CHAPTER 18

Monitoring: Urinary Catheterisation

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OVERVIEW

By the end of this chapter you should be able to:

- understand the indications and contraindications for insertion of a urinary catheter
- identify and understand the relevant anatomy
- be aware of different types of urinary catheter
- describe the procedure of performing a urethral and suprapubic catheterisation
- understand the complications of urethral and suprapubic catheterisation.

Introduction

Urinary catheterisation is a relatively simple practical procedure to master and gets easier with practice. It is important to familiarise yourself with the catheter packs used in your hospital and the catheter types available in your clinical area. Remember to take a chaperone with you and always document this in the notes. Follow your hospital's infection control procedures.

Urethral catheterisation

Indications

- Acute urinary retention.
- To monitor fluid balance, for example in septic and shocked patients.
- Epidural/spinal anaesthesia or in sedated patients.
- Intraoperatively.
- Deeply unconscious patient – for example tricyclic antidepressant overdose.
- To manage urinary incontinence, for example in elderly patients who are immobile and incontinent.
- To irrigate the bladder in cases of profuse haematuria.
- Intravesical drug therapy, for example to administer chemotherapy in bladder carcinoma.

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Contraindications

- Pelvic trauma – check for blood at the urethral meatus and perform a digital rectal examination for a high riding prostate. This would suggest a urethral tear and catheterisation may cause additional trauma.
- A relative contraindication is a known urethral stricture which would make urethral catheterisation difficult. A specialist urology opinion should be sought.

Urogenital anatomy

The differences in male and female urogentital anatomy are illustrated in Figures 18.1 and 18.2. The main difference is in urethral length; the male urethra is 18–20 cm long and the female is just

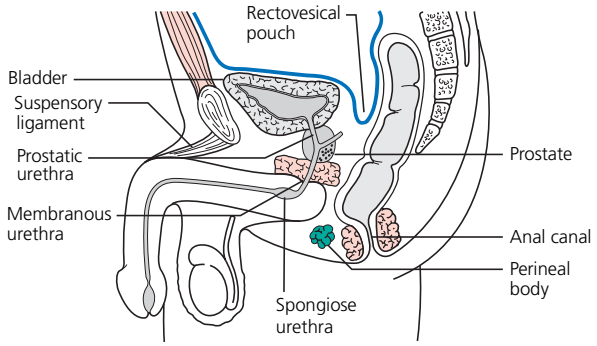

Figure 18.1 A sagittal section through the male pelvis. (From Faiz O, Moffat D. (2006) *Anatomy at a Glance*, 2nd edn. Blackwell Publishing, Oxford, with permission.)

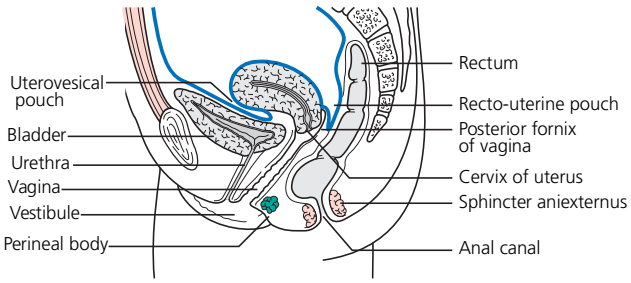

Figure 18.2 A sagittal section through the female pelvis. (From Faiz O, Moffat D. (2006) *Anatomy at a Glance*, 2nd edn. Blackwell Publishing, Oxford, with permission.)

4 cm long. The male urethra passes through the prostate gland which may make catheterisation more difficult if the prostate is enlarged.

Catheter types

There are different catheters for males and females due to the differing length of urethra. A male catheter can be used in female patients. Foley catheters have a balloon to keep them in place. Originally invented by Fredrick Foley, the intention for use was to achieve haemostasis and so there were different sizes of balloon available – 10, 20 and 30 mL. You will most commonly use the 10-mL balloon for urinary catheterisation where the balloon acts to keep the catheter in situ. Do not inflate the balloon with air as the balloon will float and may cause irritation. Use sterile water (saline can crystallise making it difficult to deflate the balloon). Most catheters come with a prefilled syringe.

Catheters also vary in external diameter which is measured in charrière (Ch); 1 charrière = 0.33 mm. 12, 14 and 16 Ch are most commonly available. A larger diameter will allow quicker drainage. Larger sizes should be used if clots or postoperative debris are present in the bladder. In general, use a size 14 Ch.

Catheters are made from different materials depending upon how long they are intended to be in situ.

Short-term catheters

- Plain latex: 7 days maximum, ideally 3 days. The latex gradually absorbs fluid, increasing its external and internal diameter, reducing urine flow and causing increasing discomfort.
- Plastic/polyvinyl chloride: used in theatre or for intermittent self-catheterisation. They are prone to bacterial contamination. They are a harder material, less flexible and can be uncomfortable.

Mid-term catheters

- Polytetrafluoroethylene: covers latex making the catheter smoother and less irritating. There is less fluid absorption but the polytetrafluoroethylene wears off after 3–4 weeks.

Long-term catheters

- Latex coated. This can be either with hydrogel, polymer hydromer or silicone elastomer, making the catheter smoother, reducing risk of bacterial colonisation and preventing fluid absorption. The catheter can be kept in for up to 12 weeks.
- Silicone: used in patients allergic to latex. Silicone is a less flexible material and the sterile water in the balloon diffuses gradually out into the bladder: a note should be made to check and top up the balloon after 6 weeks. The thickness of the silicone is less than latex-based catheters. Therefore they have a larger internal diameter with subsequent better drainage to comparable Ch sizes of latex catheter. Again, they can be kept in for up to 12 weeks.

Specialist catheters

- Three-way catheters: these have a third port that allows irrigation to run into the bladder. The catheter itself has a large diameter to allow blood and debris to pass into the drainage bag.
- Coude/Tiemann catheters: have a 45° bend at the tip allowing easier passage through an enlarged prostate.
- Council tip catheters: have a small hole in the end to allow passage over a guidewire.

Box 18.1 **Equipment for insertion of a urinary catheter**

Most hospitals stock catheter packs which contain most of the things you will need. While assembling your trolley you will need the following:

- two pairs of sterile gloves
- incontinence pad to place underneath the patient
- lubricant – commonly contains lidocaine 2% and chlorhexidine 0.25% alongside lubricating gel
- catheter pack + 10-mL syringe (normally prefilled)
- cleaning solution (saline or chlorhexidine-based cleaning solution)
- catheter: keep the stickers from the packaging to stick into the notes
- catheter bag (depending on indication or need: can be a leg-bag that attaches to the patient's inside leg, an hourly bag for accurate measurement or 4-hourly bag)
- catheter stand.

Figure 18.3 Equipment required for urinary catheterisation.

Step-by-step guide: urinary catheterisation

- **Give a full explanation to the patient in simple terms and ensure they consent to the procedure.**
- **Set up your trolley (Box 18.1 and Figure 18.3)**
- **Prepare your trolley as a sterile field. Wear a plastic disposable apron and sterile gloves, and take alcohol hand rub with you.**

1 Set up your sterile field and put on sterile gloves.
2 Position the patient lying supine on an incontinence pad and maintain their dignity at all times (Figure 18.4a). Obese or pregnant women may need to be positioned differently with knees bent to a greater extent or in the left lateral position if heavily pregnant.
3 Clean around the urethral meatus with cleaning solution (normal saline is acceptable) using a one wipe technique, cleaning downwards then disposing of the gauze (do not place the dirty gauze back into your sterile field) (Figure 18.4b). Repeat this until satisfied the area is clean. In females you will need to

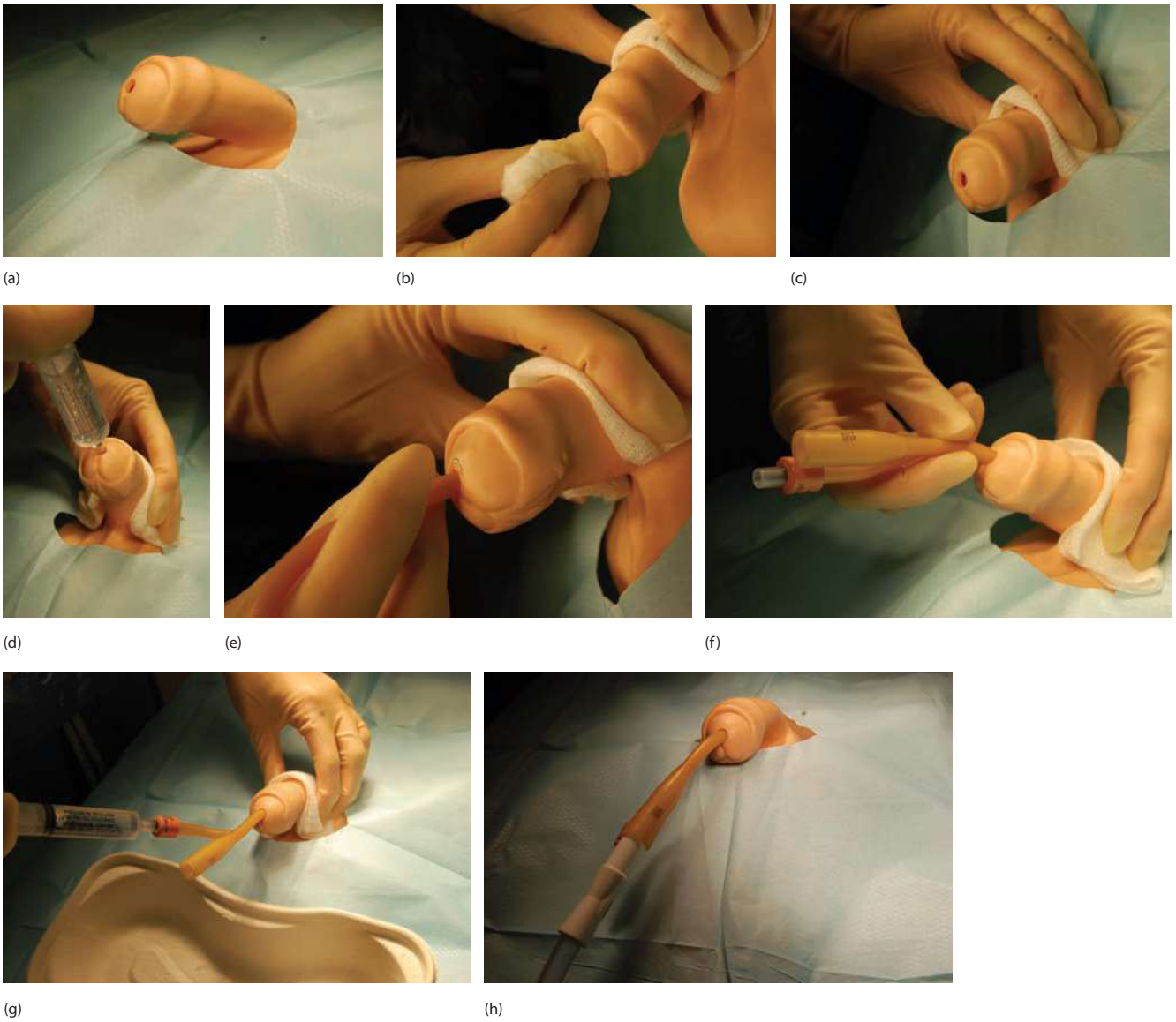

Figure 18.4 Step-by-step guide: urinary catheterisation. (a) Aperture drape around penis. (b) Cleaning the meatus. (c) Holding penis with gauze to maintain sterility. (d) Insertion of lubricant gel into the urethra. (e) Insertion of catheter. (f) Catheter fully inserted. (g) Filling the balloon with sterile water. (h) The catheter connected to collection bag.

separate the labia with your non-dominant hand; in males hold the shaft of the penis with some gauze (Figure 18.4c) and retract the foreskin if necessary.

4 Remove your first pair of gloves, clean your hands with alcohol gel and put on the second pair of sterile gloves.

5 Remove the catheter from its plastic covering and place it in the provided kidney dish from the catheter pack.

6 Take the sterile white sheet from the catheter pack and tear a small hole in the middle fold (unless already fenestrated). Place this across the patient with the hole over the genital area giving access to the urethra.

7 Insert lubricant into the urethra (Figure 18.4d). In males hold the penis at 90° and squeeze the tip of the penis gently to keep the gel in. In theory you should allow 5 minutes for preparations with local anaesthetics in them to have full effect. This, however, is rarely practical.

8 Feed the tip of the catheter into the urethra and up to the bifurcation of the catheter (Figure 18.4e,f). In males position the penis at 45° to straighten the urethra. Encourage the patient to take slow deep breaths in and out, especially in males as you pass through the prostate. If you are having difficulty, change the angle at which you are holding the penis and gently try a twisting motion – this may help you to get past the prostate. Remember, you may not see urine draining straight away as there may be some lubricant temporarily blocking the catheter.

9 Once urine is draining, fill the balloon up with 10 mL of sterile water (Figure 18.4g).

10 Do not pull the catheter back on the balloon – this can be uncomfortable. Allow gravity to do the work for you!
11 Attach the appropriate catheter bag (Figure 18.4h). Before you do so, do you need to send a urine sample, for example as part of a septic screen? If so, remember to document on the lab request form that it is a catheter sample of urine (CSU). Attach the bag to the stand.
12 In uncircumcised males, make sure that you replace the foreskin back over the glans penis to prevent paraphimosis (and document this in the notes).
13 Make sure the patient is comfortable, clean and dry before leaving the bedside.
14 Dispose of all your waste from the procedure in yellow clinical waste bags.
15 Document the procedure in the notes including your name, grade, date, time, name of your chaperone, indications for catheterisation, type of catheter inserted, volume of sterile water inserted into the balloon, date that the catheter should be reviewed and date when it should be removed or changed.

Potential complications (listed early to late)

- Urethral trauma: reduced by using adequate lubricant.
- Haematuria: this should settle. If this starts after a catheter has been in situ for some time it may require further investigation.
- Urinary tract infections and pyelonephritis: treat with oral/IV antibiotics according to microbiology advice and consider removing the catheter. Always send a 'catheter sample of urine' (CSU). Note that the presence of bacteria in the urine alone does NOT confirm a UTI.
- Debris and stone formation leading to catheter blockage – flush the catheter and consider removing or changing it.
- Traumatic hypospadias in long-term male catheters – always examine for this, especially in the community. The patient may then require suprapubic catheterisation.

Removal of catheter

A trial without catheter (TWOC) should generally be undertaken in the morning so that if recatheterisation is required it can be done during normal working hours.

1 Check in the notes how much water was inserted into the balloon.
2 Clean around the urethral meatus and catheter itself.
3 Use a 10-mL syringe to deflate the balloon and ensure the same volume comes out as was inserted.
4 Ask the patient to relax and take some slow breaths; this relaxes the pelvic floor muscles.
5 Remove the catheter as gently as possible – the deflated balloon may cause discomfort in male patients as it passes through the prostate so warn patients of this.
6 Dispose of the catheter and bag in clinical waste bins.
7 Advise the patient that they are likely to experience urgency and urethral irritation when urinating but that this should settle in 24–48 hours.
8 Residual volumes should be measured by ultrasound after micturition and documented.

Suprapubic catheters

Suprapubic aspiration of urine and catheterisation was first described by Huze and Beeson in 1956 and advocated as a superior way to obtain a 'clean catch' of urine for bacterial culture. It is a relatively safe procedure but should only be performed by a competent healthcare professional.

Indications

- Urinary retention.
- Urine sampling in paediatrics.
- Phimosis.
- Chronic infection of urethra/periurethral glands.
- Urethral stricture.
- Urethral trauma.
- Post transurethral surgery.
- Resection of prostate.
- Neuropathic bladder.

Contraindications

- Known bladder tumour (can cause spread).
- Neobladder.
- Empty/indefinable bladder.
- Lower abdominal surgery/scarring.
- Pelvic irradiation.
- Unfamiliarity with procedure.
- Refusal of a competent patient.

Advantages over urethral catheterisation

- Reduced urethral stricture formation.
- Lower rates of infection – bacteriuria, pyelonephritis and urinary sepsis.
- Prevention of penile pressure necrosis.
- Reduced interference with sexual function.
- Possibly more acceptable to patients.

Step-by-step guide: insertion of suprapubic catheter

- **Give a full explanation to the patient in simple terms and ensure they consent to the procedure.**
- **Set up your trolley (Box 18.2).**
- **Prepare your trolley as a sterile field. Wear a plastic disposable apron and non-sterile gloves, and take alcohol hand rub with you.**

1 Give clear and simple explanations throughout. Lie the patient supine with the abdomen and pelvic area exposed. Children should be held in a supine frog-legged position (assistance for this will be needed). Wear sterile gloves and gown, considering also personal protective equipment such as eye protection.
2 Palpate 2 cm above the symphysis pubis in the midline for a full bladder. This should be confirmed by ultrasound and ideally the procedure done under ultrasound guidance, with the transducer covered with a sterile glove.
3 Clean the area using a circular motion and treat as a sterile field.

Box 18.2 **Additional equipment for the insertion of a suprapubic catheter**

In addition to the equipment listed in Box 18.1 you will need the following:
- ultrasound machine
- 22G needle
- local anaesthetic (e.g. 1% lidocaine)
- 10/20-mL sterile syringe
- scalpel
- cystostomy kit, these vary widely between various manufacturers, you should be familiar with the contents of the kit before you need to use it!
- catheter dressing.

4 Infiltrate the skin with local anaesthetic in the midline 2 cm superior from the pubic symphysis.
5 For aspiration, use a 22G needle (short length in children), attached to a 10/20-mL syringe. Advance the needle while aspirating until urine appears. In children the bladder is still an abdominal organ so the needle should be angled slightly towards the abdomen (cephalad). In adults the bladder is a pelvic organ so the needle should be angled slightly towards the pelvic floor (caudad). Once the sample is obtained, remove the needle and apply pressure with gauze before applying a sterile dressing to the site.
6 For suprapubic catheter insertion you will have a cystostomy kit as part of your equipment set up on your sterile tray. At the site of the aspiration, make a small incision with a scalpel.
7 Insert the trochar and cannula in the same direction as the aspiration needle until the bladder is entered and you aspirate urine.
8 Remove the trochar – urine should now gush out of the distended bladder. In some kits the cannula itself acts as the catheter which is sutured in place and connected to the drainage bag. In others, a Foley catheter is inserted through the cannula and the balloon inflated. The cannula then normally peels apart and can be removed.
9 Secure the catheter with a dressing.

Suprapubic catheterisation in a non-distended bladder can be performed after filling the bladder with saline via a flexible cystoscopy. Occasionally, particularly if there has been lower abdominal surgery, an open cystostomy under general anaesthetic is necessary.

Complications

These are rare but potentially serious.
- Infection: superficial of the skin and subcutaneous tissues, intra-abdominal or bladder.
- Peritoneal perforation with or without visceral injury. Can be potentially life-threatening if bowel is perforated and catheter left in place. A vesicocolic fistula may form.
- Haematuria: as with urethral catheterisation this is usually temporary and more commonly microscopic.
- Inability to aspirate urine: you will need to contact the urology team.

Table 18.1 Causes of oliguria and anuria.

Prerenal
Hypovolaemia
Hypotension
Renal artery stenosis (in combination with an ACE inhibitor)
Renal artery thrombosis
Hepatorenal syndrome
Renal
Acute tubular necrosis:
• ischaemic secondary to reduced renal perfusion
• toxins – e.g. myoglobin in rhabdomyolysis
• drugs (e.g. gentamicin)
• infection (e.g. malaria)
Vasculitis, for example:
• Wegener's
• Churg–Strauss
• Goodpasture's
• herpes simplex virus
Toxins:
• drugs – NSAIDs, diuretics
• calcium/oxalate
Postrenal
Ureteral obstruction
Bladder outlet obstruction
Renal calculi
Prostatic hypertrophy
Renal vein thrombosis

Why monitor urine output?

It is outside the scope of this book to discuss in full the monitoring of urine output. The production of urine is a reflection of fluid balance status of the body and how well the kidneys are functioning to excrete waste products and regulate fluid balance. A reduction in urine output is a signal that all is not physiologically normal in the body; this requires your attention.

Oliguria is a reduced urine output, defined as a urine output of less than 300 mL in 24 hours, or better, less than 0.5 mL/kg/hour. Anuria is the failure to produce any volume of urine and requires urgent attention. Causes of reduced urine output can be prerenal, renal and post-renal (Table 18.1).

Any patient with low urine output should be thoroughly assessed as to the likely cause. Oliguria for more than 2 hours is an emergency. If in doubt or the patient is not responding to initial treatment, get senior advice.

Handy hints/troubleshooting

- If the catheterisation is handed over to you out of hours, always take a brief history and examine the patient to ensure you are happy with the indications.
- Always check for allergies, especially latex.
- Take a drug history – if the patient is on anticoagulation haematuria secondary to catheterisation is more likely and may last longer.
- Take a chaperone who is the same sex as the patient, unless the patient has any objections.
- Some people use a double glove technique with one larger set of gloves over ones normal size as this saves time during the procedure.
- Consider the impact on sexual function, particularly in patients who may require long-term catheterisation – is suprapubic catheterisation more appropriate?

Further reading

Aguilera P, Choi T, Durham B. (2004) Ultrasound-guided cystostomy catheter placement in the emergency department. *Journal of Emergency Medicine* 26: 319–21.

Berne RM, Levy MN. (2000) *Principles of Physiology*, 3rd edn. Mosby Publishing, St Louis.

Blandy J. (1998) *Lecture Notes on Urology*. Blackwell Science, Oxford.

Brewster S, Cranston D, Noble J, Reynard J. (2001) *Urology: A Handbook for Medical Students*. Bios Scientific, Oxford.

Kumar P. Pati J. (2005) Suprapubic catheters: indications and complications. *Br J Hosp Med* 66: 466–8.

Mallet J, Doherty L. (2001) *The Royal Marsden NHS Trust: Manual of Clinical Nursing Procedures*, 5th edn. Blackwell Science, Oxford.

Roth D. (2006) *Suprapubic Aspiration*. www.emedicine.com/proc/topic82964.htm