

Catheterisation Techniques and Iatrogenic Urethral Injury: Points to Ponder

Manne T¹, Krishnamoorthy S^{2*} and Kumaresan N²

¹Department of Urology and Renal transplantation, Senior Registrar, Sri Ramachandra Institute of Higher Education & Research (SRIHER), Porur, Chennai 600116, India

²Department of Urology and Renal transplantation, Professor, Sri Ramachandra Institute of Higher Education & Research (SRIHER), Porur, Chennai 600116, India

*Corresponding author:

Sriram Krishnamoorthy,
Department of Urology and Renal transplantation, Sri Ramachandra Institute of Higher Education & Research, Porur, Chennai 600116,
Tel: +91- 8056139257;
E-mail: sriramuro@gmail.com

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1. Abstract

Urethral catheter insertion is a common procedure done in hospital admitted patients. Iatrogenic urethral injuries are one of the common preventable complications related to urological procedures. Patients with urethral injury present with frank bleeding from the urethra. The bleed may sometimes be so severe that they may even occasionally present with urosepsis or hemodynamic instability, we present a case of attempted urethral catheterisation, following which he presented to us in a state of shock and a mal-positioned catheter. Following suprapubic diversion and a perineal compression tamponade, the patient recovered well. As most catheterisations are done by interns or Para-medical support team, Nursing staff, an orientation programme, illustrating the methods of catheterisation, precautions to be taken during catheter insertion and before balloon inflation is essential to minimize this potentially avoidable morbidity. It is prudent to also educate patients who need self-calibration for stricture urethra or in patients with detrusor underactivity who need to do self-catheterisation. Patients who are paraplegic, needing regular bladder emptying have to exert greater caution, especially if the urethra is insensate. A few learning points are to be borne in mind before insertion of the catheter, which if properly followed, can minimize catheterisation associated morbidity and ensuring patient wellness. It is the responsibility of the senior surgeons and the urologists to educate the interns and

the junior nursing staff about the techniques of urethral catheterization to minimize catheter induced iatrogenic urethral injuries.

2. Introduction

Urethral catheterisation is one of the most common bedside procedures performed in hospitalized patients. About 12-16% of in-patients need catheterization at any given time [1]. Mostly, this procedure is being performed by the para-medical support team, trainee intern doctors, or junior medical officers. The most common reason for catheterisation in hospital admissions is urine output monitoring, especially in patients who get admitted to the emergency room for neurological illness [2]. The other indications include acute urinary retention and hematuria. While most catheterisations are uneventful, a few patients develop post catheterisation urosepsis, frank bleeding from the urethra or urethritis. Of these, urethral bleed is a very scary complication. On most occasions, a urologist or a senior medical officer reaches the scene, only after the traumatic incident had taken place.

Most primary care centres refer such patients with post catheterisation urethral bleed for further management. On a few occasions, patients lose a lot of blood and reach higher centres in a state of hemodynamic instability. As in most instances, this procedure is done by the junior residents or by nursing staff, it becomes imperative to educate them regarding the catheterisation techniques and

more importantly, to alert them on when to call for the specialized team to intervene. This manuscript illustrates the authors' experience of catheterisation induced urethral injury. Authors have also attempted to highlight the need to know the proper technique of catheterisation, precautions to be taken during catheterisation and the methods to avoid such preventable iatrogenic injuries to the urethra.

3. Authors' Experience

A 45-year-old male presented to the emergency room with one episode of fever and altered sensorium for 1 day. He had a urethral bleed with the passage of blood clots since morning. Because of his altered sensorium and the need for urine output monitoring, he was catheterised elsewhere, following which he developed intractable urethral bleed and was referred to our centre for further management. On admission at ER, he was drowsy, his heart rate was 116/min and blood pressure was 80/46 mmHg. He did not have any voiding difficulty before this admission. His urethra and genitalia were blood-stained with frank blood at the meatus. The Foley catheter was placed in situ. There were about 100 ml of blood-stained fluid in the urobag. CT scan of the abdomen revealed a malposition of the Foley catheter. The bulb of the Foley catheter

was noted in the bulbar urethra. There was air in the urinary bladder. Emphysematous changes were noted in the right seminal vesicle, corpus spongiosum and corpora cavernosa. Figure 1 illustrates the CT image of the pelvis, demonstrating the air pockets in the right seminal vesicle (1a, yellow arrows) and corpora cavernosa (1b, blue arrows).

After ascertaining the malposition of the Foley catheter in the bulbar urethra, prompt action was taken to deflate the Foley catheter. There was a gush of about 50 ml of blood mixed with clots from the urethra. A quick gentle attempt at catheterisation after adequate lubrication failed. A tight perineal compression dressing was applied and a Supra Pubic Catheter (SPC) was left in situ. During the hospital stay, the cause of initial presentation to the hospital was identified to be meningitis and was conservatively managed. The perineal compression was removed after 48 hours and SPC was removed after 2 weeks of patient stabilization. This mini review illustrates a faulty technique followed while inserting the catheter. The proper technique of catheter insertion, methods to avoid iatrogenic urethral injuries, need for an orientation program for the interns, junior residents and the nursing staff and learning points from the authors' experience are discussed below.

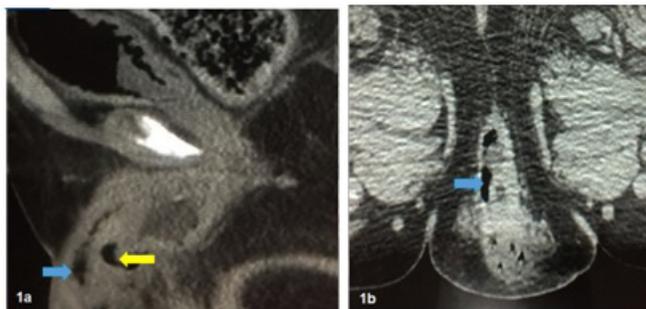


Figure 1: CT scan of the penis and scrotum; Fig 1a showing air pockets in RIGHT seminal vesicle (yellow arrow) and Fig 1b showing air in the corpora cavernosa (blue arrow).

4. Technique

The word 'catheter' derives its origin from the Greek word, 'kathienai', whose literal meaning is 'to thrust into'. The catheter consists of 4 essential parts: a balloon at the tip, long flexible hollow tubing that transports urine out of the patient's urinary bladder, a urine drainage channel and a balloon inflation port. Figure 2 explains in detail the various parts of the Foley catheter. Sound knowledge of the parts of a catheter is the basic prerequisite for a better understanding of the techniques of safe catheterisation.

The most important primary step in catheterisation is an assessment of the appropriate size of the catheter to be inserted. Catheter size is measured by a unit called 'French'. 1 French equals 0.3 mm. Catheter sizes range from 6 FR to 26 Fr (2 mm to 8.7 mm). Each size of the catheter would have a unique colour code. This colour code is fixed and uniform and followed by all manufacturers across the world. Figure 3 is the pictorial representation of

the colour code of various sizes of catheters in clinical practice. A larger catheter for a smaller urethral lumen could be disastrous, as it can lead to urethritis and urethral stricture. Usage of smaller-sized catheters could cause defective drainage of urine and may also lead to frequent catheter blockage. It is prudent to choose the optimal size of the catheter considering the patient's age and adequacy of the urethral lumen.

The method of catheterisation is not just to be learnt, but to be mastered. The technique involves strict asepsis and a 'no-touch technique'. Catheters are supplied sterile, encased in a protective aseptic sleeve. The portion of the sleeve (on the side of the catheter tip) is detachable and the catheter should be inserted without touching its surface. Such a 'no-touch technique' shields the urinary tract from external contamination and is the most widely accepted method of catheter insertion [3].

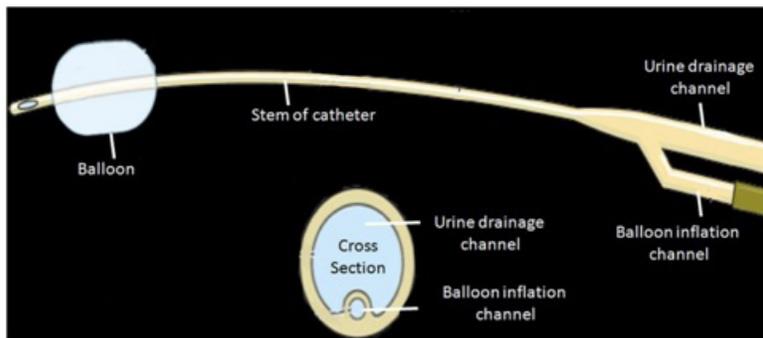


Figure 2: Parts of the Latex Foley catheter

Colour	Size French
Green	6
Blue	8
Black	10
White	12
Green	14
Orange	16
Red	18
Yellow	20
Purple	22
Blue	24
Black	26

Figure 3: Colour codes of various catheters ranging from 6 Fr to 26 Fr

The best way of catheterisation is to adopt a ‘one-hand double gloved technique’. The cleaning of external genitalia and lubrication of the urethra with local anaesthetic gel is done with one hand, keeping the other hand sterile. Before insertion of the catheter, the outer glove is to be discarded and a catheter inserted with an inner sterile glove. The other hand is to be placed only on sterile drapes [4]. After the catheter is inserted inflation of the balloon is done only after ascertaining efflux of urine. In cases where the bladder is empty, about 20 ml of saline can be injected and aspirated to ascertain the position of catheter tip to be within the urinary bladder. This technique not only ensures an uneventful catheterisation but also avoids the occurrence of potentially preventable iatrogenic urethral injury. It is prudent to retract the prepuce and clean the smegma adherent to corona glandis and inner prepuce to prevent procedure-related infections. Care must be taken to pull back the prepuce over the glans penis to avoid paraphimosis. Similarly, care must be taken to deflate the balloon fully before pulling it out. This can be confirmed by a collapse of the balloon inflation channel.

5. How to Avoid Iatrogenic Urethral Injury

Iatrogenic urethral injury is one of the common causes of urethral trauma and most of them are related to improper catheterisation. Perineal or penile shaft pain is seen in almost all patients (100%) and urethral bleed is noticed in 86% of patients [5]. The mechanisms by which urethral injury can occur while catheterisation are by an accidental inflation of balloon inside the urethra and trauma

by catheter tip [6]. The former mechanism is usually observed when the catheter gets coiled in the prostatic urethra or when it fails to negotiate the ‘S’ bend of the bulbar segment of the urethra. The latter mechanism is seen in false passages commonly observed in patients with paraplegia, who are on Clean Intermittent Self-Catheterisation (CISC). In such patients with insensate urethra, repeated CISC may lead to false passages and corpus spongiosal injuries. It may not be uncommon to come across cases of undiagnosed stricture urethra. In such cases of difficult catheterisations, the best technique to be adopted is ‘Rail Road technique’. Here, an atraumatic hydrophilic guidewire is first inserted and coiling of the guidewire inside the bladder is ascertained sonographically. The Foley catheter is ‘Fish mouthed’ and threaded co-axially over the already placed guidewire [7]. However, the ideal and fool-proof method of placement of catheter is through cystoscopic guidance. However, as cystoscopy may not be readily available at all times, co-axial placement of catheter over a guidewire would be the safest method of catheterisation in difficult circumstances. This technique was introduced and popularized by Freid and Smith [8].

Rarely, an ill-trained staff nurse or an intern might attempt to pull out the catheter without completely deflating the balloon. The ‘Creep phenomenon’, wherein the balloon fails to deflate completely, leaving a thin rim of fluid to remain within the balloon, may cause urethral injury when attempts are made to pull the catheter out. Such complication is more often observed in SPC rather

than urethral catheters [9].

The key step in avoiding urethral injury is to ensure that the meatus is normal. This can be done by ascertaining that there are no features of Balanitis Xerotica Obliterans (BXO). The presence of BXO may be a harbinger of underlying stricture urethra. Whenever resistance is encountered while inserting the catheter, extreme care must be taken not to advance the catheter further beyond. Repeated attempts may create false passages in the urethra and may further aggravate urethral injury [10]. Spongiosal injuries may cause a torrential bleed and hemodynamic instability.

The European Association of Urology Guidelines on Urethral Trauma recommends urethroscopy as the first-line investigation for suspected urethral trauma from catheterisation [11]. If a false passage is found, endoscopic guidewire placement and catheter insertion is recommended. SPC drainage of urine is preferred in cases of pre-existing urethral strictures. It has been studied that unnecessarily prolonged catheterisation, traumatic catheterisation and over usage of instrumentations may lead to anterior urethral strictures.

Most complications were encountered with improper catheterisation. Urethral erosions were more commonly seen with indwelling catheters. The fixation of catheter to the thigh or leg causes ventral urethral erosions due to bowstring formation of the penis while erection. This can be prevented to some extent by fixing the catheter to the ventral abdominal wall [12].

In our patient, the Foley's bulb was inflated in the bulbar urethra which caused urethral injury and urethral bleed. The diagnosis was confirmed after a CT scan and the catheter was removed. Usually, the bleed settles down with perineal compression and SPC placement.

6. Nursing/Intern Orientation Program

Urethral catheterisation is one of the commonly performed minor procedures in any hospital setting. Trained personnel do it in community settings as well. Warren et al reported that 15 to 25% of hospitalized individuals need catheterization at some point of time during their admission period [13]. As most catheter insertions are done by interns or junior nursing staff, a proper training cum orientation program regarding the types of catheters, their colour codes, usage of appropriate size and proper aseptic method of catheterisation is required to prevent this potentially preventable complication of iatrogenic urethral injury.

Iatrogenic urethral injuries continue to haunt the training interns and paramedical nursing staff. In one of the largest studies on iatrogenic urethral injuries, Kashefi et al reported an overall incidence of 3.2 urethral injuries for every 1000 patients [14]. Davis reports 6.7 urethral injuries per 1000 catheterisations and Bhatt et al report 4.7 injuries per 1000 catheter insertions [15, 16]. Thomas et al, in their study on iatrogenic urethral injuries, observed that

about 76% of interns had no proper practical training about catheterisation [17]. Irish health service recommends all junior doctors undergoing their internship to train enough to become safe, competent and confident in catheterisation techniques [18].

While there is no denying that the interns and the nursing staff need to be properly trained on catheterisation techniques, patient education on self-catheterization also needs to be given equal importance. Nurses play a vital role in patient education regarding catheterisation techniques. Patients who need to be on CISC have to be taught the proper way of doing it. As there is no universally accepted standard method employed to teach and guide nurses on CISC, most of them, using their clinical judgement to determine the method and type of catheter to use, rely on their own experience and institutional policies. This paves way for inconsistencies and inadequacies in the quality of patient education regarding catheterisation techniques. Newman in 2011, in his review on best practice methods of catheterisation, had recommended the need for guidelines and evidence-based research for the nurses to effectively educate and train patients regarding safe methods of self-catheterisation [19]. A sound understanding of the basic principles and methods of catheterisation techniques is needed to prevent such iatrogenic injuries.

7. Learning Points

1. Iatrogenic urethral injury is a common preventable cause of catheterisation induced complications.
2. Most urethral injuries are related to faulty techniques or lack of adherence to principles of catheterisation.
3. Catheter position to be ascertained before balloon inflation, by letting out some urine first.
4. Complete deflation of the balloon is to be verified before pulling it out.
5. First-line management in such cases is urethroscopy, guidewire insertion and co-axial threading of the 'Fish-mouthed' catheter.
6. It is prudent to call for a urology consultation or leave the patient with an SPC in cases of difficulty.

8. Conclusions

Iatrogenic urethral injuries are one of the common and preventable urological procedure-related complications, especially in hospitalized male patients. A proper orientation training programme for the nurses and interns would greatly minimize the incidence of catheterisation related urethral injuries and other complications. The onus is on the surgeons and urologists to ensure that proper training about catheterisation techniques is given to all the junior residents, interns and staff nurses, which not only aids in minimizing catheter-related morbidity but also ensures adequate patient wellness and safety.

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