



Case report

Delay in diagnosis of urethral perforation due to catheterisation in a person with cervical spinal cord injury. Importance of (1) imaging studies done promptly for detection and documentation of urethral trauma, (2) Urethrotech catheterisation device to minimise urethral trauma and achieve successful catheterisation: A case report

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ABSTRACT

Introduction and importance: Spinal cord injury patients are at risk for urethral trauma during catheterisation. We report a patient in whom urethral perforation due to catheterisation was not recognised for ~ four days.

Case presentation: Following a routine catheter change by community nurses in a male person with tetraplegia, the catheter drained only a small amount of urine. Therefore, the patient attended the hospital where the staff removed the catheter but could not place a new catheter. The doctor tried different catheters and on fifth attempt, inserted a catheter. The patient continued to bypass urine and was prescribed Solifenacin. On self-referral to spinal unit, urethral trauma was suspected. CT of pelvis revealed the balloon of the Foley catheter in the penile urethra at penis base with the tip projecting beyond the penile shaft. Suprapubic cystostomy was done. The patient continued to leak urine from the penis; required penile sheath drainage and an additional leg bag.

Clinical discussion: This case illustrates the value of CT of pelvis including the penis in detecting urethral trauma and misplacement of the catheter. Physicians should look for symptoms and signs of urethral trauma and incorrect positioning of the catheter. Imaging studies should be done without delay to assess urethral trauma and misplacement of urinary catheter.

Conclusion: We use Urethrotech urethral catheterisation in patients in whom the first attempt to insert a catheter per urethra is unsuccessful, or in patients with a history of difficult catheterisation. This helped to minimise urethral trauma and achieve successful catheterisation.

1. Introduction

Persons with spinal cord injury are at risk for developing urethral trauma during urethral catheterisation. The common complications of urethral catheterisation are bleeding per urethra, minor urethral trauma, misplacement of urethral catheter, and rarely, perforation of urethra.

Several techniques for difficult urethral catheterisation have been

described, including the passage of a narrow, reinforced or angled tipped urethral catheter, the blind passage of a guidewire into the bladder or the use of an introducer [1]. A review of different approaches for difficult male urethral catheterisation revealed six main approaches. 1) Passage of either a Glidewire, guide wire or filiform under direct vision; 2) Blind passage of a filiform, guide wire, Glidewire or hydrophilic catheter; 3) “The Peel-away sheath placed on a cystoscope/resectoscope technique”; 4) “The rigid ureteroscope placed inside the 22F Foley

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technique”; 5) Suprapubic catheterization; and 6) “The instillation of 60 cc of saline through the catheter as it is advanced technique” [2]. Nair and associates [1] recommended the technique of introducing an angled open-ended taper tip ureteric catheter per urethra and advancing it until the obstruction is overcome. Aspiration of urine with a syringe would confirm position within the bladder. A ureteric guide wire was threaded through the ureteric catheter and then the ureteric catheter was

withdrawn leaving the guide wire in position. A Foley catheter with its tip removed was rail-roaded over the guide wire. The guide wire is subsequently removed, and the Foley catheter balloon inflated to secure its position.

We report a unique case of a person with cervical spinal cord injury in whom the catheter perforated the penile urethra, and the tip of the catheter was lying beyond the corpus spongiosum for some time, as this

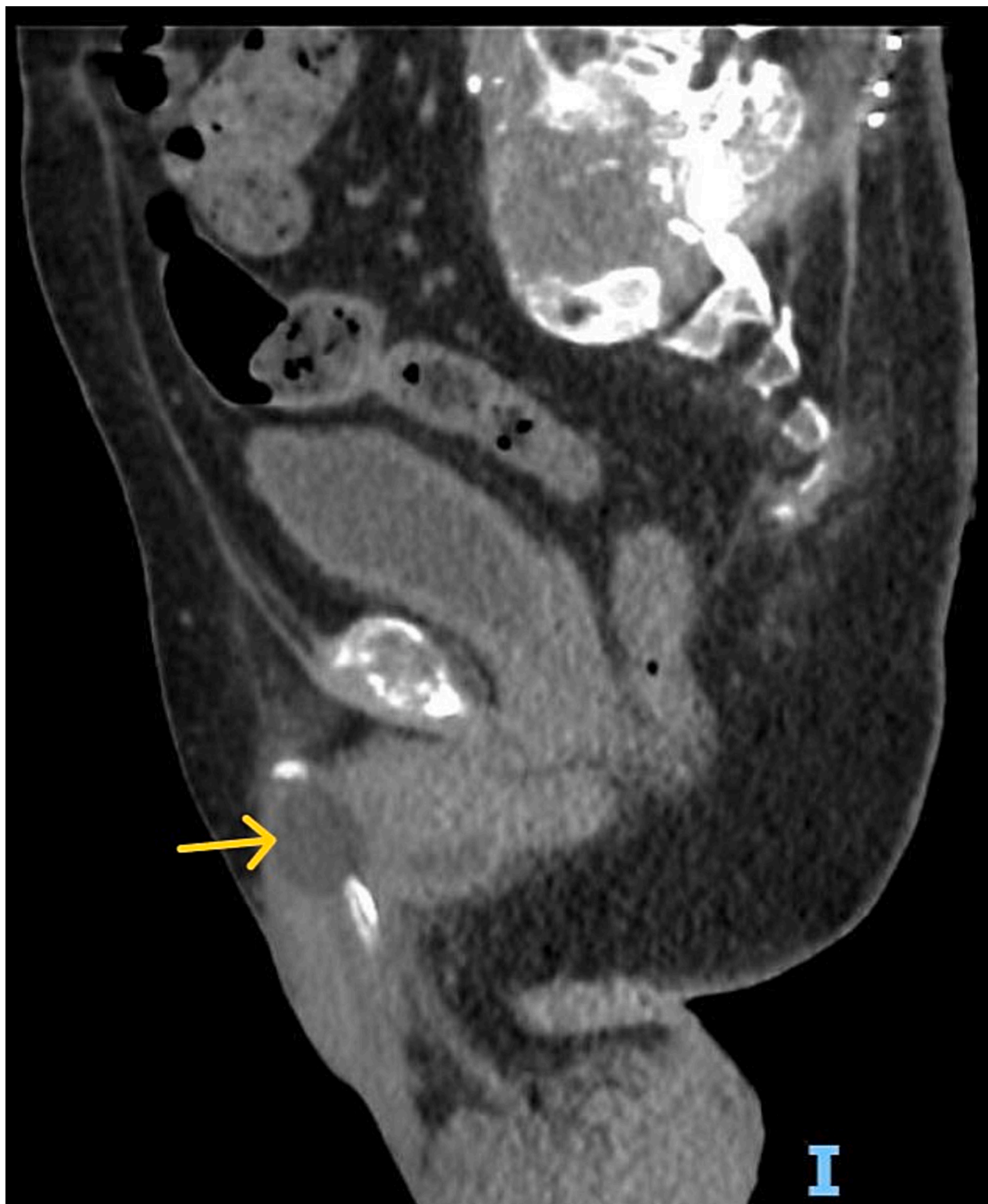


Fig. 1. CT of pelvis (sagittal view) shows the balloon of the Foley catheter inflated in the penile urethra at penis base (arrow).

complication was not recognised by the health professionals for few days. We discuss the value of CT of pelvis including the penile urethra to detect misplacement of the urinary catheter and assess the urethral trauma. We wish to convey the message that physicians should look for symptoms and signs of urethral trauma and incorrect positioning of the urethral catheter in a proactive manner. Imaging studies should be performed without delay to detect misplacement of urinary catheter and assess the extent of urethral trauma due to catheterisation. Prompt diagnosis followed by repositioning of the catheter will help to minimise the long-term sequelae of catheterisation-associated urethral trauma in persons with spinal cord injury. We adhered to SCARE criteria in this case report [3].

2. Case presentation

Community nurses carried out a routine catheter change in a 64-year-old male person with tetraplegia. The new catheter drained only a small amount of urine. The nurse tried to remove the catheter; however, the catheter could not be removed. The patient was taken to the Emergency department of a nearby hospital; the Foley catheter was palpable at the base of the penis. The staff removed the catheter but could not place a new catheter. The Urology doctor tried different catheters and on fifth attempt, inserted a catheter.

The patient was bypassing urine. Four days after insertion of the catheter, the patient was informed that bypassing was due to bladder spasms, and he was given a prescription for Solifenacin, a competitive, specific cholinergic receptor antagonist.

The patient contacted the spinal unit because he continued to experience bypassing of urine. The common causes for leakage of urine around the urethral catheter in spinal cord injury patients are: (i) partial or complete blockage of the catheter, (ii) bladder spasms, (iii) misplacement of the catheter. With the history of difficult catheterisation, we suspected urethral trauma and misplacement of the urethral catheter in this patient. Urgent CT of pelvis including penis was performed. CT of pelvis revealed that the balloon of the Foley catheter was inflated in the penile urethra at penis base (Figs. 1 and 2) with the tip of the Foley catheter projecting beyond the penile shaft which suggested an extraluminal position of the catheter in the corpus spongiosum and

beyond. (Fig. 3) The conclusion was urethral rupture with Foley balloon inflated in the base of penis with rent near the penile shaft base with tip extending into the soft tissue and beyond.

Flexible cystoscopy showed false passages in the urethra. Urgent suprapubic cystostomy was performed. The patient was prescribed Enoxaparin 40 mg subcutaneously as prophylaxis for venous thrombo-embolism 24 h later. The patient continued to pass blood-stained urine. Haematuria became severe after Enoxaparin was prescribed for venous thrombo-embolism prophylaxis. Therefore, five days later, Enoxaparin was stopped.

CT abdomen and pelvis with contrast was performed eight days after suprapubic cystostomy. Pre-contrast and contrast-enhanced scans were obtained. CT showed residual haemorrhage and oedema around the base of the penis (Fig. 4) and clot was seen within the urinary bladder. (Fig. 5) There was no extravasation of contrast during enhancement in this CT. Haematuria subsided gradually. Leakage of urine from the penile urethral meatus persisted. The patient needed a penile sheath and another leg bag as he already had one leg bag connected to the suprapubic catheter.

Swelling of the penis persisted for about five months. (Fig. 6) Ultrasound scan of the penis performed around 24 weeks after suprapubic cystostomy showed venous engorgement of the corpora cavernosa (Fig. 7) and superficial oedema in the penis.

3. Discussion

A scoping review of the literature on the morbidity and mortality associated with urinary catheterization revealed that the most significant catheter complications are severe mechanical trauma (perforation, partial urethral damage) [4]. When Perforation of urethra occurs, patient's relatives may file a complaint [5] or even sue the doctor and the hospital for medical negligence as illustrated by the case of Mick in the District Court of New South Wales [6].

Physicians, who perform or supervise urethral catheterisation in patients with spinal cord injury, should have a high index of suspicion for urethral trauma due to catheterisation. The obvious signs of urethral trauma are bleeding from the urethra and haematuria following urethral catheterisation. Other signs and symptoms include:

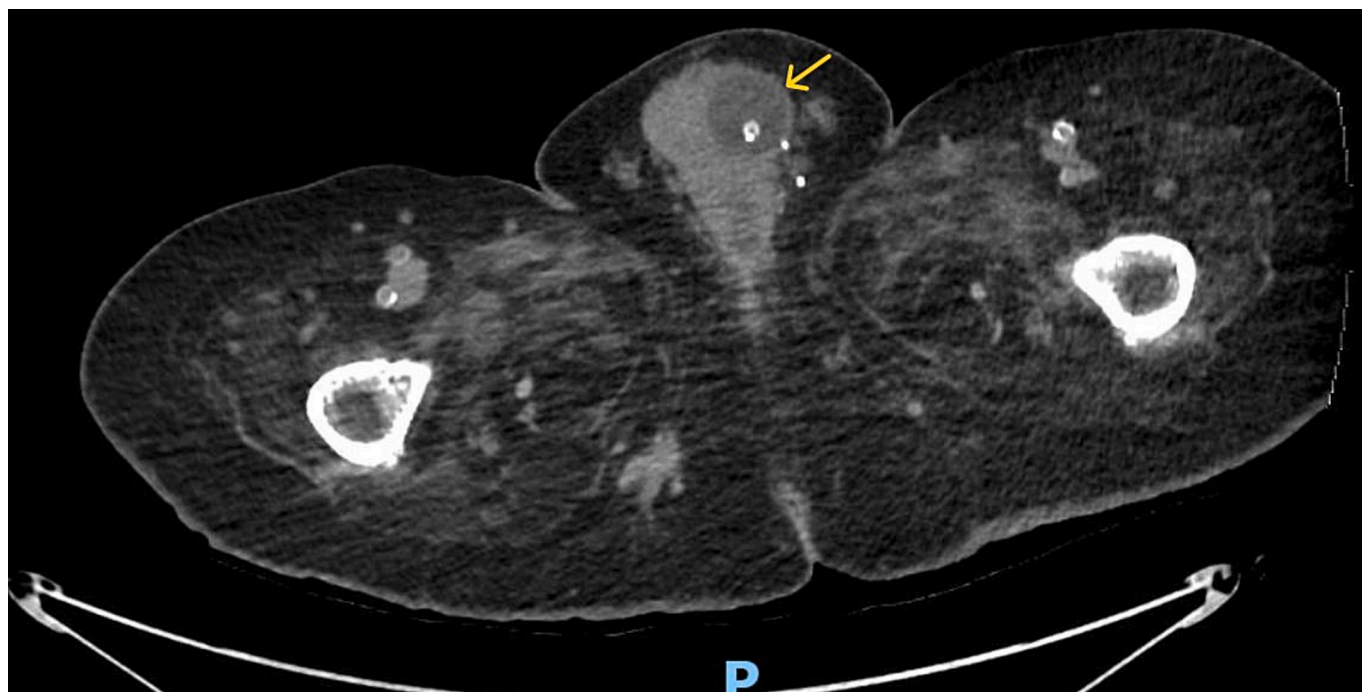


Fig. 2. CT of pelvis (axial view) shows the balloon of the Foley catheter inflated in the urethra at penis base (arrow).



Fig. 3. CT of pelvis (sagittal view) shows the tip of the Foley catheter projecting beyond the penile shaft (arrow).

1. Urine leakage from the penis, minimal or no urine output through the catheter should alert the physician to look for misplacement of the catheter and associated trauma to the urethra.
2. The long catheter sign is a useful aid to suspect misplacement of the catheter in male patients [7]. The long catheter sign refers to one-half or more of the catheter remaining outside the penis.
3. Sometimes, the balloon of Foley catheter may be palpable in the base of the penis or in the perineum.

When urethral trauma and misplacement of the catheter is suspected, CT of pelvis including the penis is valuable in detecting misplacement of the urethral catheter, assessing the extent of urethral trauma, and diagnosing delayed complications of urethral trauma associated with catheterisation. Prompt diagnosis and correct placement of the catheter will reduce the long-term sequelae of urethral trauma and allow the urethral tear to heal.

In the past, simplified cystography [8] or ultrasound scan of the urinary bladder was performed to detect misplacement of the catheter. Leslie and associates [9] prefer simplified cystogram when possible, to an ultrasound scan of the urinary bladder. But we have found that CT of pelvis including the penis which to be an accurate and reliable test to reveal the position of Foley balloon and the tip of the catheter. This

radiological study can be performed rapidly and provides precise information without ambiguity. Sometimes, urethral trauma and misplacement of catheter in a person with spinal cord injury may remain silent. When MRI of pelvis is done for another indication, e.g., assessment of a pressure sore, the radiologist may notice misplacement of the Foley catheter as an unexpected finding. (Figs. 8 and 9) Then the radiologist should notify the attending physician so that the urinary catheter can be repositioned and further damage to the urethra is averted.

4. Prevention of urethral trauma during urethral catheterisation

Urethral perforation caused by urethral catheterisation can lead to potentially catastrophic consequences as illustrated by the case reported by Cullivan and associates [10]. Therefore, it is important to take adequate steps to prevent this complication. Urethral trauma during catheterisation is often due to a failure to follow the correct catheterisation technique: (i) use of excessive force to insert a catheter, (ii) failure to recognise spasm of the urethral sphincter, (iii) inadequate lubrication, (iv) choice of inappropriate catheter for the given patient. Pre-existing urethral false passage, urethral stricture, enlarged prostate, or distorted anatomy of urethra and bladder neck due to earlier surgery e.g., bladder neck resection, increase the risk of urethral trauma during



Fig. 4. CT of pelvis (sagittal view) performed eight days after the first CT shown in [Figs. 1, 2 and 3](#), shows the balloon of Foley catheter within the urinary bladder (yellow arrow). Residual oedema and haemorrhage are seen around the base of the penis (red arrow).

catheterisation. Education of health professionals in the correct technique of urethral catheterisation is needed as well as regular refresher training of doctors and nurses to remain updated in advances in urethral catheterisation. Assigning designated staff to perform urethral catheterisation has helped to reduce the catheterisation-induced urethral trauma in our centre.

Kravchick [11] recommends constructing an algorithm for difficult male urethral catheterisation. We use Urethrotech Urethral catheterisation device [12] in male patients in whom the first attempt to insert a catheter per urethra is unsuccessful, or in patients with a history of difficult catheterisation because of spasm of urethral sphincter, enlarged prostate, urethral false passage, or distorted anatomy of urethra because of previous surgery.

The Urethrotech Urethral Catheterisation Device (Urethrotech Limited, 24 Garth Rd, Kingston upon Thames KT2 5NY, United Kingdom) incorporates a flexible hydrophilic Nitinol guidewire, which protrudes 50 cm from the tip of a standard 5.3 mm diameter 3-way Foley catheter. This is designed to allow the correct positioning of the catheter while avoiding trauma to the urethra. The soft tip of the guidewire is designed to avoid urethral trauma and will turn back if the wire is pushed against an obstruction or a non-negotiable false passage. When the guidewire enters the bladder, it curls up on itself as the catheter is advanced. The full length of the catheter is passed over the guidewire. When the catheter reaches the bladder, urine should flow freely through the main catheter urine drainage channel. Then about 30 ml of sterile saline is injected through the drainage channel of the catheter. There

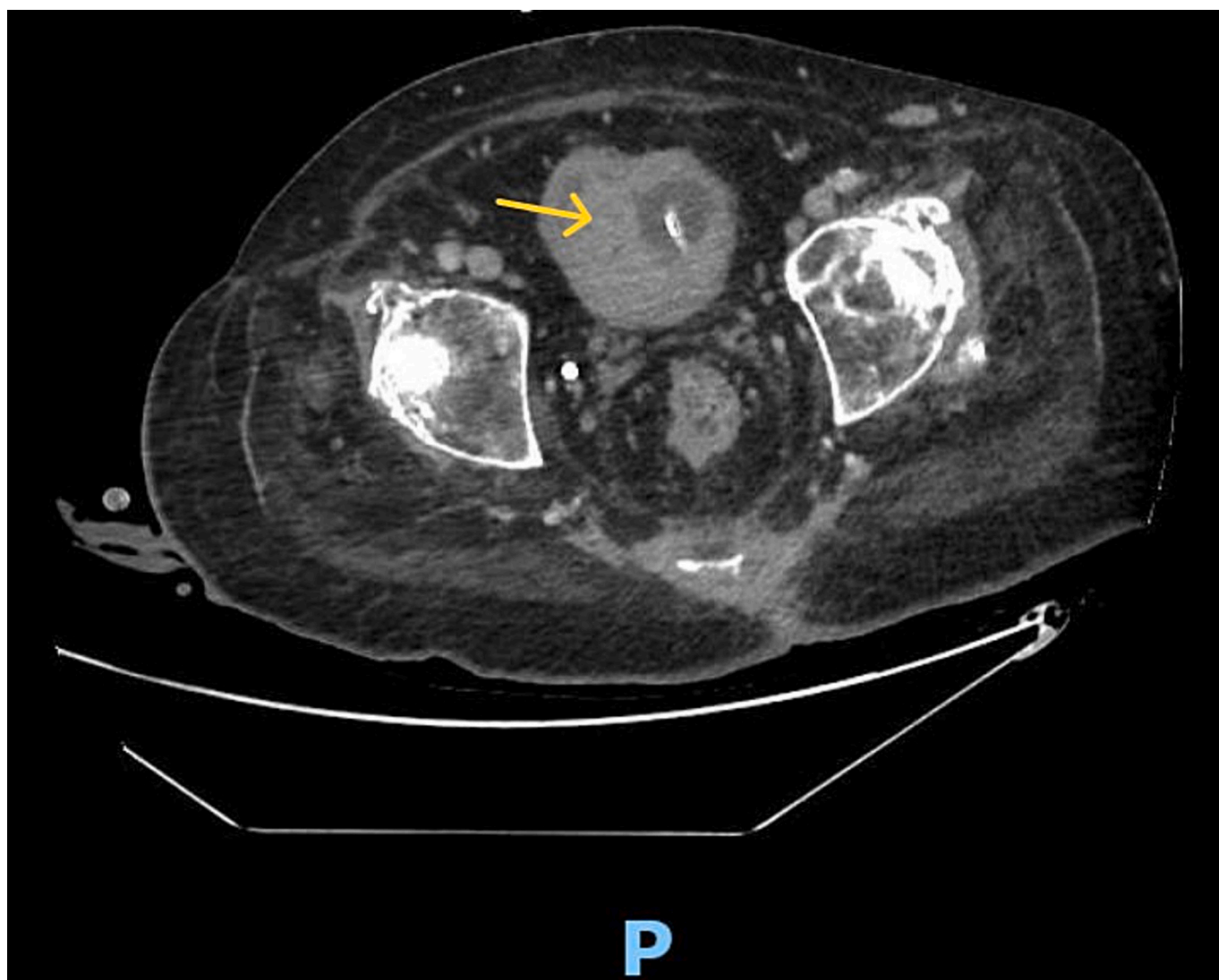


Fig. 5. CT of pelvis (axial view) performed eight days after the first CT shown in Figs. 1, 2 and 3 shows blood clot within the urinary bladder (arrow). Balloon of Foley catheter is seen inside the bladder.

should be no bypassing nor any resistance to the injection of saline. Then the fluid is aspirated back into the syringe. It should be possible to aspirate urine mixed with saline readily. This indicates that the catheter is correctly positioned, and that the Foley balloon may be safely inflated so that the catheter stays in place. The guidewire is then withdrawn and disposed of.

However, we observed a few shortcomings with this technique.

1. In patients, who are prescribed anticoagulant for prophylaxis for venous thromboembolism or for treatment of deep vein thrombosis or pulmonary embolism, bleeding per urethra and hamaturia may occur following the insertion of the guide wire.
2. In patients with incomplete lesions (American Spinal Injury Association Impairment Scale B) or those with hypersensitivity, insertion of the guidewire in the urethra may be very painful even after instilling a local anaesthetic drug in the urethra. When the guidewire gets coiled inside the urinary bladder, these patients may feel severe pain in the bladder area.
3. The cost of the Urethrotech urethral catheterisation device may be significant, but cheaper than flexible cystoscopy or suprapubic catheterisation. Each single-use Urethrotech UCD costs £198.98 (excluding VAT). A cystoscopic catheterisation procedure costs £694 (excluding VAT) per catheterisation. An outpatient suprapubic

catheterisation procedure costs £454 (excluding VAT) per catheterisation. Suprapubic catheterisation costs £2400 for an inpatient case [12].

5. Conclusion

1. Urethral trauma during catheterisation is preventable in spinal cord injury patients by education and training of doctors and nurses in the correct technique of urethral catheterisation and assigning designated staff to perform urethral catheterisation.
2. Physicians caring for spinal cord injury patients should have a high index of suspicion for urethral trauma due to catheterisation and possible misplacement of urethral catheter. CT of pelvis including penis should be done without delay to assess urethral trauma and to check the position of the tip of the catheter and the Foley balloon. Ultrasound scan of the bladder and penis, CT of pelvis including the penis are useful to (i) document any misplacement of urethral catheter, (ii) assess the acute urethral trauma and subsequently, the sequelae of catheterisation associated urethral trauma.
3. We use Urethrotech urethral catheterisation device in (i) patients with history of difficult catheterisation because of enlarged prostate, spasm of urethral sphincter or urethral false passage, and (ii) patients in whom the first attempt at catheterisation by a trained health



Fig. 6. Clinical photograph of the penis taken sixteen weeks after suprapubic cystostomy shows residual swelling of the penis.

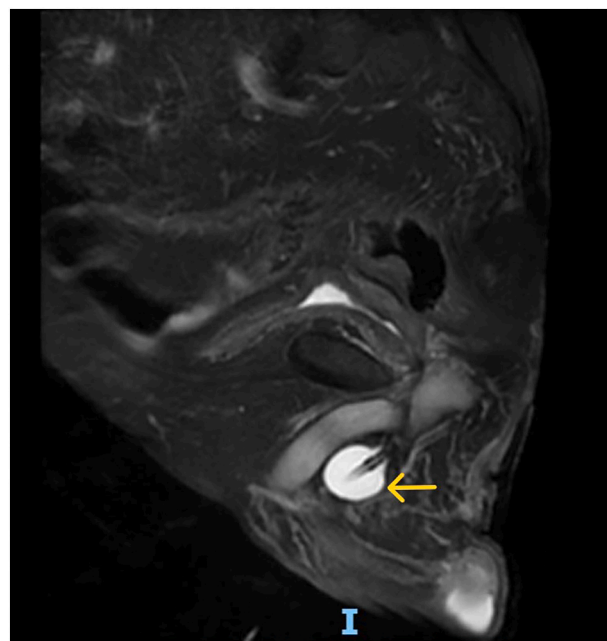


Fig. 8. MRI of pelvis - T-2 weighted image (sagittal view) in a patient with tetraplegia and pressure sore posterior to the left ischial tuberosity and a track extending down to the hamstring muscle compartment, shows the surprise finding of Foley balloon filled with water seen as a bright circle in the penile urethra (arrow).

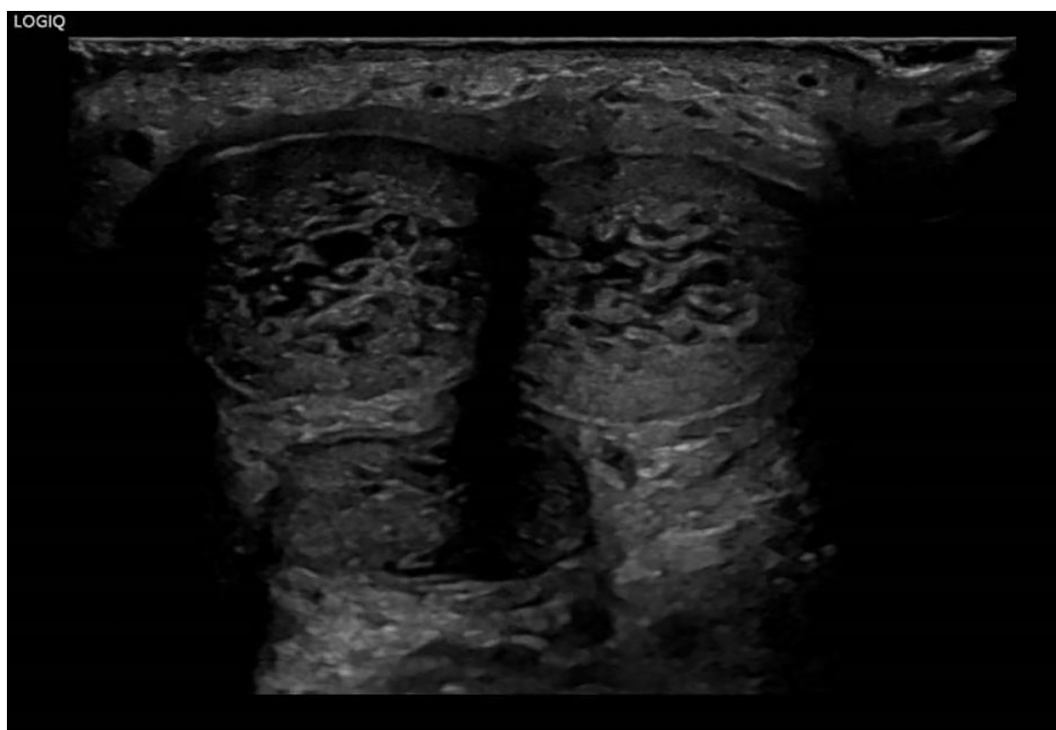


Fig. 7. Ultrasound scan of the penis performed around 24 weeks after suprapubic cystostomy showed venous engorgement of the corpora cavernosa and superficial oedema in the penis.

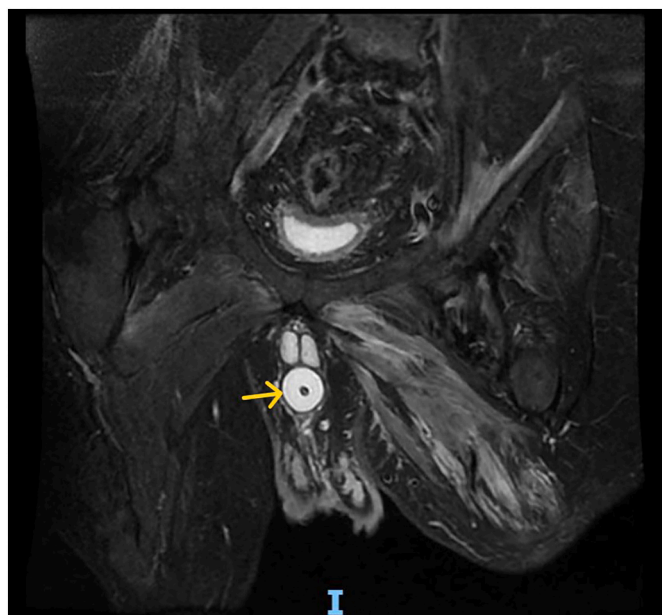


Fig. 9. MRI of pelvis - T-2 weighted image (coronal view) in the same patient as Fig. 8, shows the Foley balloon filled with water as a bright circle in the penile urethra (arrow).

professional is unsuccessful. Use of Urethrotech urethral catheterisation device has helped to achieve successful catheterisation as well as minimise catheterisation-associated urethral trauma in selected patients with spinal cord injury.

Consent for publication

This patient has tetraplegia. He gave verbal informed consent for publication of this case along with the images. The carer signed the consent form in his presence.

Ethical approval

Ethics clearance was not necessary for publication of a case report where no new interventional procedure was performed, or no non-approved drug was used. The patient gave consent to the publication of the case and the images.

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Author contribution

Dr Vaidyanathan Subramanian conceived the concept, wrote the draft, discussed with the patient, obtained consent.

All authors reviewed the manuscript.

Guarantor

The first author is the guarantor of the case report.

Research registration number

Not applicable.

Conflict of interest statement

There is no conflict of interest.

Data availability

Not applicable.

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