4

Aseptic technique

Chapter contents

Definition

Aseptic technique is the effort taken to keep the patient as free from hospital micro-organisms as possible (Crow 1989). It is a method used to prevent contamination of wounds and other susceptible sites by organisms that could cause infection. This can be achieved by ensuring that only sterile equipment and fluids are used during invasive medical and nursing procedures. Ayliffe *et al.* (2000) suggest that there are two types of asepsis: medical and surgical asepsis. Medical or clean asepsis reduces the number of organisms and prevents their spread; surgical or sterile asepsis includes procedures to eliminate micro-organisms from an area and is practised by nurses in operating theatres and treatment areas.

A randomized prospective study has been undertaken to evaluate whether some procedures should be included in the medical or surgical category. Using a medical aseptic non-touch technique compared to a surgical technique when changing central venous devices, fluids or lines caused no difference in infection rates, indicating that it was safe to use the simpler non-touch medical aseptic technique (Larwood *et al.* 2000).

Indications

Patients have a right to be protected from preventable infection and nurses have a duty to safeguard the well-being of their patients (King 1998). An aseptic technique should be implemented during any invasive procedure that bypasses the body's natural defences, e.g. the skin and mucous membranes, or when handling equipment such as intravenous cannulae and urinary catheters that have been used during these procedures.

Whilst it is difficult to maintain sterility, it is important to prevent contamination of sterile equipment. Poor aseptic techniques can lead to contamination. A 22% syringe contamination rate was observed for syringes

prepared by intensive care unit nurses, compared to a 1% rate for the syringes prepared by pharmaceutical technicians (Van Grafhorst *et al.* 2002).

A study to establish nurses' actions whilst carrying out aseptic techniques suggested that not all nurses followed the same actions and that the rationale for the practice of aseptic techniques is not always research based (Bree-Williams & Waterman 1996). Similar discrepancies were found amongst medical staff (Sellors *et al.* 2002). Nurses can feel uncertain about how to undertake an aseptic technique (Hallett 2000). Unfortunately some infection control practices routinely used cannot be rigorously studied for ethical or logistical reasons, for example wearing versus not wearing gloves (Mangram *et al.* 1999).

Briggs *et al.* (1996) suggest assessment of the individual patient's circumstances before each procedure. By predicting and planning for potential problems asepsis can be maintained.

Reference material

Hospital-acquired infection (HAI) (also called nosocomial infection) is defined as infection occurring in patients after admission to hospital that was neither present nor incubating at the time of admission. Infections acquired in hospital but not manifest until after the patient is discharged are included in the definition (Ayliffe *et al.* 2000). Crowe & Cooke (1998) reviewed the case definition for nosocomial infections, finding areas of consensus and variation which made comparisons of infection rates difficult.

In 1980 a national survey found that one in ten patients acquired an infection whilst in hospital (Meers *et al.* 1980). Few changes were found following a second national prevalence survey of HAI which was reported on in 1996. This survey assessed 37 111 patients from 157 centres and found a HAI prevalence rate of 9% (range 2–29%) (Emmerson *et al.* 1996). Three major sites of infection related to asepsis were highlighted: urinary tract infection 23.2% (risk increased following catheterization), surgical wound infection 10.7% and skin infection 9.6% (invasive procedures increasing the risk of skin infection).

Immunocompromised patients have an increased risk of HAI. Risk factors include underlying disease, invasive procedures, medical devices and length of hospital stay. Prevention of infection for those immunocompromised patients with multiple risk factors cannot always be achieved (Taylor *et al.* 2001). Infections acquired by neutropenic patients differ from those of general hospitalized patients. Bloodstream infections are the most common infections for neutropenic patients with haematological malignancies (Glauser & Calandra 2000) and recovery from these is often poor (Garrouste-Orgeas *et al.* 2000).

Risk factors associated with HAI include invasive procedures, indwelling devices, malignancy, a stay in intensive care or surgical department and length of hospital stay (Rojo *et al.* 1999).

The cost of infection is high, to both the patient and the hospital. HAI increase mortality and morbidity and cause an increase in pain and suffering experienced by the patients (Fagon *et al.* 1994). The patient may be inconvenienced by a prolonged period of hospitalization, which can cause economic and social hardships to the whole family: 1–4 days for urinary tract infection; 7–8.2 days for surgical site infection; 7–21 days for bloodstream infections and 6.8–30 days for pneumonia (Jarvis 1996). The hospital will have increased waiting lists and increased hospital costs. Breaks in aseptic techniques have been implicated in outbreaks of infection (Manning *et al.* 2001). It is essential when aseptic techniques are used as a method of preventing infection that these procedures are sound in theory and are carried out correctly.

Hospitals recognize the significance of nosocomial infections and employ infection control teams to:

- Reduce the likelihood of patients being exposed to infectious micro-organisms while in hospital.
- Provide adequate care for patients with communicable infections.
- Minimize the likelihood of employees, visitors and communicable contacts being exposed to infectious micro-organisms.
- Develop policies for appropriate management of patients with communicable infections.
- Provide surveillance systems which give adequate feedback to appropriate staff.
- Provide education in techniques to prevent the emergence and spread of infection.

A 10-year study in the USA found that an infection control team reduced the incidence of HAI by up to 32%. Hospitals in the study with no infection control programme experienced an increase in infection rates of up to 18% (Haley *et al.* 1985a). A 3-year study reported a reduction in the infection rate from 10.5 to 5.6% following the introduction of an infection control team (French *et al.* 1989).

A survey of factors which influence compliance with infection control procedures highlighted lack of knowledge, lack of time and shortage of staff and the standard set by senior staff including surgeons and nurses (Sherwood 1995) and overcrowding (Archibold *et al.*

Table 4.1 Surgical site infections can be further divided by surgical category

Surgical category	Infection risk
Clean (non-traumatic wound where respiratory, alimentary and genitourinary tracts were not entered)	1.5–4.2%
Clean/contaminated (non-traumatic wound in which respiratory, alimentary and genitourinary tracts were entered without significant spillage)	Less than 10%
Contaminated (fresh traumatic wound from a relatively clean source or an operative wound with gross spillage from the gastrointestinal tract or entrance into genitourinary or biliary tract in the presence of infected urine or bile)	10–20%
Dirty or infected (traumatic wound from a dirty source or delayed treatment, faecal contamination, foreign bodies, a devitalized viscus or pus)	20–30%

1997) as relevant indicators. It was suggested that greater emphasis and knowledge may motivate staff to make time for correct compliance with infection control procedures.

All staff involved in patient care must receive education and training in the prevention of HAI (DoH 2001a). Creativity is required when facilitating learning related to infection control (Ford & Koehler 2001). Feedback of infection rates can achieve changes in practice (Reilly 2002).

When cross-infection does occur the cost of investigating and controlling even a small outbreak is high. It has been estimated that an infection increases the costs of health care by more than 300% (Whitehouse *et al.* 2002), emphasizing how important it is to prevent infection. The Infection Control Standards Working Party has prepared standards for practice to make prevention, detection and control of infection in hospitals as effective as possible (Infection Control Standards Working Party 1993). Surgical wound infections are the second most common nosocomial infection in England and Wales (Mangram *et al.* 1999). Prevention of postoperative wound infections relies on flawless aseptic technique principles in the operating theatre and the wards (Clayton 1996).

The diagnosis of infection relies on classic signs of inflammation such as local redness, swelling and pain, although decreased numbers of neutrophils produce minimal or atypical clinical signs of infection (Candell & Whedon 1991). These local signs and symptoms can precede a further sequence of events, which can be lymphangitis, lymphadenitis, bacteraemia and septicaemia which, if not promptly recognized and treated, can result in death.

Some patients die each year as a result of HAI. Whilst many of these fatalities occur in patients already dying from other causes and/or in patients whose infections were not preventable, a proportion of these deaths are avoidable (DoH 1995; Taylor *et al.* 2001). The risk of death increases with the severity of the patient's underlying disease.

A study to assess nurses' adherence to aseptic techniques revealed an unanticipated high number of errors (McLane *et al.* 1983). The nurses' heavy workload was a contributing factor in poor compliance to aseptic techniques, which suggests that unnecessary time-consuming aspects of an aseptic technique should be avoided (Kelso 1989). This view is supported by Bree-Williams & Waterman's (1996) study, which highlighted that the practice of aseptic technique has become ritualistic and complex, and simpler practices are easier, cheaper and not detrimental to the patients.

Gwyther (1988) discusses how most teaching occurs on the hospital ward and questioned whether this teaching was based on knowledge of the principles of, for example, wound care, or simply on experience. Jenks & Ferguson (1994) reviewed the discrepancy between what is taught in the classroom and what nurses experience in the clinical setting. This suggested that collaboration is needed between education and service staff to integrate learning within the nursing curricula. Thomlinson (1990) emphasizes the importance of replacing infection control procedures which involve unnecessary ritual with sound, cost-efficient and environmentally responsible practices to encourage a greater understanding of the principles of asepsis. These authors highlight a continuing problem and it has been suggested that the principles of aseptic techniques need to be re-established (Lund & Caruso 1993), to ensure nurses understand the importance of prevention of infection (Davey 1997).

Principles of asepsis

Infection is caused by organisms which invade the host's immunological defence mechanisms, although susceptibility to infection may vary from person to person (Gould 1994). The risk of infection is increased if the patient is immunocompromised (Hart 1990) by:

- Age. Neonates and the elderly are more at risk because their immune systems are less efficient.
- Underlying disease. For example, those patients with severe debilitating or malignant disease.

- Prior drug therapy, such as the use of immunosuppressive drugs or the use of broad-spectrum antimicrobials.
- Patients undergoing surgery or instrumentation.

The following factors must be considered when nursing immunocompromised patients.

- Classic signs and symptoms of infection are often absent.
- Untreated infection may disseminate rapidly.
- Infections may be caused by unusual organisms or organisms which, in most circumstances, are non-pathogenic.
- Some antibiotics are less effective in immunocompromised patients.
- Repeated infections may be caused by the same organism.
- Superinfections, where a patient acquires a more pathogenic organism (of the same or different species) than the one already causing infection (Laurence *et al.* 2002), require nursing care of the highest standard, including strict adherence to aseptic technique to prevent such infections.

Sproat & Inglis (1992) suggest that a basic principle of infection control for all patients is to assess the risk of infection from one patient to another and to plan nursing care accordingly before action is taken. Haley *et al.* (1985b) add that if each patient is evaluated individually it is possible to focus more closely on those patients who are most susceptible to infection. The most usual means for spread of infection include:

- Hands of the staff involved
- Inanimate objects, e.g. instruments and clothes
- Dust particles or droplet nuclei suspended in the atmosphere.

Hand washing

Hand washing is well researched and uncontroversial, having been found to be the single most important procedure for preventing nosocomial infection as hands have been shown to be an important route of transmission of infection (DoH 2001a). Even brief contact can transmit 10 000 colony-forming units to hands (Gould 1993). However, studies have shown that hand washing is rarely carried out in a satisfactory manner (Taylor 1978a), with the most important factor inhibiting hand washing being busyness (Cohen *et al.* 2002) or inaccessible sinks (Harris *et al.* 2000). Studies have shown that up to 89% of staff miss some part of the hand surface during hand washing (Taylor 1978a) (Fig. 4.1).

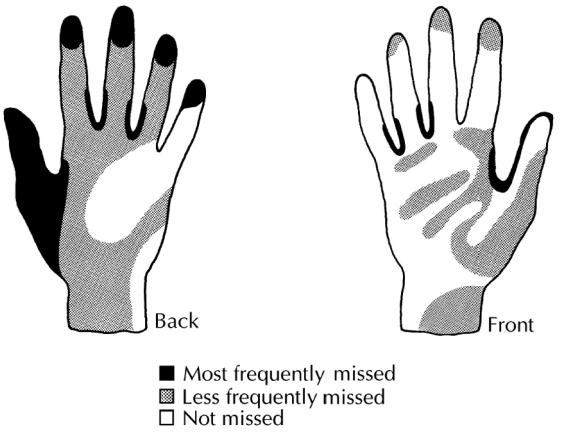

Figure 4.1 Areas most commonly missed following hand washing. (Reproduced by kind permission of *Nursing Times*, where this article first appeared in 1978.)

Hands must be cleaned before and after every patient contact (DoH 2001a). Hand washing can be achieved by three methods:

- Soap and water are effective in removing physical dirt or soiling and transient micro-organisms (Grinbaums *et al.* 1995). Extrinsic contamination of non-medicated liquid soap can lead to handborne transmission of infection (Sartor *et al.* 2000).
- Antimicrobial detergent is effective in removing physical dirt and soiling and more effective in removing resident micro-organisms than soap and water.
- Alcohol-based handrub, whilst not effective in removing physical dirt or soiling, is more effective in destroying transient bacteria than more time-consuming hand-wash methods. Therefore, hands that are visibly soiled or potentially contaminated with dirt or organic matter must be washed first with liquid soap and running water before using alcohol-based handrub (DoH 2001a).

Taylor (1978b) and Phillips (1989) use Feldman's criteria for hand washing, which include the following:

1 Roll up sleeves, remove rings and wrist watches.
2 Use continuously running water.
3 Use soap.
4 Position hands to avoid contaminating arms.
5 Avoid splashing clothing or floor.
6 Rub hands together vigorously.
7 Use friction on all surfaces.
8 Rinse hands thoroughly with hand held down to rinse.
9 Dry hands thoroughly.

Hand washing should be undertaken after patient contact and before an aseptic technique is performed (DoH 2001a).

A dispenser of alcoholic handrub should be placed on the lower shelf of all trolleys used for aseptic techniques, to allow hands to be cleaned during the aseptic procedure. A nurse with 'socially clean' hands will not need to wash them during the aseptic procedure, but should use a bactericidal alcoholic handrub whenever disinfection is required, e.g. after opening the outer wrappers of dressings. It is unlikely that nurses' hands will become soiled with blood or body fluids as long as blood and body fluid precautions are adopted at all times (Hart 1991). The use of a handrub will also remove the need for the nurse to leave the patient during the procedure to wash the hands at the nearest basin, during which time contamination may occur.

Compliance with hand washing can be improved through targeted teaching (Colombo *et al.* 2002). Multiple interventions to improve compliance have been seen to be more successful than individual events, although compliance can decrease when interventions cease (Hinkin 2002).

The wearing of rings increases the number of bacteria on hands (Salisbury *et al.* 1997). Studies comparing the quantities of bacteria from under rings and watches found increased numbers of bacteria compared to the control group who were not wearing jewellery. Effective hand washing is difficult to achieve if watches and rings are not removed (Field *et al.* 1996). Artificial nails harbour microbes and cannot be cleaned as effectively as short, natural nails and must not be worn by those undertaking aseptic techniques (Porteous 2002).

Washed, wet and poorly dried hands can more easily transfer micro-organisms to other surfaces than dry hands (Patrick *et al.* 1997); the damper the hands, the greater the number of micro-organisms (Taylor *et al.* 2000). Thorough drying of hands after hand washing is essential but lapses in hand drying do occur (Chandra & Milind 2001). Electric air drying or disposable paper towels are the usual method of hand drying; the choice depends on the area where the hand washing is being undertaken and on issues such as noise and heat generation, waste disposal and the availability of a regular supply of paper towels. Research indicates that there is no significant difference between the two drying methods (Gustafson *et al.* 2000). However, if hands have not been washed thoroughly, electric air drying removes more organisms than paper towels (Ansari *et al.* 1991). Electric air dryers have been found to be ineffective for drying larger amounts of water (Merry *et al.* 2001). This suggests that the preferred method is the drying of hands with a good-quality paper towel (DoH 2001a).

No-touch technique

A no-touch technique is essential to ensure that hands, even though they have been washed, do not contaminate the sterile equipment or the patient. This can be achieved by the use of either forceps or sterile gloves (DoH 2001a). However, it must be remembered that forceps may damage tissue (David 1991) and gloves can become damaged during use (Driever *et al.* 2001). There is no direct evidence that gloves that leak result in transmission of infection (DoH 2001a). However, gloves can become contaminated during use with firm touching of the skin rather than light touching, leading to increased contamination (Kocent *et al.* 2002). Gloves must be removed carefully to prevent hands becoming contaminated during removal (DoH 2001a).

It has been reported that prolonged glove use can produce occlusion conditions which encourage the rapid growth of skin flora on nurses' hands (Pereira *et al.* 1997). It is, therefore, essential to clean hands following the removal of gloves.

Inanimate objects

All instruments, fluids and materials that come into contact with the wound must be sterile if the risk of contamination is to be reduced. Crow (1994) suggests four principles of asepsis which are: know what is sterile, and what is not sterile, keep these two types of items separate and replace contaminated items immediately. The sterile supplies department should normally provide all sterile instruments.

The Department of Health (NHSE 2000) requires that all surgical instruments are traceable to the process that washed, packed and autoclaved the pack, and on whom the pack has been used. A traceability system means that the cleaning, packing and sterilization process can be checked. This ensures that the correct procedure had been undertaken at all stages of the process. If a problem occurs either with the pack or with the patient on whom the pack has been used, the instruments can be traced. These systems involve the instrument pack being labelled to prove it has gone through a sterile process. Prior to the pack being released from the autoclave, a trained person inspects the autoclave cycle responsible for the sterilization of the pack, to ensure the autoclave cycle was completed satisfactorily (NHSE 2000). When using the pack it must be checked for conformance; this includes whether the steam indicator has changed colour, the product is in date and it is undamaged. Once the pack has been used, the label has to be removed from the pack and put in the patient's notes.

All medical devices must carry the CE (Conformité Europèene) marking 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 (Medical Devices Agency 1997). Any faults or incidents with medical devices must be reported (Medical Devices Agency 2000).

The manufacturer's recommendations for all clinical supplies must be followed at all times. The reuse of single-use items must not occur and could result in legal, economic and ethical consequences (Medical Devices Agency 1995).

Forceps can be used to arrange the dressing pack, and then to remove the used dressing before being discarded (Kelso 1989). Alternatively the washed hands can be inserted into the polythene waste bag to arrange the pack before removing the used dressing. The bag which contains the used dressing is then inverted, before the bag is attached to the dressing trolley. Any equipment that becomes contaminated during a procedure must be discarded. On *no* account should it be returned to the sterile field. Care must also be taken to ensure that equipment and lotions are sterile and that packaging is undamaged before use.

While following aseptic technique, it is important to evaluate the whole procedure to ensure that the principles are followed throughout the whole process. Potential problems such as reusing left-over dressings or taking tape from a contaminated roll (Oldman 1991) will therefore be avoided.

The dressing trolley

Most disinfectants are not sporicidal, have a limited antimicrobial spectrum and must be used only on clean surfaces or equipment, e.g. instruments, as they may fail to penetrate blood or pus (Ayliffe *et al.* 2000). Therefore it is essential that equipment such as trolleys is cleaned daily and, when it becomes contaminated, with a detergent solution and dried carefully with paper towels. This will remove a high proportion of micro-organisms, including bacterial spores (Ayliffe *et al.* 2000). Prior to use for aseptic technique, trolleys should be wiped over with chlorhexidine in 70% ethanol alcohol using a clean paper towel (Ayliffe *et al.* 2000). Trolleys used for aseptic procedures must not be used for any other purpose.

Personal protective equipment (PPE)

PPE means all equipment which is intended to be worn to protect a person against risks to their health and that which may compromise their safety. The Personal Protective Equipment at Work Regulations (HSE 1992) require employers to carry out a formal assessment of the PPE needs of their employees. The aim of the assessment is to identify any foreseeable risks that cannot be controlled by other means and the suitable PPE available to reduce risk (Masterson & Teare 2001). All PPE must have an appropriate British Standard kitemark or European Community CE mark. Staff required to wear PPE must be provided with information, instruction and training on the hazards from which the PPE does or does not protect the wearer, and the purpose, correct use, limitations, maintenance and storage information related to the PPE. If an individual is carrying out any task that involves blood or body fluids they require PPE for the following reasons.

- To prevent the user's clothing becoming contaminated with pathogenic micro-organisms which may subsequently be transferred to other patients in their care (Callaghan 1998).
- To prevent the user's clothing becoming soiled, wet or stained during the course of their duties.
- To prevent transfer of potentially pathogenic micro-organisms from user to patient.
- To prevent the user acquiring infection from the patient (DoH 2001a).

Uniform and other protective clothing should not be taken home for laundering unless it is unavoidable (Ayliffe *et al.* 2000). In these circumstances an automatic washing machine and an automatic dryer on a hot setting should be used (Kiehl *et al.* 1997).

There is evidence that transfer of organisms can occur from one room to another on clothing (Hambraeus 1973). An impermeable apron offers better protection than a cotton gown, which allows bacteria and moisture to pass through because of the weave (Mackintosh *et al.* 1980). It is therefore recommended that a disposable plastic apron, which is impermeable to bacteria, is worn during aseptic procedures. Plastic aprons are single-use items and are worn for one procedure or episode of patient care and then removed (DoH 2001a). Gowns must be worn when undertaking invasive surgical procedures, for example when inserting central venous catheters (DoH 2001b). Reusable gowns demonstrate variations in penetrability but the disposable gown performs to a higher standard (Lankester *et al.* 2001). Reusable gowns can allow bacteria to pass through, providing a false sense of security to the wearer (Lovitt *et al.* 1992).

Surgical masks are an integral part of theatre clothing. However, it has never been shown that wearing a surgical mask decreases postoperative wound infections (Tunevall 1991). Lipp & Edwards (2002) suggest further research is required to evaluate the benefit to patients of surgical masks. The wearing of masks continues to be

essential for the wearer's protection against aerosol contamination from blood and body fluids (Sharma *et al.* 1997; Edwards 2001). Masks must be worn as part of routine universal precautions when there is a risk of airborne aerosol of blood or body fluids, administration of toxic drugs or contact with patients who are smear positive with drug-resistant tuberculosis (DoH 1998). These masks must comply with The Control of Substances Hazardous to Health (COSHH) (1988) regulations. For surgical procedures undertaken on the wards masks are generally not required. There is no evidence that wearing a face mask is important in preventing catheter-related infection during central catheter insertion (DoH 2001b).

Gloves

Disposable gloves are available in latex and synthetic materials, in sterile and non-sterile form and with and without powder (O'Toole 1997). Some people are allergic to the natural proteins or the chemical additives found in latex medical gloves, resulting in allergic reactions that range from contact dermatitis to anaphylactic shock (Medical Devices Agency 1998). Some allergies are caused by the use of powdered gloves (North Thames Audit and Clinical Effectiveness in Occupational Health 2000). Non-powdered gloves made from materials other than latex must be provided (Medical Devices Agency 1998).

Latex allergy guidelines pertaining to the safety of patients and staff must be available, All health care workers must be knowledgeable about latex allergy and its related issues (Wright *et al.* 2001). Problems related to latex allergies must be reported to the Occupational Health Department immediately for early diagnosis and treatment (Medical Devices Agency 1996). Incidences of latex sensitivity are reportable to the Health and Safety Executive under RIDDOR (HSE 1995; NHSE 1999).

Boxed, clean, non-sterile, powder-free gloves made from materials other than latex are safe for routine use (Rossoff *et al.* 1993), in particular to protect hands from contamination with organic matter and micro-organisms (DoH 2001a). However, boxed, clean, non-sterile gloves should not be used for aseptic techniques (Kunaratanapruk & Silpapojakul 1999; Raybould 2001) as there is insufficient evidence to justify a practice change to non-sterile gloves for aseptic techniques (St Clair & Harrabee 2002). Efforts must be made when wearing gloves to avoid glove contamination (Kocent *et al.* 2002) and glove damage (Cork *et al.* 1995).

Protective footwear

Micro-organisms can be found on the bottom of footwear (Haigh 1993). However, the risk of acquiring infection from floors (Ayliffe *et al.* 2000) and the bottom of health care workers' footwear is low (Haigh 1993). Whilst washable shoes must be kept for those entering the operating theatre (Ayliffe *et al.* 2000), footwear worn elsewhere in the hospital is chosen to comply with risk management rather than infection control.

Environmental cleanliness

The NHS requires that patients are nursed in a clean, comfortable and safe environment. The NHS Performance Assessment Framework (1999) includes a cleanliness standard. The standard can be used to monitor and improve cleaning services. The standard has five key objectives: take cleaning seriously, listen to patients, infection control, education, development and monitoring. Included in the standard are lists of elements and their cleaning requirements. These include odour control and a tidy, uncluttered, well-maintained environment (NHS 2001).

Good hospital hygiene is an integral and important component for preventing HAI. Unfortunately extensive contamination of the hospital environment is known to occur (Oie *et al.* 2002). The patient area must be visibly clean, free of dust and soilage before an aseptic technique is commenced. Therefore thorough cleaning, clean laundry, safe collection of waste and food hygiene and pest control are essential (DoH 2001a).

Routine cleaning of the environment is the responsibility of the hospital domestic staff. Cleaning must be suspended during aseptic techniques (Ayliffe *et al.* 2000).

Patient hygiene

Most surgical site infections are caused by micro-organisms from the patient's own commensal flora (Lauwers & de Smet 1998). People who shower with chlorhexidine detergent have a significant reduction in skin flora (Paulson 1993). During surgery, studies indicate that preoperative showering with chlorhexidine reduces intraoperative wound contamination, although there was no significant difference in bacterial counts at the end of surgery between preoperative bathing with chlorhexidine or plain soap (Byrne *et al.* 1991a). Concerns regarding the colonization of the skin with potential pathogens of the patients who had preoperative chlorhexidine were unfounded (Byrne *et al.* 1991b). A large prospective study to establish whether showering or bathing was more efficient in reducing skin flora found that showering decreased levels by 93.55% and bathing by 70.98% (Byrne *et al.* 1990).

Studies have established that it is not detrimental for stitches of surgical wounds to get wet, as healing is not delayed and there is no increase in the incidence of infections (Noe *et al.* 1988).

A protective dressing should be worn whilst showering or bathing to protect the wound and stitches. After showering any non-waterproof dressing should be changed immediately. The use of a transparent film dressing allows continuous inspection and more secure anchorage as well as protecting against wetting during showering (Ward *et al.* 1997).

Airborne contamination

The spread of airborne infection is most likely to occur following procedures such as bed making (Shiomori *et al.* 2002) and cleaning, which can disperse organisms into the air. Airborne contamination of sterile goods can occur (Dietze *et al.* 2001). Ideally such activities should cease 30 minutes before a dressing is to be undertaken. To reduce further the risk of airborne contamination of open wounds the wound should be exposed for as short a time as possible (Ayliffe *et al.* 2000). Dirty dressings should be placed carefully in a yellow clinical waste bag, which is sealed before disposal (Lowbury *et al.* 1981). Clean wounds should be dressed before contaminated wounds. Colostomies and infected wounds should be dressed last of all to minimize environmental contamination and cross-infection.

Air movement should be kept to a minimum during the dressing. This means that adjacent windows should be closed and the movement of personnel within the area discouraged.

Procedure guidelines: **Aseptic technique**

Equipment

1 Sterile dressing pack* containing gallipots or an indented plastic tray, low-linting swabs and/or medical foam, disposable forceps, gloves, sterile field, disposable bag.
2 Fluids for cleaning and/or irrigation.
3 Hypo-allergenic tape.
4 Appropriate dressing (see Ch. 47, Wound management).
5 Appropriate hand hygiene preparation.
6 Any other material will be determined by the nature of the dressing: special features of a dressing should be referred to in the patient's nursing care plan.
7 Any extra equipment that may be needed during procedure, e.g. sterile scissors.
8 Chlorhexidine in 70% spirit and paper towels for cleaning trolley.
9 Total traceability system for surgical instruments and patient record form.

Procedure

	Action	Rationale
1	Explain and discuss the procedure with the patient.	To ensure that the patient understands the procedure and gives his/her valid consent.
2	Clean hands with bactericidal alcohol rub.	Hands must be cleaned before and after every patient contact and before commencing the preparations for aseptic technique, to prevent cross-infection.
3	Clean trolley with chlorhexidine in 70% spirit with a paper towel.	To provide a clean working surface.
4	Place all the equipment required for the procedure on the bottom shelf of a clean dressing trolley.	To maintain the top shelf as a clean working surface.
5	Take the patient to the treatment room or screen the bed. Position the patient comfortably so that the area to be dealt with is easily accessible without exposing the patient unduly.	To allow any airborne organisms to settle before the sterile field (and in the case of a dressing, the wound) is exposed. Maintain the patient's dignity and comfort.
6	If the procedure is a dressing and the wound is infected or producing copious amounts of exudate, put on a disposable plastic apron.	To reduce the risk of cross-infection.
7	Take the trolley to the treatment room or patient's bedside, disturbing the screens as little as possible.	To minimize airborne contamination.
8	Loosen the dressing tape.	To make it easier to remove the dressing.
9	Clean hands with a bactericidal alcohol handrub.	To reduce the risk of wound infection.

Procedure guidelines: ***Aseptic technique*** *(cont'd)*

	Action	Rationale
10	Check the pack is sterile (i.e. the pack is undamaged, intact and dry. If autoclave tape is present, check that it has changed colour from beige to beige and brown lines), open the outer cover of the sterile pack and slide the contents onto the top shelf of the trolley.	To ensure that only sterile products are used.
11	Open the sterile field using only the corners of the paper.	So that areas of potential contamination are kept to a minimum.
12	Check any other packs for sterility and open, tipping their contents gently onto the centre of the sterile field.	To prepare the equipment and, in the case of a wound dressing, reduce the amount of time that the wound is uncovered. This reduces the risk of infection and a drop in temperature of the wound which will delay wound healing (Stronge 1984).
13	Clean hands with a bactericidal alcohol rub.	Hands may become contaminated by handling outer packets, etc.
14	Place hand in disposable bag, arrange contents of dressing pack.	To maintain sterility of pack.
15	Remove used dressing with hand covered with the disposable bag, invert bag and stick to trolley.	To minimize risk of contamination, by containing dressing in bag.
16	Where appropriate, swab along the 'tear area' of lotion sachet with chlorhexidine in 70% spirit/swab saturated with 70% isopropyl alcohol. Tear open sachet and pour lotion into gallipots or on indented plastic tray.	To minimize risk of contamination of lotion.
17	Put on sterile gloves, touching only the inside wrist end.	To reduce the risk of infection. Gloves provide greater sensitivity than forceps and are less likely to cause trauma to the patient.

Carry out procedure

18	Make sure the patient is comfortable.	
19	Dispose of waste in yellow plastic clinical waste bags.	To prevent environmental contamination. Yellow is the recognized colour for clinical waste.
20	If necessary, draw back curtains or, if appropriate, help the patient back to the bed area and ensure the patient is comfortable.	
21	Check that the trolley remains dry and physically clean. If necessary, wash with liquid detergent and water and dry throughly with a paper towel.	To reduce the risk of spreading infection.
22	Clean hands with bactericidal alcohol handrub.	To reduce the risk of spreading infection.
23	Place sterility label from the outside of any surgical instrument packs used during the procedure on the patient record form which is to be placed in the patient's notes.	Provides a record, as the sterility label proves the pack has gone through a sterile process and that prior to release has been inspected by a trained person in the Sterile Services Department.

*Please note that for some procedures it may be more appropriate to use different types of sterile packs (e.g. intravenous packs). Since usage of these will vary locally reference is generally made to 'sterile dressing pack'.

Procedure guidelines: **Hand washing**

Hands must be cleaned before and after each patient contact, and after any task that may have resulted in the hands becoming contaminated. There is substantial evidence to indicate that hand washing is the single most important action to reduce the incident of hospital-acquired infection (DoH 2001a).

Procedure guidelines: ***Hand washing*** *(cont'd)*

Equipment and facilities

Wrist/knee/elbow or automatic taps should be used in all clinical areas in order to prevent dirty hands contaminating the taps, which could lead to cross-contamination of the next person who uses the taps. Hand basins should be located conveniently near to where they are required. They must be maintained in good working order and always kept stocked with a plentiful supply of paper towels and liquid soap in disposable containers.This ensures the soap containers are not topped up from a larger container. Soap containers can become contaminated (Ayliffe *et al.* 2000) and by renewing them on a regular basis, a potential source of infection is removed. It is important that the design of the paper towel dispenser allows for easy removal of the paper towel without contaminating the remaining towels. Contaminated paper towels could lead to cross-infection.

Procedure

	Action	Rationale
1	Remove rings, bracelets and wristwatch.	Jewellery inhibits good hand washing. Dirt and bacteria can remain beneath jewellery after hand washing.
2	Roll up sleeves.	Long sleeves prevent washing of wrists.
3	Cover cuts and abrasions on hands with waterproof dressing.	Cuts and abrasions can become contaminated with bacteria and cannot be easily cleaned. Repeated hand washing can increase the injury.
4	Remove nail varnish and artificial nails. Nails must also be short and clean.	Long nails and false nails can be a source of infection by harbouring dirt and bacteria. Nail varnish can become cracked, which could lead to contamination if the nail polish fell into a patient's wound. Nail polish can also inhibit effective hand washing by potentially harbouring bacteria in microscopic imperfections of nail varnish.
5	**Hands that are visibly or potentially soiled or contaminated with dirt or organic material should be washed with liquid soap from a dispenser and running hand-hot water.**	Liquid soap is very effective in removing dirt, organic material and any loosely adherent transient flora, but has little antimicrobial activity. Liquid soap must be used, as tablets of soap can become contaminated.
	(a) Turn on the taps using wrist/elbow or foot and direct the water flow away from the plughole. Run the water at a flow rate that prevents splashing.	Plugholes are often contaminated with micro-organisms that could be transferred to the environment or the user if splashing occurs.
	(b) Run the water until hand hot.	Hand-hot water to be used to ensure that the skin of hands is not damaged by cold water. Water that is too hot could cause scalding. Soap is more effective in breaking down dirt and organic matter when used with hand-hot water.
	(c) Wet the surface of hands and wrists.	Soap applied directly onto dry hands may damage the skin. The water will also quickly mix with the soap to speed up hand washing.
	(d) Apply liquid soap and water to all surfaces of the hands.	To ensure all surfaces of the hands are cleaned.
	(e) Rub hands together for a minimum of 10–15 seconds, with particular attention to between the fingers and the tips of fingers and thumbs.	To ensure all surfaces of the hands are cleaned. Areas that are missed can be a source of cross-infection.
	(f) Nail brushes should not be used.	Nail brushes can damage the skin and result in increased shedding of bacteria from the hands.
	(g) Rinse soap thoroughly off hands.	A residue of soap can lead to irritation and damage to the skin. Damaged skin does not provide a barrier to infection for the health care worker and can become colonized with potentially pathogenic bacteria, leading to cross-infection.
	(h) Care must be taken not to contaminate the taps, sink or nozzle of the soap dispenser with dirt or organic material that is washed off hands.	Contamination of the nozzle of the soap dispenser can result in contamination of the liquid soap, leading to cross-infection.

Procedure guidelines: ***Hand washing*** *(cont'd)*

Action	Rationale
(i) Dry hands thoroughly with a good-quality disposable paper towel from a towel dispenser.	Damp hands encourage the multiplication of bacteria and can potentially become sore.
(j) Dispose of used paper towels in a black bag on a foot-operated stand.	Black is the colour coding for paper waste. Using a foot-operated waste bag stand prevents contamination of the hands.
6 Hands that are visibly clean and not soiled or contaminated with dirt, organic material or toxic substances can be cleaned using an alcoholic handrub.	The antimicrobial activity of alcohol is due to its ability to denature proteins. Alcoholic handrub solutions are a quick convenient method of cleansing clean hands of Gram-negative, Gram-positive vegetative bacteria, tuberculosis and a variety of fungi, but have poor activity against bacterial spores and cannot remove dirt, organic material or toxic substances such as drugs or radioactivity. Alcoholic handrub comes in a variety of solutions, gels and foams with an emollient (which reduces the drying effect of the alcohol).
(a) Follow the manufacturer's instructions for the amount of handrub to be used.	The instructions must be followed so that the correct amount of handrub is used to ensure effective hand cleaning. Too much will cause delays and leave hands sticky, too little will not clean hands adequately.
(b) Rub an alcoholic handrub into **all** areas of the hands, until the hands are dry.	To ensure all areas of the hands are cleaned. Alcohol is a rapid-acting disinfectant, with the added advantage that it evaporates, leaving the hands dry. This prevents contamination of equipment, whilst facilitating the application of unpowdered gloves.
7 Hand washing for surgical procedures outside the operating theatre to be undertaken using a bactericidal detergent.	Rapid multiplication of bacteria occurs under surgical gloves if hands are washed with a non-bactericidal soap. The use of bactericidal soap reduces the resident skin flora. Bactericidal detergents have a persistent activity, which means that following use the bacteria appear to reproduce slowly on hands.
(a) Turn on the taps using wrist/elbow or foot and direct the water flow away from the plughole. Run the water at a flow rate that prevents splashing.	Plugholes are often contaminated with micro-organisms that could be transferred to the environment or the user if splashing occurs.
(b) Run the water until hand hot.	Hand-hot water to be used to ensure that the skin of hands is not damaged by cold water. Water that is too hot could cause scalding. Soap is more effective in breaking down dirt and organic matter when used with hand-hot water.
(c) Wet hands with hand-hot water.	Applying bactericidal detergent direct onto dry hands increases the risk of skin damage/irritation.
(d) Apply the amount of bactericidal detergent advised by the manufacturer.	The correct amount of detergent must be used to ensure effective hand cleaning.
(e) The following washing/rubbing actions should be undertaken five times: • Rotational rubbing of wrists • Palm to palm • Right palm to back of left hand • Left palm to back of right hand • Palm to palm, fingers interlaced • Back of fingers of one hand to palm of other hand with fingers interlaced • Rotational rubbing of right thumb in left palm and left thumb in right palm • Rotational rubbing of fingers in clasped palm of opposite hand.	All surfaces of hands must be thoroughly washed for effective hand washing to have taken place.

Procedure guidelines: ***Hand washing*** *(cont'd)*

Action	Rationale
(f) Holding hands upright, rinse them and wrists under hand-hot running water to remove soap.	Soap residue can cause skin damage. Hands must be held upright to ensure water splashes from unwashed areas of arm do not run down onto clean hands.
(g) Dry hands carefully using a good-quality paper towel.	Wet hands can encourage the growth of bacteria and may lead to sore hands.
8 Hand washing for surgical procedures in theatre. The routine is the same as above but the forearms are included. The hand washing is extended to 2 minutes during which time repeated applications of the bactericidal detergent are required. Hands are dried using a sterile disposable paper towel.	The optimal length of the hand washing is unknown. The important factor is that all areas have been effectively cleaned and rinsed. To prevent contamination from unsterile paper towels.

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