Urethral catheters: a review of current practice

Introduction

The urethral catheter is one of the most recognizable and useful devices found on the wards. It is used in good measure by all medical and surgical specialities – both in hospital and the community. Its ubiquitousness has led to its acceptance as a benign tool. This does not, however, take into account the costs of morbidities that occur as a result of its use and the specialized care required to manage patients with long-term catheters. It is imperative therefore for medical practitioners of all specialities to understand the indications, techniques and complications that may occur.

History

The first documented use of urethral catheters dates back to antiquity with the Indian surgeon Sushrata describing them in his work the Sushruta-Samhita, which roughly dates back to the 6th century BC. He describes the use of catheters for management of urinary retention, stricture surgery and lithotomy. The catheters were made of various materials including iron, wood, gold and silver, and lubricants used included butter and ghee. Erasistratus of Iulis is credited with naming the catheter, derived from kathienai in greek meaning 'send down' and his original catheter is described as being the shape of a roman S (Smith, 1870) (*Figure 1*). Metal catheters remained in predominant use until the late 19th century. In the middle part of this century vulcanized rubber was discovered and Auguste Nelaton then developed the flexible red rubber catheter, making the process of catheterization a less agonizing experience (Rugendorff and Wilson, 1997).

The next technological leap was the development of an anchoring system for urethral catheters. In 1935 Frederick Foley developed an inflatable balloon to retain the catheter in the bladder, and despite losing a patents battle with Bard its modern day equivalent is still referred to as a 'Foley catheter'.

Since then other materials have been used in the manufacture of catheters. Silicone catheters can be used long term (up to 12 weeks) and have been associated with significantly decreased rates of urethritis (Nacey et al, 1985) and urethral stricture (Ferrie et al, 1986) compared with traditional latex catheters. Catheters made from polyvinylchloride and polyethylene have a wider lumen and are useful in the perioperative period when bladder irrigation or washouts are required. They should only be used as a short-term measure because of patient comfort and tolerability.

Antibiotic impregnated catheters significantly decrease the rate of gram positive bacteriuria (Darouiche et al, 1999). Another promising idea is that of catheters coated with silver alloy which are effective in preventing infections as compared with catheters coated with silver oxide or uncoated standard catheters (Saint et al, 1998).

Figure 1. A metallic 'S' shaped catheter from the Roman era.

Mr Priyadarshi Kumar *is Research Registrar in Urology and* **Miss Jhumur Pati** *is Consultant Urological Surgeon, Department of Urology, St Bartholomew's and Homerton Hospitals, London E9 6SR*

Correspondence to: Mr P Kumar

Techniques

Before the insertion of a urethral catheter there are a few prerequisites that will ensure that the procedure is made easier and safer. It is important to relax the patient and explain the procedure. It is extremely important that aseptic precautions are used to ensure that infective complications are minimized. The technique itself varies with the sexes as a result of the varying anatomy.

In the male, anaesthetic gel should be instilled in the urethra and then a penile clamp applied for 10 minutes. With one hand the penis should be drawn vertically into the air – this action straightens the urethra as illustrated in *Figure 2*. Meanwhile the catheter should be guided with forceps or the other hand into the urethra. Only upon reflux of urine should the catheter balloon be inflated with water – 10 ml for standard two-way catheters or up to 30 ml for irrigating catheters (the amount is usually stated on the catheter valve).

In the female, identification of the urethral meatus is the most important step (*Figure 3*). In the obese patient this may need assistants to retract back the labial folds for adequate visualization. Occasionally, the meatus is situated on the anterior vaginal wall. After instillation of anaesthetic gel the catheter should be advanced into the meatus till there is free flow of urine.

In either sex, if there is no flow of urine then the balloon should not be inflated in

Figure 2. a. Male urethra in anatomical position which (b) straightens upon lifting the penis vertically.

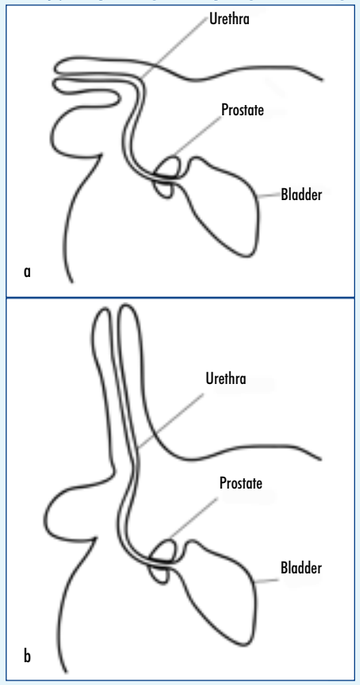
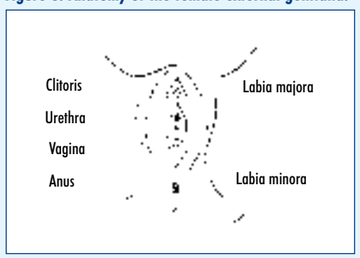


Figure 3. Anatomy of the female external genitalia.



case the catheter is not in the bladder. A washout with a bladder syringe will confirm if the catheter is within the bladder. If an equal amount of fluid is returned after instillation then correct placement is confirmed. Saline should not be used for balloon inflation as it may crystallize causing difficulty in balloon deflation.

The catheter may be attached to a drainage bag or a valve (*Figure 4*). The advantages of a valve are that it simulates normal voiding (the patient empties the catheter once the bladder fills) and it also helps preserve bladder muscle tone. Patients also find this more convenient. However, it can not be used in the atonic bladder, in the presence of diminished sensation, in the confused or poorly compliant patient.

Indications for urethral catheterization

Urethral catheters may be used as a short- or long-term measure. The indications are summarized in *Table 1*.

Complications

The most common complications of long-term catheter use are sepsis, blockages and encrustation. The best method of avoiding these complications is to ensure catheter changes occur regularly at 8–12 weeks with district nurse follow up. Frequent blockages may be treated with regular instillations, e.g. Suby-G. Sepsis secondary to the catheter is the most common infection in institutionalized patients with long-term catheters (Warren, 1994).

When traumatic displacement occurs it is important to document that the catheter has been extruded intact – any retained fragments need to be removed. Haematuria should not be attributed blindly to the catheter and requires full investigation with cystoscopy and upper tract imaging. Bladder spasm may require the insertion of a smaller calibre tube or reduction in the amount of water in the balloon – thus decreasing irritation to the trigone and bladder neck. Alternatively, pharmacotherapy may be given in the form of oral anticholinergics. With long-term use there may be the development of stones with the encrustations acting as a nidus for calculus formation.

Long-term catheterization is associated with an increased incidence of bladder neoplasia and pre-malignant changes and screening by cystoscopy has been suggested in view of this increased risk (Delnay et al, 1999). It is extremely important that the foreskin is replaced every time the catheter is changed otherwise paraphimosis ensues necessitating reduction or even surgery, either dorsal slit or circumcision.

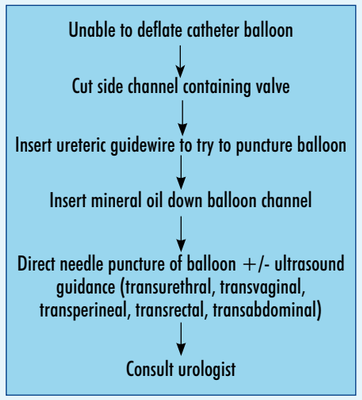
Chronic usage especially in the institutionalized patient may lead to the development of traumatic hypospadias secondary to urethral pressure necrosis. Another problem is that of the catheter balloon that cannot be deflated and this occurs either because of valve dysfunction or blockage of the channel. This problem may be approached in a stepwise and logical progression as detailed in *Figure 5*.

Figure 4. Catheter valve.

Table 1. Indications for urethral catheterization

Short term	Post-epidural/spinal anaesthesia
	Post-surgery
	Urinary retention
	Urine output monitoring
	Intravesical therapy
	Urine diversion, e.g. pressure ulcers, Fournier's
Long term	Incontinence
	Urinary retention, e.g. unfit for surgery
	Neuropathic bladder

Figure 5. Deflating the undeflatable urethral catheter – stepwise approach.



Conclusions

Although a common procedure, urethral catheterization should only be used when necessary – as this is the best way of minimizing associated complications. If a catheter is required then good technique and proper after care will decrease morbidity. There are constantly evolving technologies aimed at reducing catheter-related sepsis and silver alloy-coated catheters may be used more commonly in the future. BJHM

Conflict of interest: none.

Figure 1 *is reproduced with permission of Historical Collections & Services, Claude Moore Health Sciences Library, University of Virginia.*

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KEY POINTS

- Is catheterization really necessary? Always question this point.
- Good technique with appreciation of anatomy and observation of aseptic precautions is the key to successful catheterization.
- Ensure patients with long-term catheters are followed up by district nurses to monitor catheter care.
- Minimize duration of catheterization to decrease incidence of complications.