultrasound has an important role in the assessment of penile fracture when there is either gross deformity making clinical assessment of the site of fracture difficult or an atypical history. Ultrasound has the advantage of allowing the site of tunical disruption to be marked on the skin^{5–8} which guides the surgical approach.⁵

Ultrasound urethrography with microbubbles has not been previously described in cases of penile fracture, and in this case allowed accurate diagnosis of urethral injury without the need for ionising radiation.

CASE PRESENTATION

A 47-year-old man, previously fit and well, presented with penile pain and swelling 12 hours after experiencing a snapping sensation in his penis during sexual intercourse with his female partner.

The history was atypical as he was able to continue with intercourse and did not have immediate detumescence. The next day, he developed scrotal and penile bruising, haematuria and dysuria raising the suspicion of a penile fracture with concurrent urethral injury.

Clinical examination was difficult as the penis was grossly swollen and boggy to palpation.

INVESTIGATIONS

After clinical examination by a urology surgeon, an ultrasound was performed to confirm the diagnosis of penile fracture.

B-mode ultrasound demonstrated a large 2×3 cm defect in the ventral tunica of the right corpus cavernosum with a possible left cavernosal injury at the penoscrotal junction. There was an adjacent fluid collection that tracked along the shaft of the penis between the corpus spongiosum and cavernosal (figure 1).

Given the presence of this fluid and the high clinical suspicion of a concurrent urethral injury, a contrast enhanced ultrasound urethrogram was carried out: a 5fr catheter was placed in the meatus and 10mL of dilute microbubbles (SonoVue, Bracco, Milan) were injected gently into the urethra.

Concurrent B-mode and cadence view imaging clearly demonstrated the normal contour of the penile urethra with a clear linear extravasation of bubbles arising at the junction of the bulbar and proximal penile urethra. The microbubbles were seen flowing into the fluid collection confirming the fluid to be urine and the presence and site of the urethral injury (figures 2 and 3).

The position of the cavernosal and spongiosal injuries were marked on the skin and the patient was transferred directly for surgical repair.

TREATMENT

The ultrasound localisation helped inform the surgical approach and a limited vertical incision was made distal to the penoscrotal junction, as opposed to the usual approach of a transverse subcoronal incision and degloving of the shaft.

On surgically inspected bilateral corpora cavernosa, tunical defects were confirmed with a large right-sided haematoma. The urethra was dissected from the corpus spongiosum and a transverse tear was identified in the dorsal, right side, which was demonstrated fully by instilling sterile gel through the meatus.

A Foley catheter was inserted under direct visualisation, past the urethral defect, into the bladder.

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Figure 1A-C B mode ultrasound images at the penoscrotal junction. (a) Longitudinal section demonstrating a 7.3 mm defect in the tunica of the right corpus cavernosum (between yellow calipers). (b) The same lesion in the RCC seen in axial section (asterisk) is demonstrated by a discontinuity in the tunica, the white line indicated by the white arrow. CS labelled with a surrounding rim of abnormal fluid. (c) Axial section of the penis at a slightly more proximal position with the defect in the LCC tunica labelled (black asterisk). CS, corpus spongiosum; LCC, left corpus cavernosum; RCC, right corpus cavernosum.

The urethral defect was then closed with monocril and the corporal tunical defects closed with buried polydioxanone (PDS).

OUTCOME AND FOLLOW-UP

A follow-up pericatheter urethrogram at 14 days demonstrated complete healing of the urethra and the catheter was removed.

DISCUSSION

Penile fracture with urethral injury is an uncommon subtype of a rare urological emergency.

During an erection, the fascia of the erectile bodies (tunica albuginea) is stretched thinly and with a sudden torque during vigorous sexual intercourse this fascia can rupture.

Confirmation of concurrent urethral injury is imperative and is normally performed with a retrograde contrast urethrogram under fluoroscopy.

Ultrasound does not require any ionising radiation or lengthy MRI scans. It gives excellent resolution of soft tissues which allows assessment of the penile tissues and localisation of tunical rupture.⁹

Figure 2 Three pairs of axial ultrasound images taken at the same level as figure 1 before microbubble injection (top row), 5 s (middle row) and 30 s after injection (bottom row). Left-hand column is cadence imaging (sensitive to microbubbles, which show up as gold/white). Right-hand column is b-mode imaging (grey scale imaging for localisation). T=0 Top row. Control cadence image. B-mode image shows CS surrounded by fluid (indicated by white arrows). T=5 s middle row. Both images shows urethra (red arrow) and fluid leaking out (white arrows). T=30 s bottom row. Microbubbles can be seen spreading throughout the fluid surrounding the CS (white arrows) confirming the presence of urethral leak. CS, corpus spongiosum.

Sonourethrography uses ultrasound to assess for urethral strictures or intraluminal lesions by distending the urethra with saline or sterile jelly.¹⁰ It has an advantage over conventional retrograde contrast urethrography as it has increased accuracy in the assessment of urethral stricture, gives information about

Figure 3 Longitudinal ultrasound cadence images of the urethra with microbubbles instilled (serial images are stitched) taken at 30 s after injection. The location of the leak is clearly visible (red arrow).

the surrounding penile soft tissues and precludes the need for ionising radiation exposure to the testicles.¹¹ Sonourethrography has been described in the assessment of urethral injury^{12 13} but the technique requires clamping/occluding the meatus with a clamp/balloon which would not have been possible in this case given the degree of pain and deformity of the penis.

Ultrasound contrast consists of tiny inert microbubbles in a saline solution that can be injected either intravenously or directly into a body cavity such as the urethra during an ultrasound. The bubbles scatter ultrasound waves which results in a stronger echo of the reflected waves, improving the contrast between different soft tissues.¹⁴

Contrast enhanced ultrasound (CEUS) is routinely used in the characterisation of liver lesions and has a growing role in the investigation of kidney perfusion lesions.¹⁵

In a single case report, intravenous microbubbles were used in the demonstration of penile laceration and haematoma in penile trauma.¹⁶ Microbubbles injected directly into the penile soft tissues have been used to demonstrate corporal anatomy in patients with complete corporeal septation, a rare malformation of the penis.¹⁷

CEUS with microbubbles injected into the urethra and bladder have been shown to be a specific and sensitive modality for assessing vesicoureteric reflux¹⁸ and more sensitive than conventional fluoroscopic cystourethrography.¹⁹

Further studies have shown the safety and efficacy of CEUS in the assessment of anastomotic leak in prostatectomy patients,^{20 21} and Berlototto suggests retrograde sonourethrography with microbubbles may be a sensitive technique to evaluate urethral injury.²²

In this case, ultrasound confirmed the presence of tunical rupture and allowed localisation of the injury with marking of the skin. Furthermore, with the addition of a microbubble retrograde urethrogram, the suspected urethral injury was confirmed and the position of the tear localised. This technique removed the need for a retrograde urethrogram hence saving exposure to ionising radiation and guided the urologists with their surgical approach.

Learning points

- Ultrasound is a useful test to confirm penile fracture and localise the site(s) of injury.
- Microbubble contrast enhanced retrograde ultrasound urethrogram can be performed simultaneously and can confirm the presence of a concurrent urethral injury.
- Characterising and localising the injury can inform the surgical approach.

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