Principles of aseptic technique in urinary catheterisation


Summary

Most nurses are aware of the importance of aseptic technique but some may be unsure about applying the technique during urinary catheterisation. This article explains the principles of aseptic technique and their application to the procedure of urinary catheterisation.

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Aims and intended learning outcomes

The aim of this article is to explain the principles of aseptic technique and encourage nurses to apply these principles to the procedure of urinary catheterisation. After reading this article you should be able to:

- Understand how infection can occur during the urinary catheterisation procedure.
- Identify the key components of an aseptic technique.
- Relate the key components of aseptic technique to the procedure of urinary catheterisation.
- Adjust practice to incorporate the principles of aseptic technique into urinary catheterisation procedures in your workplace.
- Consider how a standardised approach to aseptic technique can improve the quality of patient care.

Introduction

The infection risks associated with catheter insertion are not a modern phenomenon. More than a century ago Stewart and Cuff (1899) identified the key risks: ‘It is highly essential that nurses should recognise the extreme importance of absolute cleanliness when passing the catheter. The careless use of an unclean instrument may introduce germs into the bladder, which will grow there and cause it to become inflamed – a most serious and painful condition, the setting up of which every nurse should do her utmost to avoid.’

This advice has changed little in more than 100 years, although current guidelines stipulate that urinary catheters must be inserted using sterile equipment and an aseptic technique (Pratt et al 2001, National Institute for Clinical Excellence (NICE) 2003).

Most nurses are aware of the importance of using an aseptic technique when inserting urinary catheters (Bridger 1997), but some nurses may feel uncertain about how to undertake such a technique (Hallett 2000). This apparent confusion is well documented. Bree-Williams and Waterman (1996) found that not all nurses followed the same actions while carrying out aseptic techniques and that the rationale for the practice of aseptic techniques was not always evidence-based. They further argued that the practice of aseptic technique had become ritualistic and complex.

McLane et al (1983) revealed an unanticipated high number of errors in nurses’ adherence to aseptic techniques, while Kelso (1989) argued that heavy workload was a contributory factor in
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poor compliance, particularly when the aseptic technique was perceived to be complicated. Schraag (2006) suggested that staff often do not apply the principles of asepsis when working in a number of healthcare settings, often believing that aseptic technique is solely applied in the operating theatre.

Urinary catheterisation

Urinary catheterisation is one of the most common healthcare interventions. Millions of urinary catheters are inserted every year, with an estimated 2.5 per cent of patients undergoing the procedure during their hospital stay (Tenke et al 2004). The frequency with which urinary catheterisation occurs should not be viewed as confirmation of its safety. Patients undergoing urinary catheterisation are placed in ‘significant danger’ of acquiring a urinary tract infection (UTI) (Pratt et al 2001).

The term healthcare-associated infection (HCAI) encompasses any infection by any infectious agent acquired as a consequence of treatment for a medical condition, or acquired by healthcare workers in the course of their duties (Department of Health (DH) 2006a). Effective prevention and control of HCAI should be entrenched in everyday practice and applied by all healthcare workers. However, effective action relies on an accumulating body of evidence that takes account of current clinical practices (DH 2006a) and an awareness of the risks posed by clinical interventions.

Best available estimates suggest that 300,000 patients in the UK develop a HCAI each year and at least 5,000 of these patients will die unnecessarily (National Audit Office (NAO) 2005). UTIs account for 23 per cent of HCAIs, 80 per cent of which can be traced to use of indwelling urinary catheters (DH 2003).

Many catheter-associated UTIs (CAUTIs) can be serious and lead to significant morbidity, particularly in patients whose health is already compromised. The risk of acquiring bacteriuria is approximately 5 per cent for each day of catheterisation. Of those patients who acquire CAUTIs, 1-4 per cent will develop bacteraemia and, of these, 13-30 per cent die (Pratt et al 2001).

Urinary catheterisation is usually carried out by nurses (Bissett 2005), who have a professional responsibility to be aware of the risks of infection related to the procedure. Failure to maintain professional knowledge and competence or failure to identify and minimise risk to patients in relation to aseptic technique could be viewed as a failure to meet the standards set out in the Nursing and Midwifery Council’s Code of Professional Conduct (NMC 2004). Practitioners performing urinary catheterisation should therefore have skills and knowledge in regard to the technical aspects of the catheterisation procedure and the ability to accurately apply the principles of aseptic technique to the procedure to minimise risk.

Catheter-associated urinary tract infection The development of CAUTI is multifaceted, however, infections will generally occur in one of three ways (Ellis 2006):

- At insertion because of poor aseptic technique.
- Via intraluminal spread because of colonisation of the drainage bag.
- Via extraluminal spread because of colonisation on the outside of the catheter.

The risk of infection with indwelling devices such as urinary catheters is therefore associated with the method and duration of insertion, the quality of device care and host susceptibility (British Medical Association 2006). Some patients are more vulnerable to infection than others. An individual’s response to invading organisms is influenced by a range of factors, including (Hart 2004):

- Age – neonates and older people have less efficient immune systems.
- Underlying disease – debilitating or malignant disease.
- Previous drug therapy – immunosuppressive drugs and broad spectrum antimicrobials.
- Surgery – instrumentation or the presence of foreign bodies including urinary catheters.

Prevention of infection for immunocompromised patients with multiple risk factors cannot always be achieved but should always be strived for (Taylor et al 2001).

National guidance The DH is committed to reducing the incidence of HCAI (DH 2006a). It has published guidance on reducing risks in key documents such as Winning Ways (DH 2003) and Essential Steps to Safe, Clean Care (DH 2006b). These documents offer guidance on reducing HCAIs based on guidelines such as those developed by Pratt et al (2001) and NICE (2003). These DH publications present clear information on what should be done in specific clinical situations to reduce risks, but give little detail about how it can be done. Saving Lives: A Delivery Programme to Reduce Healthcare Associated Infection Including MRSA (DH 2005) provides a framework to enable organisations to understand the systems and processes required to reduce HCAI. Local interpretation of national
guidance is required to address the ‘how to do’ issues. Detailed operational protocols at local level should incorporate the most important principles for preventing HCAI based on national guidance and guidelines (Pellowe 2004).

However, translating guidance into routine clinical practice can prove difficult. The NAO (2005) highlighted wide variations in compliance with good infection control policies, particularly those relating to catheter care. Despite the significant dangers posed by CAUTIs, Tew et al (2005) suggest that healthcare workers often display ‘catheter apathy’, regarding UTI as an acceptable, harmless consequence of urinary catheterisation which is easy to treat. However, which variations in technique are a result of catheter apathy and which are caused by a lack of understanding of the nature of the risks involved is unclear.

Several simple catheter care practices are recommended to prevent or delay the onset of CAUTI. These include (DH 2003, 2005, 2006b):

- Limiting the risk by avoiding unnecessary catheterisation and removing the catheter as soon as possible.
- Undertaking the procedure and after care as safely as possible.
- Ensuring that only healthcare workers who are competent in aseptic technique should insert urinary catheters.
- Maintaining a closed drainage system.

**Aseptic technique**

Baillière’s nurses’ dictionary (Weller 1997) defines asepsis as ‘freedom from pathogenic micro-organisms’ and aseptic as ‘free from sepsis’. Aseptic technique refers to practices that help to reduce the risk of post-procedure infections in patients by decreasing the likelihood that micro-organisms will enter the body during clinical procedures. The aim of an aseptic technique is to prevent the transmission of micro-organisms either directly or indirectly to wounds or susceptible sites, thus reducing the risk of infection (Hart 2004). It is essential when aseptic techniques are used as a method of preventing infection that these procedures are sound in theory and carried out correctly (Hart 2004).

Aseptic techniques are those that do some or all of the following:

- Remove or kill micro-organisms from hands and objects.
- Use sterile instruments and other items.
- Reduce the patient’s risk of exposure to micro-organisms that cannot be removed.

Aseptic technique can, therefore, refer to any of the practices performed immediately before and during a clinical procedure, such as urinary catheterisation, to reduce infection. These include:

- Hand washing and surgical scrub.
- Using personal protective equipment, for example, gloves, aprons and surgical attire.
- Patient preparation.
- Maintaining a sterile field.
- Using a safe technique.
- Maintaining a safe environment in the procedure area.

Each of these components should be included in every procedure.

**Time out 1**

Consider your professional accountability with reference to the NMC Code of Professional Conduct (NMC 2004) in relation to your practice in performing aseptic technique. Are you confident you understand the key principles of aseptic technique? You may wish to make a list of these and discuss them with a more senior colleague.

**Time out 2**

Take a few minutes to reflect on the last time you undertook urinary catheterisation or observed this procedure being performed. Think of ways in which you could evaluate the effectiveness of the aseptic technique used during the procedure.

**Time out 3**

Soiled hands can be effectively cleaned using an alcohol hand rub. Is this statement true or false? Check your answer with the information in the following section.

**Hand washing**

Hand washing is the single most important procedure for preventing HCAIs, because hands are an important route of infection transmission (Hart 2004). Rowley (2001) suggests that many patients become infected during simple procedures because of poor hand washing technique by healthcare personnel.

Hands should be cleaned before and after every patient contact (Pratt et al 2001), and before an aseptic technique is carried out, even when sterile gloves are also used.
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It is important to remember that hands are colonised by resident and transient bacteria. Skin flora are comprised of mainly Gram-positive organisms of low pathogenicity, for example, diphtheroids, micrococci and coagulase negative staphylococci (*Staphylococcus epidermidis*). Their function is mainly protective and they are difficult to remove without the use of a disinfectant hand wash. However, these organisms are opportunist and may cause infection if introduced into an invasive device such as a urinary catheter. The use of alcohol gel hand rub will slow down bacterial growth.

Transient skin flora are comprised of a mixture of Gram-negative and positive organisms, many of which are harmful if introduced into a susceptible site or to a susceptible person, for example, coliforms such as *Klebsiella* species, *Proteus* species, *Acinetobacter* species, *Escherichia coli* and meticillin-resistant *Staphylococcus aureus* (MRSA). These organisms favour damp conditions such as under rings and artificial nails, but they can be found on all parts of the hands, clothing and in the environment. Porteous (2002) advises that artificial nails should not be worn by those undertaking an aseptic technique because they harbour microbes and cannot be cleaned as effectively as short, natural nails.

Transient flora can be removed using either a soap and water wash or an alcohol hand rub. Both methods require an effective technique to ensure coverage of the whole hand (Royal College of Nursing 2005). Only physically washed hands with soap and water will remove soiling and spores (Infection Control Nurses Association 2003). Appropriate use of an alcohol hand rub avoids the need for nurses to leave the patient during the procedure to wash their hands, during which time contamination may occur (Hart 2004).

Mapping the stages involved in the urinary catheterisation procedure can be used to help nurses assess at which points hands should be washed with soap and water and when alcohol gels can be used. In mapping the process, the healthcare team can identify all points at which hand contamination will occur and what the most appropriate method of hand decontamination will be. The team may find it useful to break down hand washing into a series of steps and consider the risks posed at each step of the process. Points to consider include:

- Access to a wash basin and running water – difficulties posed in patients’ homes.
- Type of tap and risk of hand contamination.
- Availability of soap – extrinsic contamination of non-medicated liquid soap can lead to hand-borne transmission of infection (Sartor et al 2000),
- Facilities available for drying hands following washing – poorly dried hands can transfer micro-organisms to other surfaces more easily than dry hands (Patrick et al 1997).

### Personal protective equipment

During invasive procedures such as urinary catheterisation, staff are at risk of exposure to potentially infectious body fluids. Aseptic techniques protect the nurse as well as the patient by acting as a barrier against micro-organisms.

A no-touch technique is essential to ensure that hands, even though they have been washed, do not contaminate sterile objects or the patient. This can be achieved by the use of either forceps or sterile gloves (Pratt et al 2001). However, it should be remembered that gloves can become damaged during use (Driever et al 2001).

Gloves should be removed carefully to prevent hands becoming contaminated during removal (Pratt et al 2001). Wearing gloves for prolonged periods of time can result in occlusion conditions that encourage rapid growth of flora on nurses’ hands (Pereira et al 1997), therefore careful hand washing is also required following glove removal.

Girou et al (2004) highlight a need for a change of behaviour in glove use. During an observational study, Girou et al (2004) found that healthcare personnel exposed patients to increased risks of infection by failing to change or remove contaminated gloves before performing activities that required an aseptic technique.

Disposable plastic aprons should be worn to protect nurses’ clothing from becoming contaminated by body fluids containing pathogenic micro-organisms which may then be transferred to other patients in their care (Callaghan 1998). Disposable plastic aprons are single-use items worn for one procedure and then discarded (Pratt et al 2001).

### Time out 4

Reflect on the last time you inserted a urinary catheter. How did you prepare the patient in advance of the procedure? Would you do anything differently next time?

### Patient preparation

Patient preparation should start by providing him or her with adequate information about the need for, insertion, maintenance and removal of the urinary catheter (Pellowe et al 2004). This includes information regarding the risks of CAUTI (DH 2006a). It may
be useful to explain the principles of aseptic technique to patients, including what they can and cannot touch during the procedure.

The usually harmless micro-organisms found on the skin of a patient may cause infection when introduced into an area of the body where they are not usually found. These normal flora can cause infection in an immunocompromised patient, who is especially susceptible to infection. Bissett (2005) suggests that if catheterisation is inevitable, a thorough risk assessment should be completed before inserting the catheter.

Maki and Tambyah (2001) emphasise that infection can occur extraluminally (via the outside of the catheter) when the catheter is inserted, therefore careful cleaning of the urethral meatus should be undertaken. Meatal cleansing involves the mechanical removal of exudate and smegma (Association for Continence Advice 2003). It is not necessary to use an antiseptic preparation to clean the urethral meatus before catheter insertion (Pratt et al 2001), however, to avoid contamination of the sterile procedure field it is advisable to use a sterile solution to cleanse the urethral meatus. Sterile saline or water may be considered. However, the team should agree what solution will be used as part of the standardisation procedure. If possible the patient should be advised to wash with unperfumed soap and water before the catheterisation procedure is commenced. Standard principles for cleansing the urethral meatus include retracting the foreskin (where possible) and cleaning the glans for men and adopting a front to back cleaning technique for women. The labia minora should be separated and the urethral opening washed using sterile water and cotton wool balls or a sterile topical solution. The urethral meatus should be undertaken. Meatal cleansing involves the mechanical removal of exudate and smegma (Association for Continence Advice 2003). It is not necessary to use an antiseptic preparation to clean the urethral meatus before catheter insertion (Pratt et al 2001), however, to avoid contamination of the sterile procedure field it is advisable to use a sterile solution to cleanse the urethral meatus. Sterile saline or water may be considered. However, the team should agree what solution will be used as part of the standardisation procedure. If possible the patient should be advised to wash with unperfumed soap and water before the catheterisation procedure is commenced. Standard principles for cleansing the urethral meatus include retracting the foreskin (where possible) and cleaning the glans for men and adopting a front to back cleaning technique for women. The labia minora should be separated and the urethral opening washed using sterile water and cotton wool balls or a sterile topical solution. Each cotton wool ball should be discarded after a single use (Dutch Working Party Infection Prevention 2004).

Maintaining a sterile field

Maintaining the integrity of the sterile field is vital wherever urinary catheterisation is being performed. Differing approaches will apply depending on the environment in which the catheterisation is performed. Regardless of whether the procedure will be performed in a hospital or the patient’s home, the same principles apply.

Catheter packs should be used to provide a sterile field. If no packs are available, a sterile field should be created using sterile hand towels. The surface to be used for the procedure should be thoroughly cleaned with a neutral detergent and warm water and then wiped using an alcohol-impregnated wipe:

- Lay out all necessary equipment on a trolley or appropriate work surface – assemble all appropriate sterile items for the procedure.
- The team should decide at which points hand washing or alcohol hand rub should be used and all staff should adhere to this protocol.
- Staff should remember there are differing degrees of clean and dirty. Sterile is a higher level of cleanliness than disinfected. Work surfaces are dirtier than equipment.
- Movement should always be from clean to dirty. Movement from dirty to clean requires sterilisation, disinfection or sanitisation first:
  - Know what is clean.
  - Know what is contaminated.
  - Know what is sterile.
  - Keep clean, contaminated and sterile items separate.
  - Keep sterile sites sterile.
  - Resolve contamination immediately.
  - Learn to recognise when you have broken the aseptic technique.

Safe technique

Urinary catheterisation is a skilled procedure for which healthcare personnel require training and an assessment of their competence (Pellowe 2004). Only staff assessed as competent should perform an aseptic technique. Nurses with expertise in urinary catheterisation should share their knowledge with newly qualified staff, nursing students and support workers, and ensure that their practice is based on the best evidence available (Bissett 2005). New staff members should have their catheterisation skills assessed by a senior member of staff who has the necessary skills before being permitted to carry out the procedure independently (NICE 2003). Local policies and procedures for the insertion of a catheter in male, female and paediatric patients should be followed (Bissett 2005).

Patients should be provided with adequate information about the need for insertion, maintenance and removal of the catheter by the person planning their care and be given the opportunity to discuss the implications of urinary catheterisation.

The choice of catheter material and size will vary depending on individual patient assessment (NICE 2003), however, silver alloy catheters have been found to significantly reduce the incidence of asymptomatic bacteriuria in hospitalised adults catheterised for less than one week, compared with standard catheters. Silver alloy catheters are also associated with a reduced risk of symptomatic UTI (Pellowe et al 2004).

Catheter selection should be made before the procedure starts, because breaking off during the procedure increases the risk of contaminating hands and sterile fields.

Antibiotic prophylaxis when changing catheters should only be used for patients with a history of CAUTI following catheter change, or...
for patients who have a heart valve lesion, septal defect, patent ductus or prosthetic valve (NICE 2003). There is evidence that changing the indwelling catheter at start of antibiotic therapy significantly improves the clinical and microbiological outcome by removing the bacteria contained within the biofilm (Raz et al 1998). However, an aseptic technique is still required even if the patient is to receive a silver alloy catheter, or is receiving antibiotic therapy.

All medical devices must carry the CE (Conformité Européenne) mark which allows patients, clinicians and other users to be confident that the medical device will perform as the manufacturer intends and is safe when used as instructed (Doherty 2006).

Urethral catheterisation can cause bruising and trauma to the urethral mucosa, which then acts as an entry point for micro-organisms into the blood and lymphatic system (Bardsley 2005). NICE (2003) recommend that an appropriate lubricant from a single-use container should be used during catheterisation to minimise trauma and infection.

**Maintaining a safe environment** Most clinical areas are not designed to meet the same high standards of asepsis as the operating theatre. However, the goal of avoiding potential HCAIs should be universal. The environment should not affect other key aspects of the technique such as hand washing and safe use of equipment. Therefore, careful consideration of the processes involved when performing urinary catheterisation in a patient’s home may be indicated. Wherever the procedure is performed, hazardous waste, wet or soiled dressings and soiled incontinence pads must be removed from the immediate area. In some cases, general cleaning may be required to ensure that there is an appropriate area in which to establish the sterile field. Avoid performing an aseptic procedure for at least 30 minutes after bed making or domestic cleaning to reduce the risk of contamination by airborne micro-organisms.

All equipment should be stored correctly to ensure its sterility; patients should be given appropriate advice if equipment is to be stored in the home. Process mapping (Box 1) enables the team to assess the equipment they are using and lobby local supply departments if they feel the equipment they are issued with is not conducive to a good aseptic technique. For example, the team may wish to only use catheters that are packaged with an inner sterile sleeve which allows for non-contamination of the catheter during insertion.

There are many ways to accomplish an effective aseptic technique. Different situations may call for a slightly different approach: for example, catheterisation as part of a surgical operation versus a procedure carried out in a patient’s home; yet the essential components will still be required. However, it may be these apparent variances that cause confusion for nurses and lead to poor implementation of the technique (Schraag 2006).

**Process mapping**

Process mapping is a method for depicting a process, such as urinary catheterisation, in a diagrammatic format. Flow charts are developed to enable the team to gain a clearer understanding of the process currently in use and to identify ways in which the process could be improved.

**Standardised aseptic technique**

It has been proposed that aseptic techniques should be standardised across an organisation, and that audits are used to monitor compliance (DH 2006a). A standardised approach to aseptic technique can achieve impressive results. In October 2003 it was reported that a specialist cancer unit had the lowest rates of MRSA and other HCAIs in the then University College London Hospitals (UCLH) NHS Trust. This was unusual because the patients in this unit were statistically more susceptible to infection than other patients because of underlying malignant disease. These results were achieved by the introduction in the unit of a standardised aseptic technique when administering procedures such as intravenous injections. This standardised approach ensured that hand washing was effective and done at the right times and eliminated ad hoc, variable aseptic techniques (UCLH 2003).

The standardised approach in this example was developed by applying a number of key
principles to the aseptic technique in question. The principles are as follows (Rowley 2001):

- The steps of the aseptic technique are broken down and focus on the main elements of risk to the patient.
- This directs practice to the most important aspects of asepsis and makes accurate and detailed audit easier.
- Known areas of ambiguity and variable practice are rationalised with prescriptive and clear direction.
- The order by which the steps of the technique are performed is fixed, which reduces the variables and makes audit and evaluation easier.
- The technique is designed to be time and cost-efficient.
- Effective hand washing is always central.

This step-by-step approach can be applied to aseptic technique during urinary catheterisation. Process mapping can be used by any healthcare team to identify where it needs to start making improvements that will have the greatest effect for patients and staff. Control of unintended variation in aseptic technique should be viewed by healthcare workers as a quality control initiative (Berwick 1991). It is vital that all relevant team members are involved in the process of practice improvement. Not only will such involvement allow everyone to contribute to the discussions, but it will also help them to understand the aim and agree how to evaluate success or lack of it. Three key questions can help provide a focus (Berwick 1996):

- Where do we want to go?
- How are we going to get there?
- What will success look like when we get there?

**Time out 7**

List the healthcare team members who should be involved in developing a standardised approach to aseptic technique within an organisation.

**References**

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Once the most appropriate method of performing an aseptic technique is agreed, a map of the improved way of working should be produced. This becomes the protocol for practice. As new clinical evidence becomes available the process should be repeated and protocols amended accordingly. It is essential that practitioners are able to apply the principles of aseptic technique to their working area. If unsure, advice should be sought from local infection control teams, specialist nurses for continence care and urology or urogynaecology nurse specialists.

**Conclusion**

Urinary catheterisation is a procedure that has the potential to cause significant harm to patients. The procedure must be performed using an aseptic technique. However, confusion about effective aseptic techniques may increase infection risks. Anyone who performs the procedure has a responsibility to ensure they are aware of the risks specific to the patient group they are caring for and have the skills and knowledge to apply the principles of a good aseptic technique in their work area. Teamwork is essential in developing a standardised approach. Reviewing the process and agreeing how the required components can be achieved can help to ensure best practice.

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